

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Inter Partes* Review of:)
U.S. Patent No. 8,461,719)
Issued: Jun. 11, 2013)
Application No.: 12/567,716)
Filing Date: Sep. 25, 2009)

For: **Wireless Energy Transfer Systems**

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,461,719**

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1004	Curriculum Vitae of Mark Allen
1005	U.S. Patent No. 8,855,554 B2 (“Cook-554”)
1006	File History for U.S. Patent No. 8,855,554 B2 (“Cook Provisional” or “CProv”)
1007	U.S. Patent No. 8,378,523 B2 (“Cook-523”)
1008	U.S. Patent Application Publication No. 2007/0145830 A1 (“Lee”)
1009	International Patent Publication No. WO 2007/101902 A1 (“Pohjonen”)
1010	Estill I. Green, <i>The Story of Q</i> , in 43 Am. Scientist 584 (1955) (“Story of Q”)
1011	U.S. Patent No. 8,143,844 B2 (“Tamura”)
1012	Frederick Emmons Terman, <i>Electronic and Radio Engineering</i> (4th ed. 1955) (“Terman”)
1013	U.S. Patent No. 7,773,041 B2 (“Wang-041”)
1014	U.S. Patent No. 7,623,078 B2 (“Wang-078”)
1015	U.S. Patent No. 8,138,977 B2 (“Zhang”)
1016	U.S. Patent No. 9,223,345 B2 (“Dabov”)

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1017	U.S. Patent Application Publication No. 2002/0153531 (“Levine”)
1018	C. Yeh et al., <i>Dielectric Ribbon Waveguide--An Optimum Configuration for Ultralow-Loss Millimeter/Submillimeter Dielectric Waveguide</i> , prepared for Space Systems Division Airforce Command, by The Aerospace Corporation (Apr. 14, 1991) (“Yeh”)
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1024	File History for Patent Application No. 12/649,635 (“12/649,635 FH”)
1025	File History for Patent Application No. 12/639,963 (“12/639,963 FH”)
1026	<i>InductEV Inc. v. WiTricity Corp.</i> , No. IPR2021-01166, Paper 35 (Dec. 20, 2022)
1027	U.S. Patent No. 7,599,743 B2 (“Hassler”)
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I. Introduction

InductEV (“Petitioner”) requests *inter partes* review of claims 16-17 of U.S. Patent No. 8,461,719, titled “Wireless Power Transfer” (“’719 patent”) (Ex. 1001). According to USPTO records, the ’719 patent is assigned to WiTricity Corporation.

The challenged claims recite systems using a source resonator to wirelessly transfer energy to a second resonator through magnetic coupling, wherein the resonators have high “quality factors” or “Q factors.” But resonators with large Q-factors were not new. As this Board recently found when invalidating a related patent claiming the same effective filing date as the ’719 patent, large Q-factors were desirable (and obvious) because they provide “frequency selectivity” for a system. *See InductEV Inc. v. WiTricity Corp.*, IPR2021-01166, Paper 35 at 45–46 (Dec. 20, 2022) (Ex. 1026). Indeed, persons of ordinary skill in the art (“POsAs”) have known for decades that “the desired value of Q is the highest one economically attainable.” *Story of Q* 584, 592 (Ex. 1010). Because POsAs have long understood the value of maximizing Q, it is no surprise that the prior art including Cook-554 (Ex. 1005) (Grounds 1 and 2) and Cook-523 (Ex. 1007) (Grounds 3 and 4) taught resonators with Q values that exceed the claimed values.

The remaining limitations of the challenged claims are unremarkable. Claim 16 adds that one resonator in the system is “enclosed in a low loss tangent

material.” But Pohjonen (Ex. 1009) explained that the “most common materials used” to enclose antennas in portable devices had low loss tangents because they maintained antenna efficiency while protecting the antenna. Pohjonen 1-3, 7. As explained below, a POSA would have found it obvious to use low-loss tangent materials to enclose resonators taught in Cook-554 (Ground 1) and Cook-523 (Ground 3), rendering claim 16 unpatentable.

Claim 17 adds that at least one of the resonators includes a “network of capacitors” and a resonator that is less thick than it is wide. The prior art taught this too. As explained in Ground 2, Cook-554 disclosed “flat panel” resonators having planar coils and “capacitive tuning” using a “set of capacitors.” In Ground 4, Lee (Ex. 1008) taught that its second (receiving) resonators are designed as planar coils connected to a bank of switched capacitors. Under both separate grounds, Claim 17 is shown to be unpatentable.

Accordingly, the Board should institute review of the ’719 patent and find all challenged claims unpatentable.

II. Identification of Challenges (37 C.F.R. § 42.104(b))

- Ground 1: Claim 16 is unpatentable under 35 U.S.C. § 103 over Cook-554, alone or with Pohjonen.
- Ground 2: Claim 17 is unpatentable under 35 U.S.C. § 103 over Cook-554.

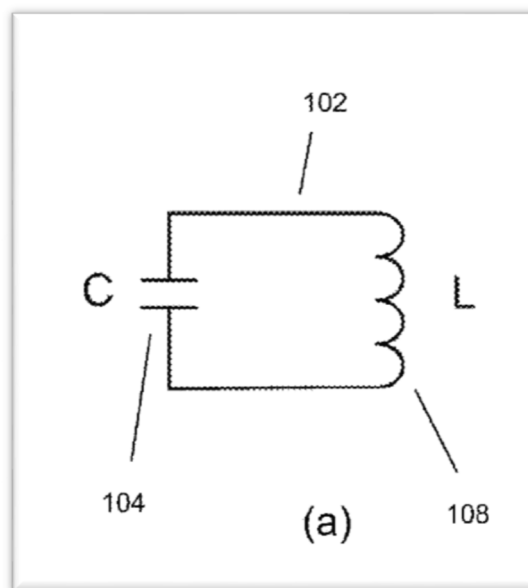
- Ground 3: Claim 16 is unpatentable under 35 U.S.C. § 103 over Cook-523 and Pohjonen.
- Ground 4: Claim 17 is unpatentable under 35 U.S.C. § 103 over Lee and Cook-523.

III. Background

A. The '719 Patent (Ex. 1001)

The '719 patent generally relates to wireless energy transmission between a “source resonator” and a “second” (or “device”) resonator, and the size and design of the resonator’s inductive and capacitive components. '719 patent 3:48-64.

A “resonator” is “a system that can store energy in at least two different forms, and where the stored energy is oscillating between the two forms,” such as a capacitor and an inductor.



Id. Fig. 6(a), 11:37-40, 18:63-19:8; Allen Decl. 42-43¹.

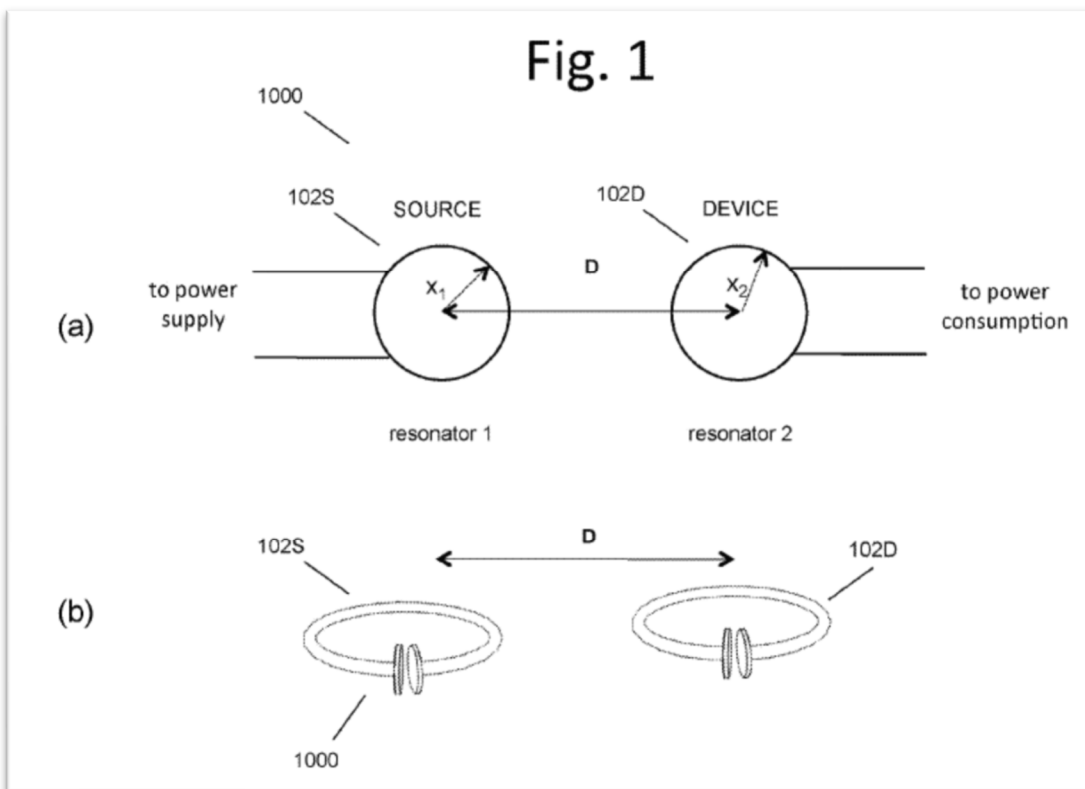
Energy oscillates between the capacitor and inductor as the “capacitor discharges transferring energy into magnetic field energy stored in the inductor which in turn transfers energy back into electric field energy stored in the capacitor 104.” ’719 patent 19:1-8. A resonator is defined in part by its “resonant frequency,” which is the frequency at which energy would “continually be exchanged between the electric field in the capacitor 104 and the magnetic field in the inductor 108” absent any losses in the system. *Id.* 20:61-21:2; Allen Decl. 44. Losses exist, however, and the “Quality Factor” of a resonator, which characterizes its energy decay, is inversely proportional to those losses. ’719 patent 20:64-21:2; Allen Decl. 44-46.

The ’719 patent states that a “high-Q resonator may be defined as one with $Q > 100$ ” and provides, as examples, that the quality factor of both the source and device resonators can be greater than 100, or they can have a “geometric mean of the resonator Q’s [that] is greater than 100, $\sqrt{Q_s Q_d} > 100$.” ’719 patent 15:42-48. The ’719 patent does not explain how the “geometric mean” relates to the performance of the disclosed system, nor does it ascribe any particular benefit to a geometric mean greater than 100 as compared to, for example, 99 or less. Allen

¹ All citations to Allen Decl. are to paragraph numbers.

Decl. 47. The '719 patent acknowledges “Q’s>100 may be realized for a variety of magnetic resonator structures using commonly available materials.” ’719 patent 24:61-65; Allen Decl. 47.

When a second resonator is located near a first source resonator and the resonators have “substantially the same resonant frequency,” the two resonators “interact and exchange energy.” ’719 patent 13:17-24. For example, the oscillating magnetic field of the “source” resonator will induce a current in the inductor of the second resonator, transferring energy over a distance D, as illustrated in Figure 1:



'719 patent Fig. 1, 14:24-27; Allen Decl. 48-54 (also describing known characteristics of parallel and series resonators); Terman 44-57, 63-72.

The '719 patent states that resonators can have various geometries and coupling orientations, but that “planar resonators may be preferable for some applications.” '719 patent 28:41-42. In a planar resonator, the inductive component is “flat” and its “low profile” (small thickness) makes it easier to integrate into “many electronic devices that are relatively flat and planar” like typical “mobile devices.” *Id.* 28:40-60, 30:65-31:9; Allen Decl. 55. Planar coils also have a “favorable coupling orientation” for applications where a source and device resonator are positioned in the same plane and alignment, such as when transferring power through a wall or window. '719 patent 28:49-54, 31:3-9. The '719 patent also discusses that it may be necessary to tune the capacitance of a resonator dynamically to match the inductive element to preserve the high Q. '719 patent 45:54-63. Tuning can be accomplished by connecting the inductive component to a “network[] of variable capacitors.” *Id.* 45:64-46:5, 46:37-44; Allen Decl. 56.

B. Prosecution History

The application leading to the '719 patent was filed on September 25, 2009, and claims priority to several provisional applications. The earliest of those provisional applications is 61/100,721, which was filed on September 27, 2008.

During prosecution, the Examiner rejected pending claims 1, 3-4 and 17 as being anticipated by Joannopoulos (Ex. 1020) and claims 1, 5-6, 18 and 21 as anticipated by Cook-492. *See* '719 FH (Ex. 1002) 577-578. The Examiner found that, among other requirements, each reference disclosed (1) a source resonator having a first Q-factor and a characteristic size, (2) a second resonator having a second Q-factor and a characteristic size, (3) the resonators coupled to exchange energy wirelessly over a distance D, and (4) wherein the square root of the product of the Q-factors is greater than 100. *Id.* These same limitations were also in pending claims 22 and 23 (challenged claims 16 and 17), but the examiner allowed those claims in view of their additional requirements. *Id.* 681. In response, the Applicant canceled the pending claims rejected by the Examiner, or amended them to depend on claims the Examiner stated would be allowable, without addressing the merits of the Examiner's rejections. *Id.* 718-719. The Examiner allowed the claims for the same reasons set forth in the original office action. Allen Decl. 63-65.

C. Person of Ordinary Skill in the Art

A POSA at the relevant time (September 2008) would have had at least a bachelor's degree in electrical engineering (or equivalent) and at least two to three years of industry or equivalent research experience in the field of wireless energy transfer. This description is approximate, and a higher level of education or skill

might make up for less experience, and vice-versa. This Petition does not rely on this precise definition, and the claims would be unpatentable from the perspective of any reasonable level of ordinary skill. Allen Decl. 37-41.

D. Claim Construction

Under 37 C.F.R. § 42.100(b), claims are construed according to *Phillips v. AWH Corp.*, which holds that “words of a claim are generally given their ordinary and customary meaning,” and “claims must be read in view of the specification, of which they are a part.”² 415 F.3d 1303, 1312-13, 15 (Fed. Cir. 2005). If the specification defines a claim term, “the inventor’s lexicography governs.” *Id.* at 1316. The ’719 patent defines “characteristic size” (recited in claims 16 and 17) and “characteristic thickness” (recited in claim 17) that this Petition identifies, while applying plain meaning for the other claim terms.³

1. “characteristic size”

The ’719 patent defines the “characteristic size” of a resonator differently depending on whether it is a “magnetic resonator” or an “electric resonator.” ’719

² Unless otherwise stated, all emphases herein are added and internal quotation marks, citations and footnotes are omitted.

³ Petitioner reserves the right to argue alternative constructions in other proceedings, and where such a defense is available, that the claims are indefinite.

patent 23:27-33. The challenged claims are not limited to either type of resonator, but the prior art applied in Grounds 1-4 use magnetic resonators. Allen Decl. 67.

The “characteristic size” of the “magnetic” resonators at issue is “equal to the radius of the smallest sphere that can fit around the **inductive** ... element.” ’719 patent 23:33-37; Allen Decl. 67-69.

2. “characteristic thickness”

Like the characteristic size, the claimed “characteristic thickness” depends on whether the resonator is “magnetic” or “capacitive” (i.e., electric). ’719 patent 23:38-42; Allen Decl. 70. The “characteristic thickness” of the “magnetic” resonators at issue here is the “highest point of the **inductive** ... element ... measured from a flat surface on which it is placed.” ’719 patent 23:38-42; Allen Decl. 70-71.

IV. Ground 1: Claim 16 is obvious over Cook-554, alone or with Pohjonen

Ground 1 turns to Cook-554’s embodiment where a receiving resonator is “integrated into a device” such as a mobile phone. That embodiment discloses each element of claim 16, including that at least one of the resonators is enclosed within a portable device housing in a part with “lower losses and better ... penetration of magnetic fields” and to “avoid a metallic housing.” Cook-554 (Ex. 1005) 17:1-2, 19:30-35. Cook-554 does not, however, expressly refer to the “loss tangent” of the material for its portable device housing. As explained in this

Ground, a POSA implementing Cook-554 would have selected a “low loss tangent material” based on Cook-554 alone, on the POSA’s knowledge, and/or in view of Pohjonen. Pohjonen explained it was standard industry practice to enclose portable electronic devices with integrated antennas using low loss tangent materials.

A. Overview of the Prior Art

1. Cook-554 (Ex. 1005)

Cook-554 is at least § 102(e) prior art because, as discussed below, it is prior art as of the filing of its provisional application (“Cook Provisional” or “CProv,” Ex. 1006). The Cook Provisional was filed on March 5, 2008, prior to the earliest claimed priority date of the ’719 patent. Cook-554’s published patent application was cited along with hundreds of other references during prosecution of the ’719 patent, but was not discussed in any office action. Allen Decl. 73.

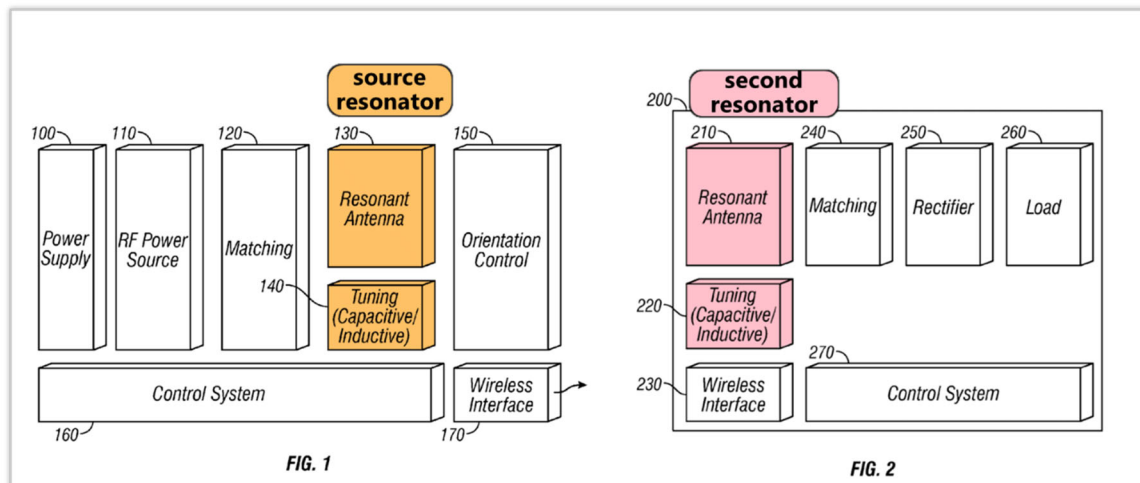
a. Overview

Like the ’719 patent, Cook-554 is directed to the “use and applications of wireless power” including “tuning of wireless antennas, and packaging of those antennas.” Cook-554 10:1-15; CProv Title, 25⁴. In particular, Cook-554 describes wireless power transfer “based on coupled magnetic resonance using magnetic

⁴ All citations to CProv are to exhibit page number.

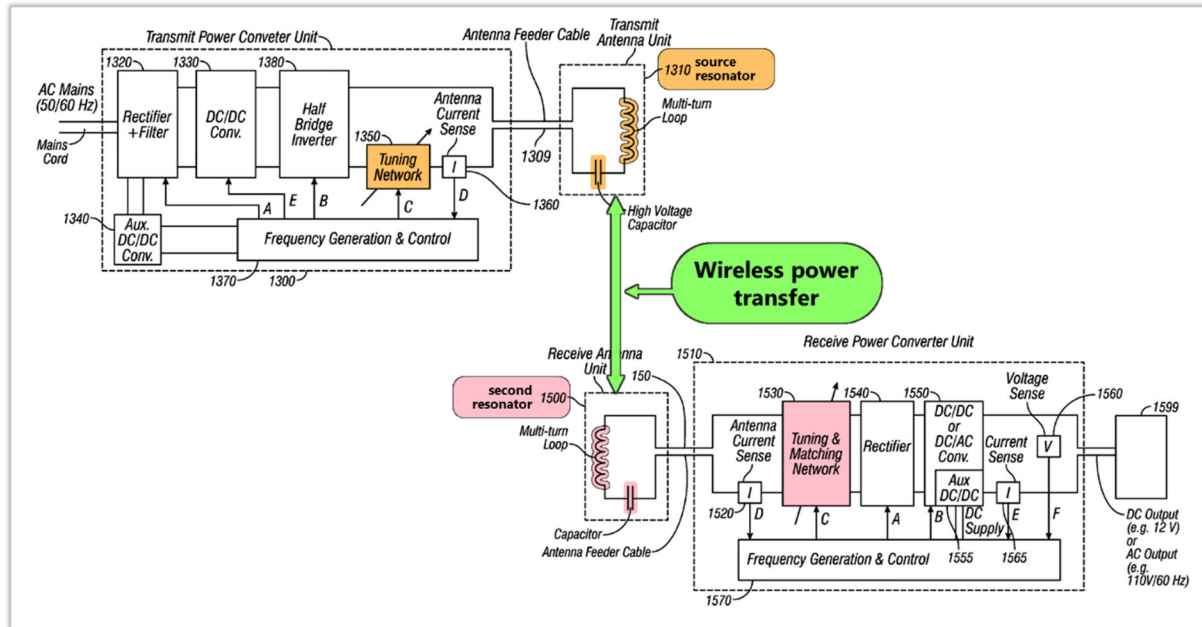
field antennas,” where wireless power is transmitted from a “resonant” transmitting antenna to a “resonant” receiving antenna. Cook-554 8:54-57; CProv 34; Allen Decl. 74.

Cook-554 shows a “generic wireless energy source” and generic “receiver” in Figures 1 and 2. Cook-554 3:21-29, 4:26-34, 6:14-32. As illustrated below, the energy source and receiver each include a resonator comprising a resonant antenna with capacitive/inductive tuning.



Allen Decl. 75-76 (annotating Cook-554 Figs. 1 and 2); CProv Figs. 3-1, 3-2.

Cook-554 provides additional details for the “transmit and receive subsystem” in Figures 13 and 15, respectively, which can be used with “any of the wireless power embodiments”:



Allen Decl. 77-79 (annotating Cook-554 Figs. 13 and 15); Cook-554 2:40-41, 11:20-24, 13:46-49; CProv 40-43 (transmit subsystem), 43-45 (receive subsystem), 59, Figs. 4-11, 4-12. The resonators have high Q-factors in the hundreds or thousands. Cook-554 13:35-41, 13:50-51, 10:32-44; CProv 17 (¶5), 26, 32, 40.

Cook-554 taught wireless energy transfer for various applications. In some embodiments, the receiving resonant antenna is “integrated” within a portable device like a cellular phone for wireless charging. *See, e.g.*, Cook-554 9:29-46, 8:65-9:4; CProv 34, 36-39; Allen Decl. 80-81. In another embodiment, called a “Wireless Power Bridge,” the transmit and receive antennas are formed as planar “flat panels” used to “transmit power through walls or windows” where it would be inconvenient to place a wire or typical wired plug. Cook-554 10:8-11:19, Figs. 10-11; CProv 40-42, Fig. 4-8; Allen Decl. 82-83.

b. Cook-554 is Entitled to its Provisional Application’s Filing Date

Cook-554 is entitled to the filing date of the Cook Provisional because Cook-554 was filed within one year of the Cook Provisional’s filing, names at least one inventor in common, and includes a specific reference to the Cook Provisional. Cook-554, Cover, 1:4-6; CProv 4; 35 U.S.C. § 119. Further, the Cook Provisional passes both prongs of the *Dynamic Drinkware* test: it provides sufficient support for at least claim 17 in the Cook-554 patent, and it “provide[s] sufficient support for the subject matter relied upon for prior art purposes in the reference patent or published patent application.” *Motorola Mobility v. Maxell*, IPR2023-00110, Paper 7 at 20 (June 15, 2023) (citing *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1381-82 (Fed. Cir. 2015)).

c. Cook-554 Claim 17 is supported by Cook Provisional

(1) Preamble

To the extent the preamble is limiting, the Cook Provisional supports claim 17’s preamble “a method comprising” for the reasons it supports the limitations discussed below. *See also* CProv 29 (“method to match to the impedance of the antenna”), 30 (“tuning methods”), 32, 55; Allen Decl. 84.

(2) Receiving Power

The Cook Provisional supports claim 17's first step: "receiving power via a resonant circuit from a non-modulated wireless magnetic field at an operating frequency and at a receive power level."

The Cook Provisional discloses "magnetic-field (inductive) coupling between a resonant transmit antenna and a resonant receive antenna and uses an [sic] non-modulated carrier frequency." CProv 40, Figs. 4-11, 4-12. The "receive antenna unit" comprises a "multi-turn loop (coil) and a capacitor" (a "resonant circuit") that "achieve[s] resonance at the desired operating frequency." CProv 40-48 (describing transmit and receive subsystems in Figs. 4-12 and 4-13), Figs. 4-12, 4-13; Allen Decl. 85-86.

(3) Converting Power

The Cook Provisional supports claim 17's second step: "converting the received power, so as to charge a battery, with a power converting circuit having an impedance value that is variable." It taught a "receive power converter unit" for a target load, which can be a "battery of a device." CProv 30 ("the target load that consumes the transferred energy (e.g. battery of a device, device circuitry"), 40, 43-45 (power for charging an "external load" like a "laptop computer"), Fig. 4-12. The receive power converter unit has a variable impedance through the use of a variable inductor or variable capacitors. CProv 55-57 (describing "Receive antenna tuning"), Figs. 4-12, 5-5, 5-6, 5-7; Allen Decl. 87-88.

(4) Varying Impedance

The Cook Provisional supports the final step in claim 17: “varying the impedance value of the power converting circuit to tune the resonant frequency of the resonant circuit based on the received power level.” It explains that in “practical high-Q designs readjusting (tuning) of the resonance frequency is often compulsory.” CProv 51. The resonance frequency can be tuned using variable capacitance, variable inductance, or a combination, to “create antenna load impedance that can be varied.” CProv 55, 44 (tuning is generally needed to “ensure that the receive antenna is operated at resonance”), 57 (“Tuneable load impedance”), Fig. 4-12; Allen Decl. 89-90.

d. Cook-554’s relevant disclosures are supported by the Cook Provisional

The discussion below mapping Cook-554 to the challenged claims also includes parallel citations to substantively similar disclosures in the Cook Provisional that provide sufficient support for the cited Cook-554 disclosures, with additional discussion as needed. Allen Decl. 91.

2. Pohjonen (Ex. 1009)

Pohjonen was published on September 13, 2007, and is prior art under 35 U.S.C. §102(a), (b), and (e). Pohjonen was not considered during prosecution of the ’719 patent.

Like the '719 patent, Pohjonen relates to the “selection of cover materials and structures for” portable radio devices comprising an internal antenna.

Pohjonen 1. Pohjonen explains that POSAs knew that the “outer cover” for a portable device with an integrated antenna “should naturally cause as little attenuation of radio waves as possible, so that it would allow the antenna to freely receive and transmit radio frequency transmissions” to maintain antenna efficiency. *Id.* POSAs also knew that “losses in the cover materials” used in portable devices was a problem with a known solution—using materials with “as low losses as possible” for the outer cover—but that the solution was generally described in the form of “abstract statements.” *Id.* 2; Allen Decl. 92-94.

Pohjonen discusses specific materials commonly used for covers of “an antenna structure for portable radio devices, which has low losses and good reliability in operation” and “increases the convenience of use to a human user.”

Pohjonen 3. Pohjonen discloses “making the outer cover of a portable radio device” from a “very low loss thermoplastic material,” preferably having a “loss tangent value of which is less than 0.005.” *Id.* Pohjonen concluded that, at these values, the outer cover “becomes acceptable in terms of only very little additional loss caused to the antenna.” *Id.* 6. Exemplary materials with loss tangents less than 0.005 include polycarbonate and polystyrene, which were already “commonly used” in outer covers for portable devices (*id.* 2) and “well suited for injection

molding and other large-scale methods of precision manufacturing of plastic components.” *Id.* 7, 2; Allen Decl. 94-96.

B. Motivation to Combine

As discussed below, Cook-554 alone or in combination with a POSA’s knowledge taught every element of claim 16, including enclosing its second resonator in a “low loss tangent material” as recited by Element [16e]. To the extent Patent Owner argues that Cook-554 alone does not render obvious that limitation, a POSA would have and could have enclosed Cook-554’s second resonator in Pohjonen’s low loss tangent material.

Initially, Cook-554 and Pohjonen are analogous to each other and the ’719 patent. Cook-554 describes the integration of resonant “antennas” for receiving wireless energy at radio frequencies (e.g., 13MHz) into portable electronic devices, and Pohjonen is directed to “the technology of antennas for portable radio devices and devices including radio functionality” at overlapping frequencies. Cook-554 3:51-54 (wireless power transmission at 13.56 MHz), 6:31-35, 9:25-65, 10:3-7, 19:15-35, Figs. 7, 10, 22A-22D; CProv 25, 29, 62, Figs. 4-4, 4-6; Pohjonen 1-2 (describing frequencies in the “range from 1MHz to 10GHz”); Allen Decl. 111-112. The ’719 patent is similar, integrating magnetic (inductive) resonators operating at frequencies up to 10 GHz in “cell phones.” ’719 patent 3:39-43 (frequencies “below 10GHz”), 59:40-53, 47:51-56, 62:27-30; Allen Decl. 112. Additionally, both Cook-

554 and Pohjonen are directed to reducing losses in the area around an integrated antenna, which is the same problem the '719 was purporting to address. Cook-554 2:2-3, 22:7-10; CProv 17-18 (¶4), 63; Pohjonen 1, 9; '719 patent 34:53-35:6; Allen Decl. 112.

A POSA implementing Cook-554's integrated resonator in a portable device would have enclosed the resonator in Pohjonen's low loss tangent material because it would protect Cook-554's second resonator from damage during manufacturing or use while maintaining antenna efficiency. Allen Decl. 113.

First, a POSA would have found Pohjonen's low loss tangent material beneficial for protecting Cook-554's integrated resonator in a portable device during manufacturing and hand-held use. Cook-554 1:59-61 (receiving antennas "fit into a mobile, handheld device"), 9:16-28; CProv 16 (¶2), 34, 36; Dabov (Ex. 1016) 10: 43-50 (describing use of "antenna chassis" to "protect the antenna from mechanical damage"); Allen Decl. 114. As Pohjonen and others explained, covers made from injection molded plastics were "typical" to protect antennas integrated in portable radio devices, and those plastics had known low loss tangents.

Pohjonen 1-2, 7, 9; Allen Decl. 114-115; *see also, e.g.*, Tamura (Ex. 1011) 2:19-20, 4:24-27 (cover made from poly vinyl chloride (PVC) to "physically protect the antenna circuit"); Wang-041 (Ex. 1013) at 5:67-6:2 ("plastic housing material as is normally used in portable electronic devices (e.g., ABS, polycarbonate,

polystyrene or the like.”); Pohjonen 2 (identifying polycarbonate and polystyrene as some of “the most common materials used for” outer covers of portable electronic devices, with loss tangents ranging 0.0004-0.0006); Dabov 10:27-50 (“[s]uitable materials” for enclosing antennas have “low loss tangent” such as “polycarbonate”); Hassler (Ex. 1027) 2:57-64. Enclosing Cook-554’s second resonator would have been obvious because it is nothing more than the application of a known technique (portable device outer covers made from injection molded plastics) to a piece of prior art (a portable device with an integrated antenna) ready for the improvement. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007); Allen Decl. 115.

Second, a POSA would have enclosed Cook-554’s second resonator in a low loss tangent outer cover to maintain efficiency while physically protecting the antenna. Allen Decl. 116. Cook-554 taught that its resonant antennas were designed to receive power at radio frequencies, and “lossy” materials near the antenna should be avoided because they “deteriorate its Q-factor” and therefore efficiency. Cook-554 6:27-35, 16:18-25; CProv 29, 50; Terman 3; Allen Decl. 116. Thus, a POSA implementing Cook-554’s integrated resonator would have looked to a non-lossy enclosure like Pohjonen’s to preserve the Q and efficiency of the resonator. Allen Decl. 117; Pohjonen 1-2, 6-7, 9-10. In particular, Pohjonen advised that if “a portable telephone device has a radiating antenna element

attached to or close to an outer cover part,” which is what Cook-554 taught (Cook-554 Figs. 7, 10, 22A-22D; CProv Figs. 4-4, 4-7, 5-8; Allen Decl. 117), “it is advisable to make said outer cover part of a material with a loss tangent value less than about 0.005.” Pohjonen 6. At these values, “the loss tangent value becomes acceptable in terms of only very little additional loss caused to the antenna.” *Id.*; Allen Decl. 117.

A POSA would have had a reasonable expectation of success enclosing Cook-554’s second resonator in Pohjonen’s outer cover because it was designed to enclose antennas “made of good [] conductor materials,” like the inductive component of Cook-554’s second resonator. Pohjonen 9; Cook-554 4:39-46 (“Copper tube or silver plated copper tube”), 13:12-20 (“multi-turn loop is made of well insulated copper wire”); CProv 29, 42; Allen Decl. 118. Likewise, Cook-554 taught that its second resonator could be integrated into a portion of a mobile phone that is “in a part that can be folded out for the purpose of wireless charging” which Pohjonen’s outer cover material is “equally well applicable to.” Cook-554 19:15-35, Fig. 22A; CProv 58, Fig. 5-8; Pohjonen 12; Allen Decl. 119. And as discussed previously, it was well known that common portable electronic devices that Cook-554’s secondary resonator was intended to “fit into” (Cook-554 1:59-61, 19:15-19; CProv 16 (¶2), 36) already commonly used low loss tangent materials for their outer covers. Pohjonen 1-2; Allen Decl. 119. Thus a POSA could have

enclosed Cook-554's second resonator in a low loss tangent material, with a reasonable expectation of success, because it would be easy and cost-effective to do so using common injection molded plastics. Cook-554 16:53-58 ("enabling wireless power ... should not significantly increase overall manufacturing costs"); CProv 50; Pohjonen 2 ("A vast majority of outer covers for portable radio devices are manufactured by injection moulding"), 6-7 (outer cover material with "suitably low loss tangent value" and "well suited for injection moulding"), 11; Allen Decl. 119.

At most, "modifying" Cook-554 with Pohjonen represents a combination of known prior art elements (antenna structures used in portable electronic devices and plastic housings) according to known methods (injection molding with common low loss tangent plastic materials) to yield predictable results (enclosures that protect an antenna while minimizing radio frequency losses in the cover materials). Allen Decl. 120.

C. Claim 16

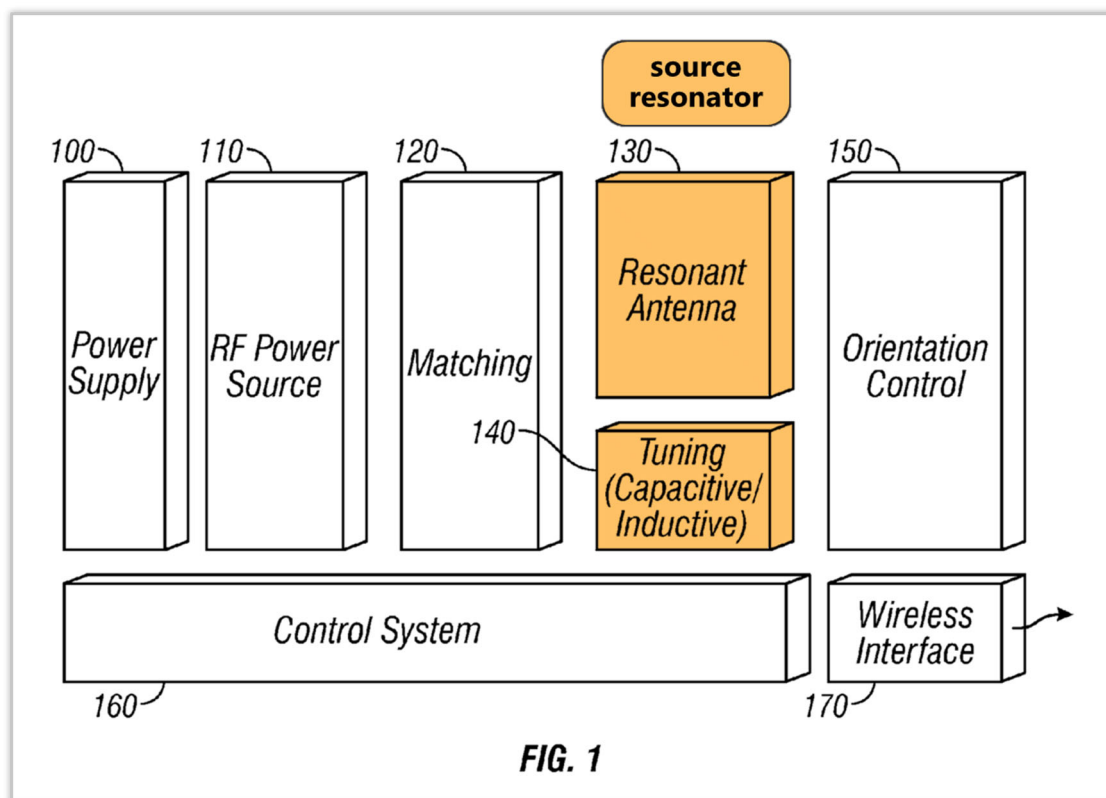
1. Element [16pre]: Preamble

Claim 16's preamble recites "a system, comprising." To the extent the preamble is limiting, it is disclosed by Cook-554 as explained in the following sections. Allen Decl. 121

2. Element [16a]: Source Resonator

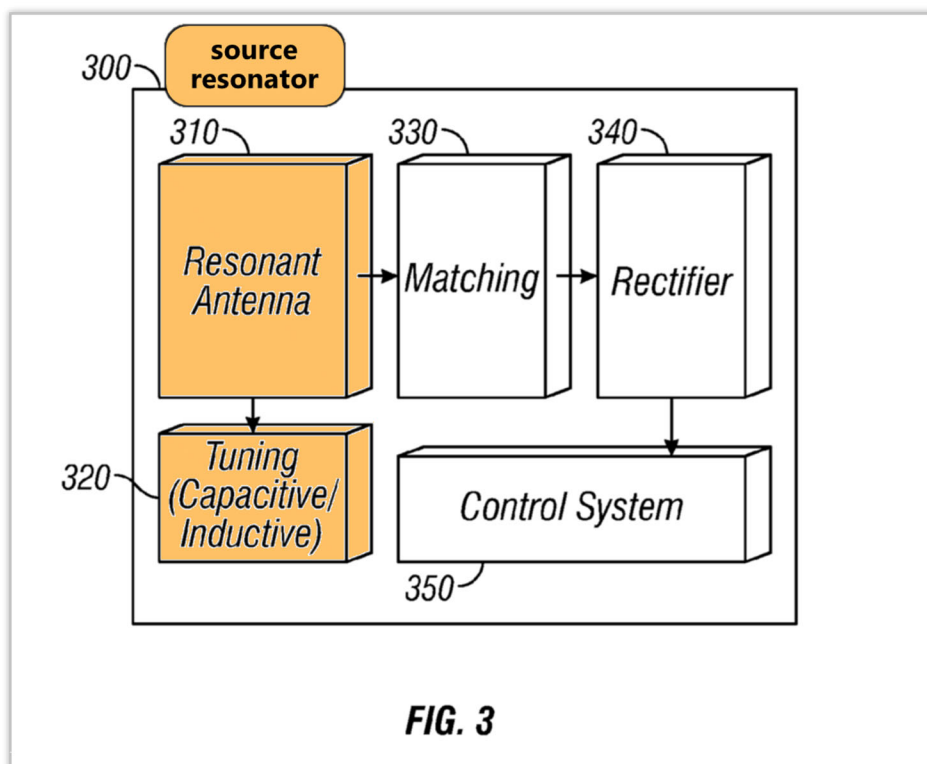
This element recites “a source resonator having a Q-factor Q_1 and a characteristic size x_1 .” Notably, Claim 16 does not recite any particular characteristic size—any size will do. Allen Decl. 122.

Cook-554’s “transmit antenna unit” and its associated “tuning network,” shown in annotated Figure 1 below, correspond to the claimed “source resonator.”



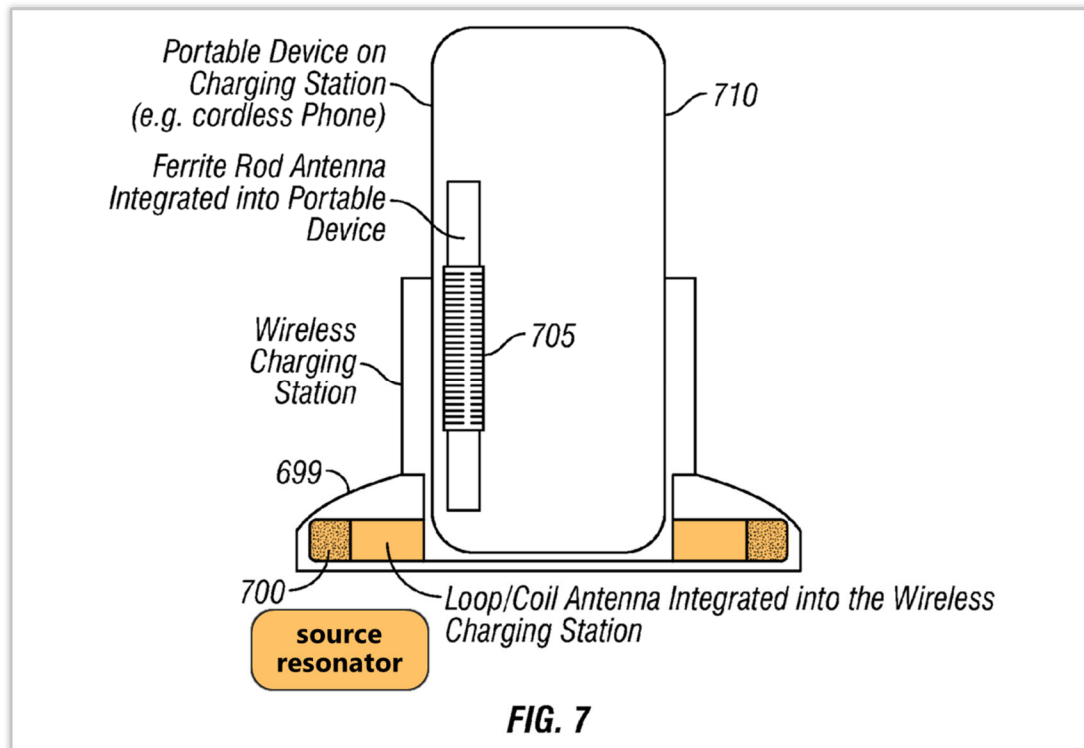
Allen Decl. 123 (annotating Cook-554 Fig. 1 (CProv Fig. 3-1)); Cook-554 3:21-32, 4:61-67, 11:12-24 (“Fig. 13 shows a block diagram of a transmit subsystem that can be used with any of the wireless power embodiments”), 11:31-35, 12:19-38, 13:12-20, Fig. 13 (CProv Fig. 4-11); CProv 23, 25-28, 41-43.

Cook-554 also describes an optional “energy relay” with a “resonant parasitic antenna” and associated tuning that also correspond to a “source resonator” because it “repeat[s] wireless power in an area.” Cook-554 8:4-34; CProv 32-33; Allen Decl. 124; *see also* ’719 patent 15:62-66 (resonator used to “relay power from a source in one location to a device in another location” can be referred to as a source resonator), 76:60-61, 83:28-35. Cook-554’s general diagram of its energy relay is below, where the “materials and components needed to build a parasitic antenna may be the same or similar to those used in an energy transmitter”:

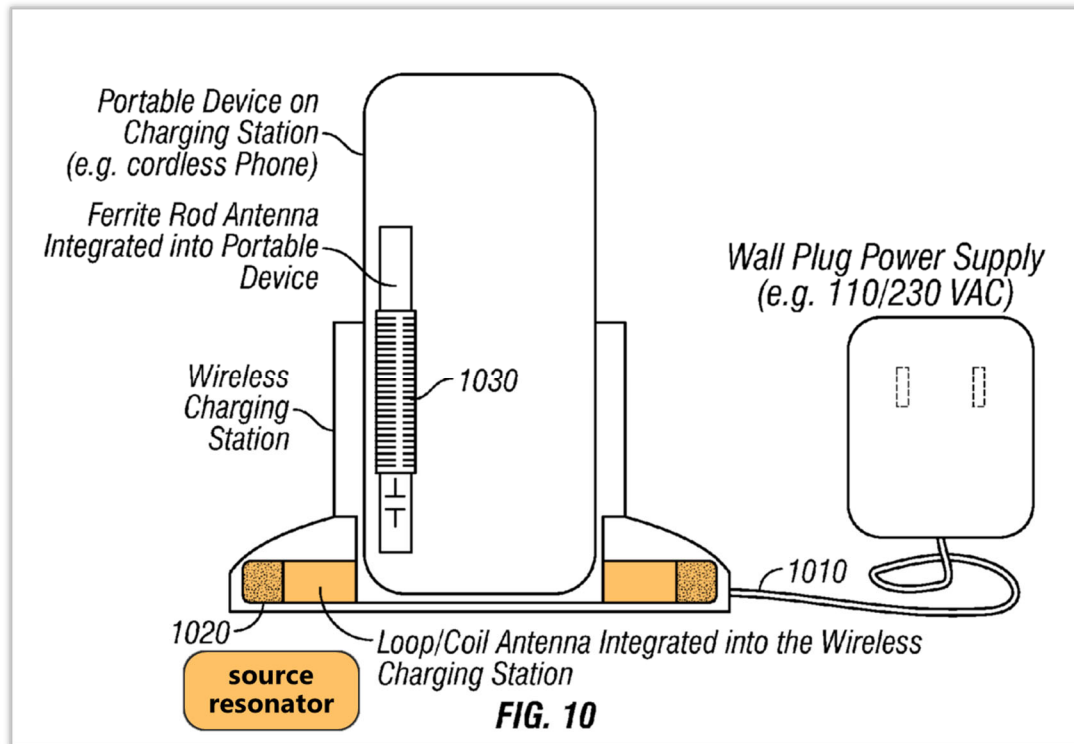


Allen Decl. 124 (annotating Cook-554 Fig. 3 (CProv Fig. 3-3)); Cook-554 8:4-49; CProv 32-33.

Cook-554's source resonator, whether as an energy relay or transmit antenna, can be integrated in a wireless charging station as shown in Figures 7 (energy relay) and 10 (transmit):



Allen Decl. 125-127 (annotating Cook-554 Fig. 7 (CProv Fig. 4-4)); Cook-554 9:16-65, Fig. 8 (CProv Fig. 4-5); CProv 36.



Allen Decl. 128 (annotating Cook-554 Fig. 10 (CProv Fig. 4-7)); Cook-554 10:3-7; CProv 36.

Cook-554's transmit and energy relay resonators are “magnetic resonators” because they transfer energy “based on magnetic coupled resonance.” Cook-554 15:23-26, 8:16-25, 8:54-57, 9:29-34, Fig. 8 (same as CProv Fig. 4-5); CProv 26, 32-34, 36, 49; Allen Decl. 127, 129. The resonators therefore have a “characteristic size X_1 ” in the '719 patent corresponding to the inductive element, e.g., the “Loop/Coil antenna” above. Allen Decl. 129; *see* Claim Construction (“characteristic size”) above.

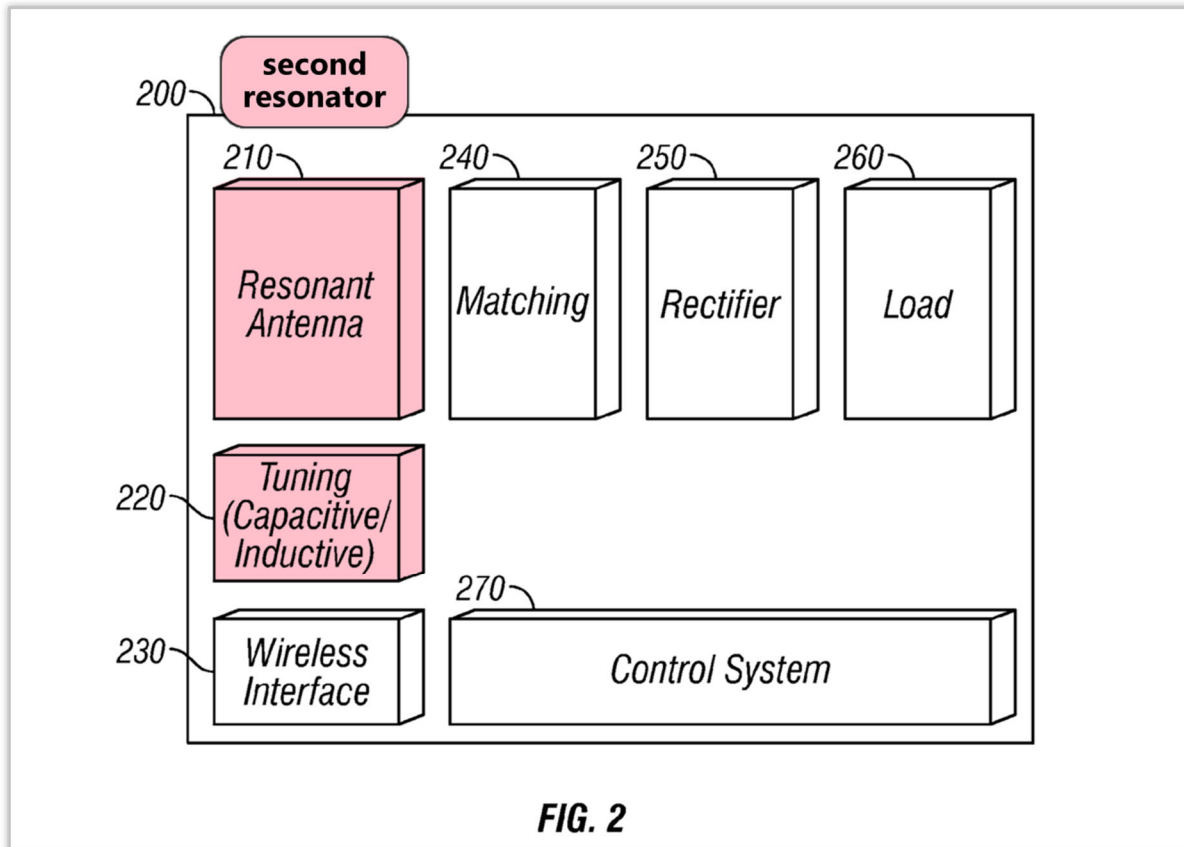
Cook-554's transmit and energy relay antenna units each have a “quality factor,” corresponding to the claimed “ Q_1 .” Cook-554 4:26-38 (transmit antenna

should “provide a Q-factor as high as possible”), 8:3-32 (same for energy relay antenna), 9:20-34; *see also* Cook-554 2:4-7, 5:1-2; CProv 28, 31; Allen Decl. 130. The transmit and energy relay antenna units may also be coupled to a tuning circuit (shown in Figs. 1 and 3 above, but not Figs. 7, 10), which is designed to “help keep a high Q” and does “not impair the antenna’s Q-factor.” Cook-554 17:34-40; CProv 51-52; Allen Decl. 131.

3. Element [16b]: Second Resonator

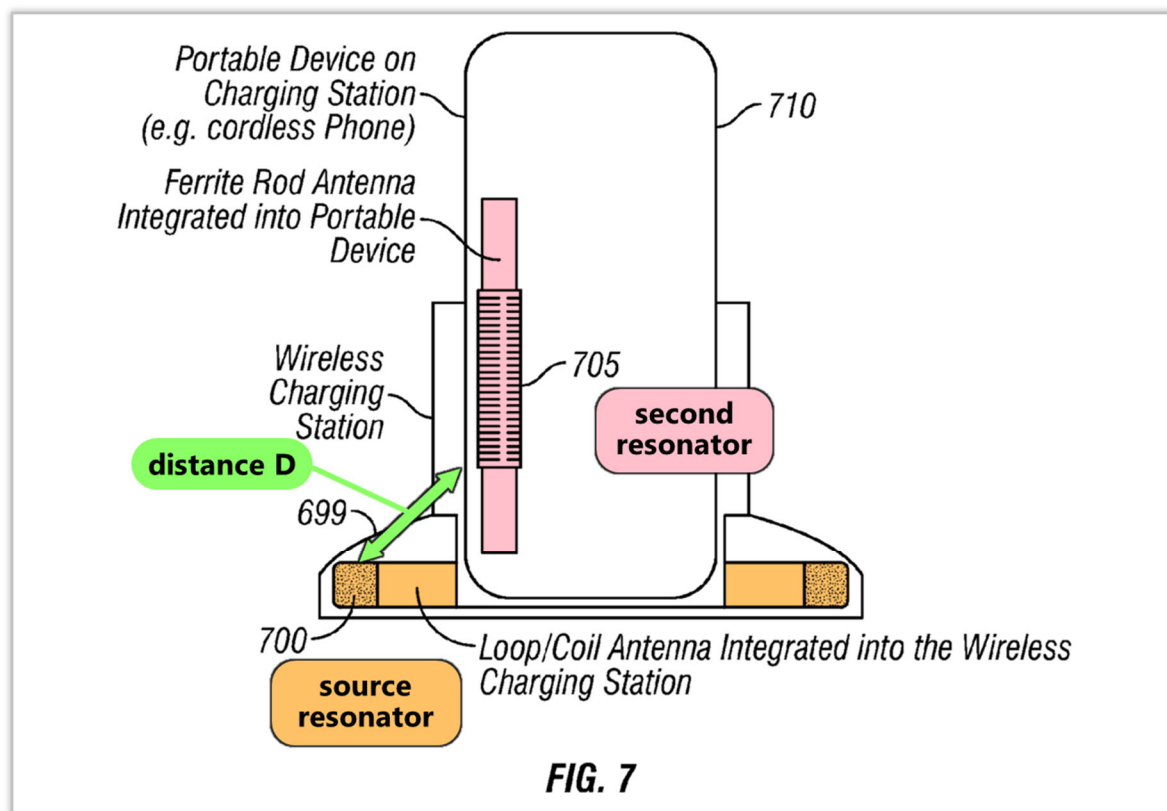
This element recites “a second resonator having a Q-factor Q_2 and a characteristic size x_2 , and located a distance D from the source resonator.” Claim 16 does not recite any particular characteristic size x_2 —any size will do. Allen Decl. 132. Cook-554 taught this element for similar reasons as the source resonator.

Cook-554’s “receive antenna unit” and its associated “tuning and matching network,” shown in annotated Figure 2 below, correspond to the claimed “second resonator.”

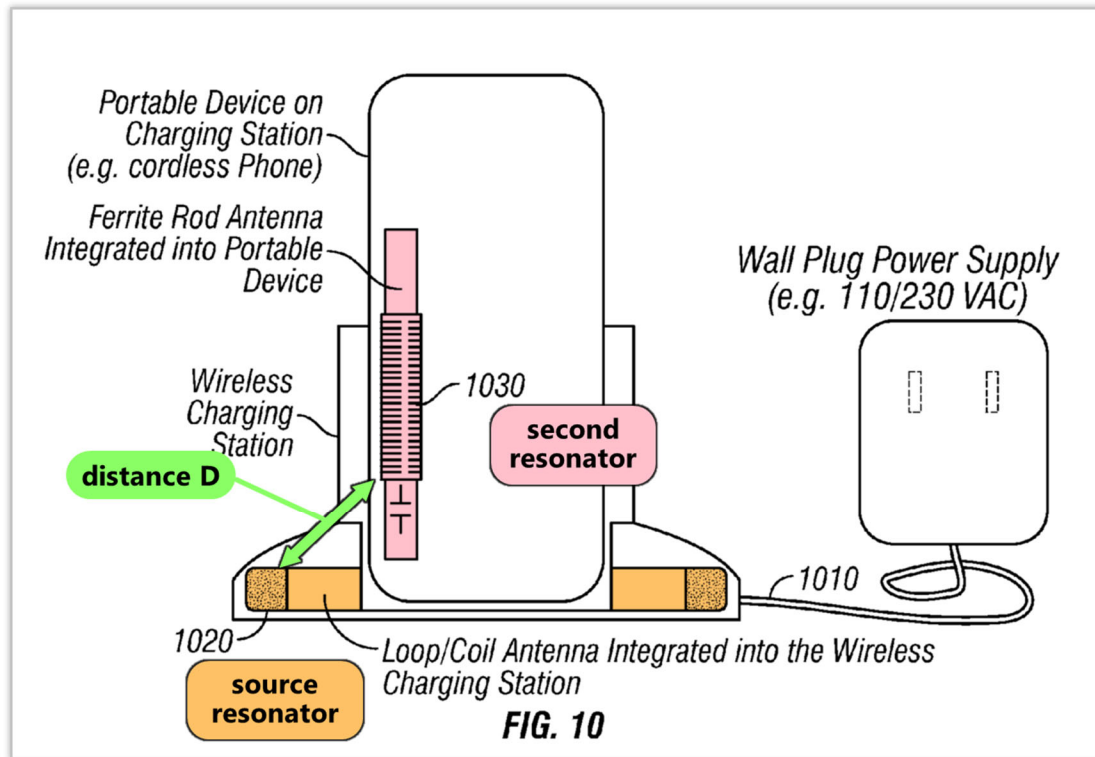


Allen Decl. 133 (annotating Cook-554 Fig. 2 (CProv Fig. 3-2)), Cook-554 6:14-19, 6:40-62 (describing tuning of receiver), Cook-554 Fig. 15 (CProv Fig. 4-12), 13:46-54; CProv 43, 50-51.

Cook taught that its second resonator can be “integrated into” a portable device, as shown in annotated Figures 7 and 10 below, to receive energy transferred wirelessly over a distance D from a source resonator:



Allen Decl. 134-135 (annotating Cook-554 Fig. 7); Cook-554 9:20-46, 6:20-32, Fig. 6; CProv 24, Figs. 4-3, 4-4.



Allen Decl. 136 (annotating Cook-554 Fig. 10); Cook-554 10:3-7, Fig. 6; CProv 36, Fig. 4-7; *see also* Ground 1 Element 16[c] (Wireless Energy Transfer). In Figures 7 and 10, the second resonator is depicted as a “Ferrite rod antenna,” though “another loop/coil structure with suitable form factor” could be used. Cook-554 9:37-41, 6:20-32; Allen Decl. 137; *see also* Cook-554 Figs. 22A-22D (alternative ways to integrate antenna); CProv Fig. 5-8 (same).

Cook-554’s second resonator is a “magnetic resonator” because it receives energy through “magnetically coupled resonance,” and therefore has a “characteristic size X_1 ” equal to the radius of a sphere that can enclose the inductive (coil) element. Cook-554 9:29-34, Figs. 7-8, 10; CProv 36, Figs. 4-4, 4-5, 4-7; *see*

Claim Construction (“characteristic size”) above; *see also* Cook-554 15:23-26, 8:16-25, 8:54-57, 9:29-34; CProv 22, 26, 36, 49; Allen Decl. 138.

Cook-554 discloses the receiving antenna has a “quality factor,” corresponding to the claimed “ Q_2 .” Cook-554 9:30-34, 6:33-35, 2:4-7; CProv 28, 31. As with the source resonator, the tuning network at the receiver does “not impair the antenna’s Q-factor.” Cook-554 6:33-7:2, 17:34-40, 18:65-67 (also explaining ferrite rod antennas can be tuned without “requiring any additional components in the tank circuit thus maintaining the Q-factor”); CProv 51-52; Allen Decl. 139.

4. Element [16c]: Wireless Energy Transfer

This element recites “wherein the source resonator and the second resonator are coupled to exchange energy wirelessly among the source resonator and the second resonator.”

Cook-554 taught this, describing “wireless energy transfer based on magnetic coupled resonance ... using resonant antenna circuits ... in both energy transmitter and energy receiver.” Cook-554 9:29-34, 15:23-26; CProv 36, 49. As discussed above, the resonator in the wireless charging station (energy source) transfers power to a portable device with an integrated second resonator (energy receiver) that “receives electrical energy.” Cook-554 9:35-65, 10:3-7, Figs. 7-8, 10 (CProv Figs. 4-4, 4-5, 4-7); Allen Decl. 140-142; *see also* Cook-554 3:6-10, 3:21-31, 4:26-34 (transmitter), 6:14-32 (receiver), 8:16-25 (energy relay), Figs. 1-3 (CProv Figs. 3-1,

3-2, 3-3); CProv 25-26 (transmitter), 28-29 (receiver), 32-33 (energy relay), 36, Figs. 3-1, 3-3, 3-4, 4-3, 4-4, 4-5, 4-7.1.

5. Element [16d]: High Quality Factor

This element recites “wherein $\sqrt{Q_1 Q_2}$ is greater than 100.”

Cook-554 taught this element, explaining its transmitting and energy relay (source) resonators have a “high Q-factor” Q_1 and receiving (second) resonators having a “high Q-factor” Q_2 . *See* Ground 1 Element 16[a], 16[b]. Cook-554 also quantifies Q, explaining its transmitting and energy relay (source) resonators in “practical system implementations” would have Q factors “up to 300” at low frequency (LF) and “up to 600 in the HF frequency range (13.6 MHz).” Cook-554 4:35-38 (transmitter), 8:26-32 (energy relay); CProv 26, 32. Similarly, Cook-554 taught that a receiving (second) resonator “integrated” in a device will have “Q-factors up to 150 may be typical at LF and up to 200 in the HF frequency range (13.6 MHz).” Cook-554 6:20-35; CProv 29; Allen Decl. 143-144.

Cook-554 explains that Q-factors for both resonators (source and receiving) should be as high as possible for efficiency and to improve the distance of power transfer. Cook-554 15:23-26 (“wireless energy transfer” is “more efficient when using resonant antenna circuits with highest possible quality factor in both energy transmitter and energy receiver”), 2:6-7, 4:26-34, 6:27-29 (“The Q-factor sets the transfer efficiency, and higher Q factors improve the distance over which the power

can be received.”), 8:23-25, 9:30-34, 12:25-27; CProv 17, 22, 26, 28, 29, 32, 43; *see also generally* Cook-554 15:23-17:40 (describing considerations for designing high Q resonators); CProv 49-52; Allen Decl. 145.

Thus, Cook-554 taught wherein the “ $\sqrt{Q_1 Q_2}$ is greater than 100,” as claimed. As set forth above, Cook-554 instructed POSAs to use the highest quality factors in both the transmitter and receiver, providing specific values for source resonator Q_1 of up to 300 or up to 600, and its second resonators have Q_2 up to 150 or up to 200—resulting in the claimed square-root value easily exceeding the required “greater than 100” for all of those disclosed values above 100 for Q_1 and Q_2 . Allen Decl. 146-147. Cook-554 also establishes *prima facie* obviousness because its disclosed ranges of Q_1 and Q_2 values overlap with the claimed range. *See Genentech, Inc. v. Hospira, Inc.*, 946 F.3d 1333, 1341 (Fed. Cir. 2020) (“an overlap creates a presumption of obviousness” and burden shifts to “the patentee to come forward with pertinent evidence that the overlapping range would not have been obvious”).

6. Element [16e]: Low Loss Tangent Enclosure

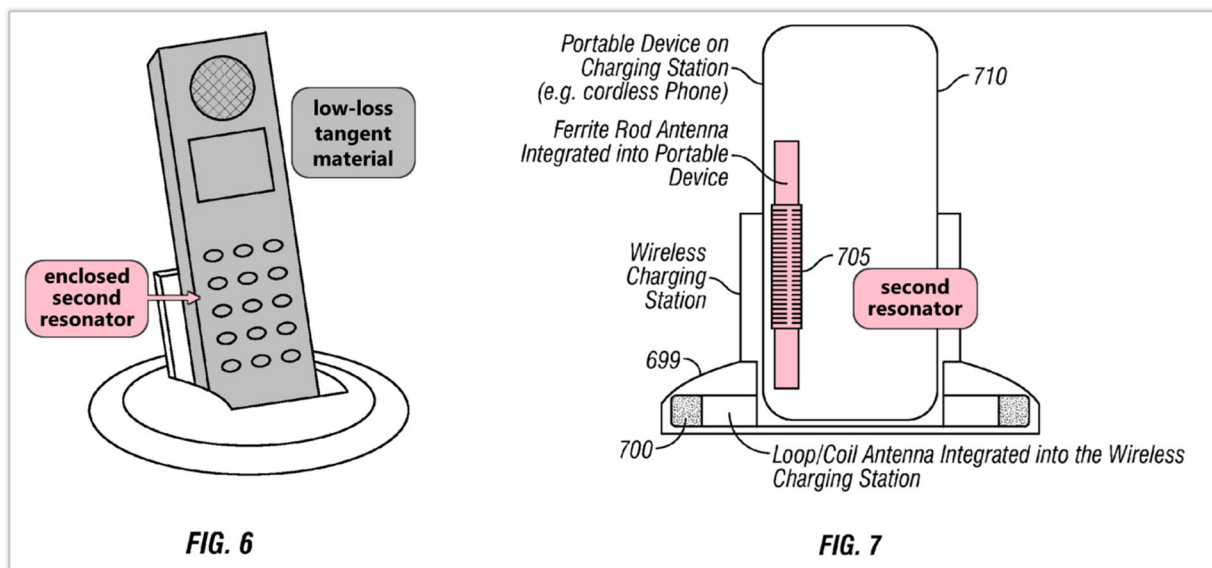
The last element recites “wherein at least one of the resonators is enclosed in a low loss tangent material.” A POSA would have found this element obvious in view of Cook-554, alone or in combination with the POSA’s knowledge and/or Pohjonen.

The '719 patent does not provide any express bounds for what constitutes a “low” loss tangent material, stating “[l]ow loss tangent materials such as Teflon, REXOLITE, styrene, and the like may be preferable for some applications.”⁵ '719 patent 26:17-24, 59:43-45. The '719 patent also alleges that a material with a “low” loss tangent “may have a negligible impact on the losses of a magnetic resonator,” whereas “moderate to high loss tangents” may have “relatively higher dissipative losses.” *Id.* 34:61-64; Allen Decl. 57-58, 149.

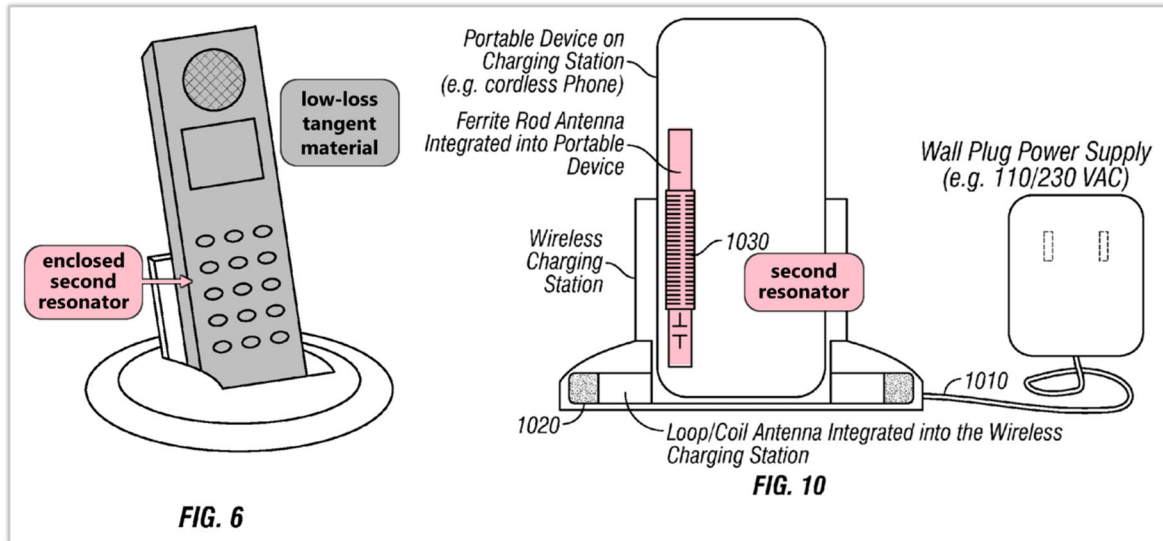
A POSA implementing Cook-554 would have found it obvious to enclose Cook-554's second resonator a low loss tangent material. As explained above, Cook-554 taught a second resonator “integrated” into a “mobile, handheld device.” Cook-554 1:59-61, 9:29-10:10, Figs. 7-8, 10, Figs. 22A-22D; CProv 16, 57, Figs. 4-4, 4-5, 4-7. A POSA would have understood that “integrated” in this context means that the resonator is “enclosed” within the external housing of the mobile device. Allen Decl. 149; Cook-554 9:20-28 (“*internal* antenna 705 in the portable device 710”); CProv Figs. 4-3, 4-4. Indeed, that is what Cook-554 shows in Figure

⁵ The '719 patent does not provide any numerical values, but a POSA would have understood the loss tangents of the '719 patents exemplary materials range from 0.0002 to 0.001 at a frequency of 10GHz. Yeh (Ex. 1017) 10, Levine (Ex. 1018) ¶ 122; Allen Decl. 58, 114.

6 (device cover on; integrated resonator not visible), and Figures 7 and 10 (device cover off; integrated resonator shown). Allen Decl. 149-150; '719 patent 59:45-49 (“integrated into ... cell phones ... so that they are not visible outside these devices”). As annotated and described below, a POSA would have understood or found it obvious that Cook-554’s portable device housing enclosing the second resonator is made from a low loss tangent material.



Allen Decl. 149 (annotating Cook-554 Figs. 6, 7 (CProv Figs. 4-3, 4-4)); Cook-554 9:16-28; CProv 36.



Allen Decl. 150 (annotating Cook-554 Figs. 6, 10 (CProv Figs. 4-3, 4-7)); see '719 patent 59:40-53 (device resonators can be “enclosed in an enclosure” made from “low loss tangent materials” including that the “device resonator may be integrated into ... cell phones”).

Cook-554 taught when integrating a resonator in a portable device, a POSA should “avoid a metallic housing” and “integrate[] the antenna into a part, causing lower losses and providing better penetration of magnetic fields.” Cook-554 17:1-2, 19:30-35; CProv 51, 58. A POSA would have understood this to mean integrating the antenna in a “low loss tangent material,” because those were the materials that were known to be “suitable for allowing electromagnetic waves (e.g., from the antenna) to pass.” Dabov 10:27-32; Pohjonen 2 (“dielectric loss tangent” is a “better measure of the actual losses” caused by an outer cover); Wang-078 (Ex. 1014) 7:16-20 (explaining polystyrene allows radio waves to be

“readily transmitted from and received by the antenna structures”); Allen Decl.

151. Cook-554 also states “lossy materials in the antenna’s surrounding” degrades resonator Qs. Cook-554 16:18-24, 19:36-50; CProv 50, 58. To maintain the Q, low loss tangent materials would be used for the portable device enclosure because those materials were known to have “very little additional loss caused to the antenna.” Pohjonen 6-7; Allen Decl. 152.

Cook-554’s teachings to enclose a resonator in a non-metallic material that causes “lower losses” and “better penetration of magnetic fields” is also at the same level of detail as the ’719 patent’s description of enclosing a resonator in a “low loss tangent material.” Allen Decl. 153; ’719 patent 34:53-64 (explaining how “electromagnetic fields” cannot significantly penetrate “metallic materials,” whereas “low loss tangent materials” have a “negligible impact on the losses of a magnetic resonator”), 59:40-53 (device resonators can be “enclosed in an enclosure” made from “low loss tangent materials,” including that the “device resonator may be integrated into ... cell phones”).

Even if not disclosed by Cook-554, a POSA would have found it obvious to enclose Cook-554’s second resonator in a low loss tangent material based on the general knowledge of a POSA and as taught by Pohjonen particularly. Allen Decl. As discussed above, Cook-554 taught that the second resonator is intended to receive power through magnetic waves, and that the material enclosing the

portable device resonator should *not* be lossy or metallic. Allen Decl. 154. These teachings would have motivated a POSA to select low loss tangent materials (e.g., plastics) because those materials (1) were commonly used for portable device covers with integrated antennas, (2) had the known benefit of minimizing losses to an integrated antenna, and (3) were non-metallic. Allen Decl. 154-155; Pohjonen 2, 7; Cook-554 17:1-2, 19:30-35; CProv 51, 58; *see KSR*, 550 U.S. at 421. A POSA would have understood, for example, the “housing material” that was “normally used in portable electronic devices” with an integrated antenna were plastics with low loss tangents, including acrylonitrile-butadiene-styrene (ABS), polycarbonate (PC), and polystyrene (PS). Wang-041 5:67-6:2; Pohjonen 2, 6-7; Dabov 10:27-50; Allen Decl. 154. These plastics were used because they were known to allow radio waves to be “readily transmitted from and received by the antenna structures” in a device, Wang-078 7:16-20, which was the intended function of Cook-554’s integrated antenna. Cook-554 9:35-65, 10:3-7, Figs. 7-8, 10 (CProv Figs. 4-4, 4-5, 4-7); Allen Decl. 154.

A POSA also would have and could have enclosed Cook-554’s receiving antenna in a low loss tangent outer cover in view of Pohjonen to (1) protect Cook-554’s second resonator from damage during manufacturing or use, and (2) improve efficiency of Cook-554’s second resonator while protecting it. *See Motivation to Combine* section above.

* * *

For the foregoing reasons, claim 16 of the '719 patent is unpatentable in view of Cook-554, alone or with Pohjonen.

V. Ground 2: Claim 17 is obvious over Cook-554

Unlike Ground 1, which relies on Cook-554's integrated device resonator embodiment, this Ground relies on Cook-554's "Wireless Power Bridge." Cook-554's Wireless Power Bridge renders claim 17 unpatentable because it taught every limitation, including "flat panel" resonators made from "thin wire" with a "number of turns" in the same plane and connected to a "capacitor bank" for tuning. To the extent Patent Owner argues that Cook-554's flat panel resonators do not disclose a thickness that is "much less" than their size as recited by Element [17f], that would have been obvious in view of Cook-554. Allen Decl. 157.

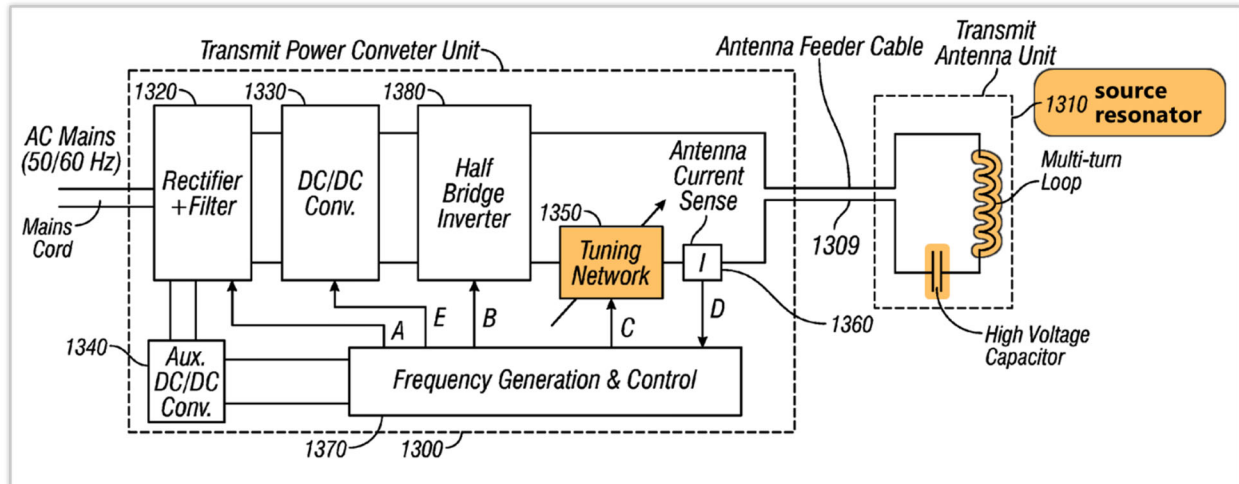
A. Claim 17

1. Element [17pre]: Preamble

Claim 17's preamble recites a "system." To the extent the preamble is limiting, it is disclosed by Cook-554 as explained in the following sections. Allen Decl. 158.

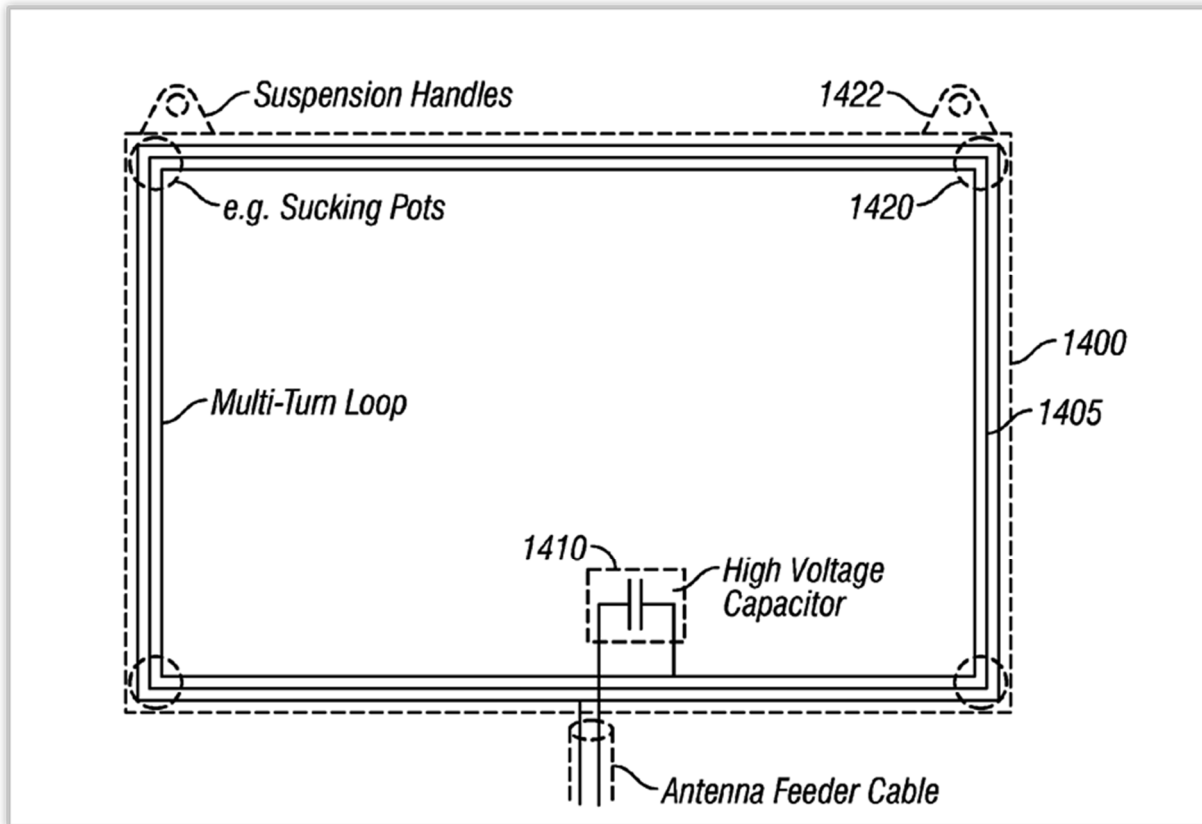
2. Element [17a]: Source Resonator

Like Element 16[a], this recites, "a source resonator having a Q-factor Q_1 and a characteristic size x_1 ." Cook-554 taught this element in the "Wireless Power Bridge," which has a source resonator including a "transmit antenna unit" and associated "tuning network":



Allen Decl. 159-160 (annotating Cook-554 Fig. 13 (CProv Fig. 4-11)), 13:12-20, 13:30-32, 11:20-35, 12:19-38, 19:51-64 (“block diagrams of the Wireless Power Bridge as shown in FIGS. 13 and 15”); *see also, e.g.*, Cook-554 Fig. 1, 3:21-32, 4:61-67, Figs 11-12; CProv 23, 25-28, 40-41, 45, Figs. 3-1, 4-8, 4-11. The transmit antenna is a “magnetic resonator” because it transmits energy “based on magnetic coupled resonance,” and therefore has a “characteristic size X_1 ” equal to the radius of a sphere that can enclose its coil element. Allen Decl. 160; Cook-554 10:32-34, 15:23-26; CProv 26, 34, 36, 49; *see* Claim Construction (“characteristic size”) above.

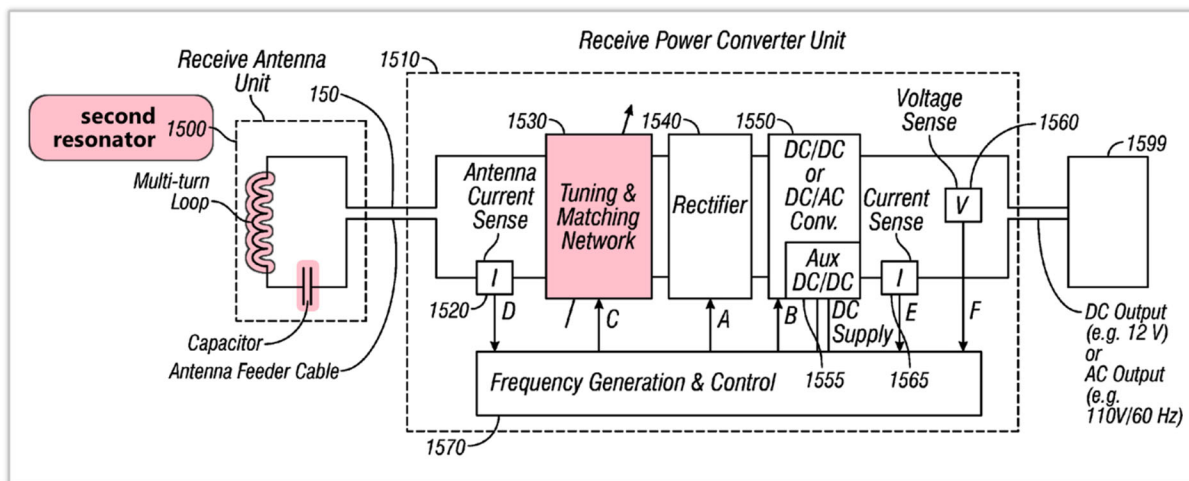
The transmitting antenna unit in the Wireless Power Bridge is a “flat panel,” with a “typical layout” shown below including a flat planar coil connected to a high voltage capacitor



Allen Decl. 161 (explaining Cook-554 Fig. 14 maps to CProv Fig. 4-3, except the CProv figure correctly shows the multi-turn loop as a spiral as discussed below in Element [17f]); Cook-554 Figs. 11-12 (CProv Fig. 4-8), 13:30-41, 10:25-31, 10:61-62; CProv 43. Cook-554 discloses that the flat panel transmit antenna unit has a “high Q-factor,” corresponding to the claimed “ Q_1 .” Cook-554 10:32-44, 10:61-65, 13:30-41; CProv 40, 43. The “source resonator” also includes Cook-554’s tuning circuit, connected through the “antenna feeder cable” in Figures 13-14, which does “not impair the antenna’s Q-factor.” Cook-554 11:31-33, 12:19-38, 17:34-40, Figs. 13-14 (CProv Figs. 4-11, 4-13); CProv 41-42, 51-52; Allen Decl. 162-164.

3. Element [17b]: Second Resonator

Like Element [16b], this element recites “a second resonator having a Q-factor Q_2 and a characteristic size x_2 , and located a distance D from the source resonator.” Cook-554’s Wireless Power Bridge embodiment taught this with a “receive antenna unit” and “tuning and matching network” corresponding to the claimed “second resonator”:

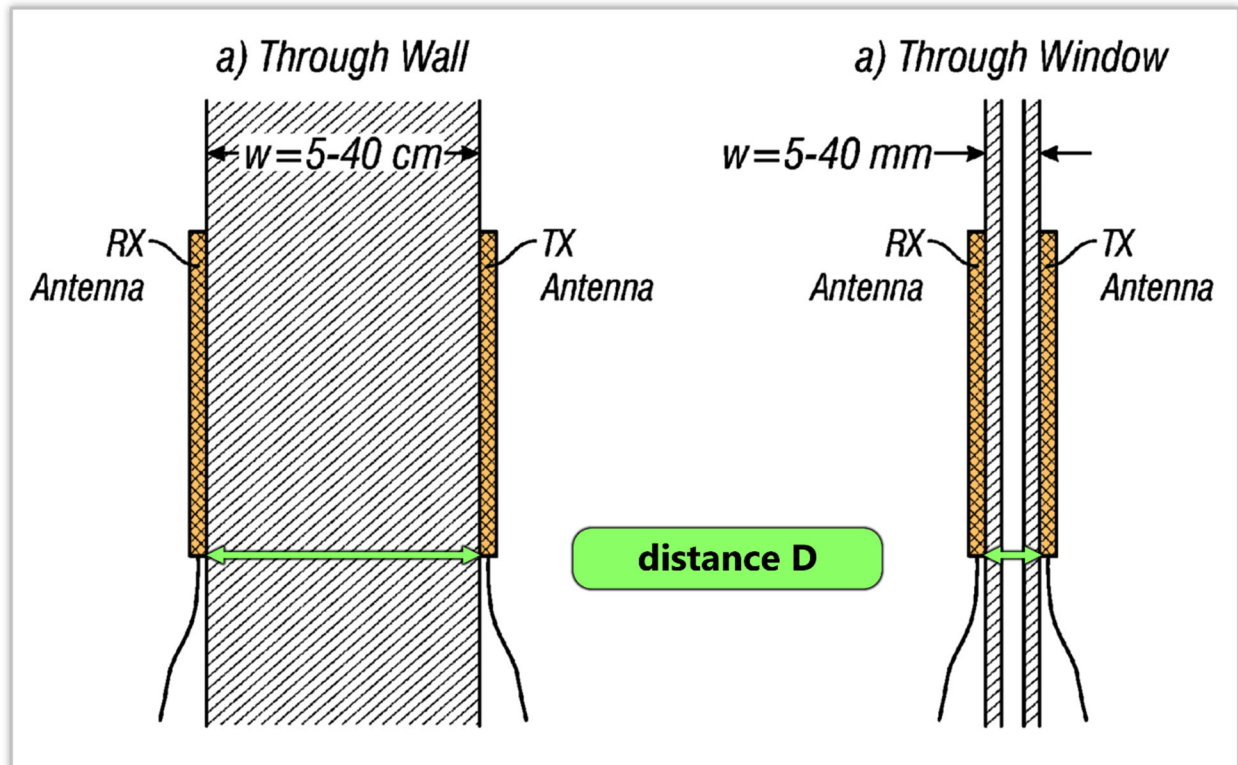


Allen Decl. 165-166 (annotating Cook-554 Fig. 15 (CProv Fig. 4-12)); Cook-554 13:46-54; 6:14-19, 6:40-62 (describing tuning of receiver), Figs. 2 (CProv Fig 4-2), 11-12 (CProv Fig. 4-8), 16 (CProv Fig. 5-1); CProv 28-30, 43, 50.

The receive antenna unit “may be identical to the transmit antenna unit 1310” including that it is a “flat panel.” Cook-554 13:46-54, 10:63-65; CProv 39-40. Cook-554’s receive antenna unit (second resonator) has a “quality factor Q_2 ” and “characteristic size x_2 ” for the same reasons as the transmit antenna unit (source resonator). See Element 17[a] above; Cook-554 15:23-26 (“Efficient

wireless energy transfer” uses “highest possible quality factor” in the “receiver”); CProv 37; Allen Decl. 167.

The source resonator is located a “distance D” from the second resonator to provide power through a wall or window:



Allen Decl. 167-169 (annotating Cook-554 Figs. 11-12 (CProv Fig. 4-8)); Cook-554 10:25-11:19; CProv 39-40; *see also* Element [17c] below (Wireless Energy Transfer).

4. Element [17c]: Wireless Energy Transfer

Like Element 16[c], this element recites “wherein the source resonator and the second resonator are coupled to exchange energy wirelessly among the source resonator and the second resonator.”

Cook-554 taught this element, disclosing “[w]ireless energy transfer” between the transmit antenna unit (“source resonator”) and the receive antenna unit (“second resonator”) based on magnetic coupled resonance. Cook-554 19:51-64; CProv 59. In particular, the “Wireless Power Bridge is based on magnetic-field inductive coupling between a resonant transmit antenna and a resonant receive antenna” allowing energy exchange wirelessly “up to 100 W, or similar.” Cook-554 10:32-60; CProv 39-40; Allen Decl. 170-171; *see also* Ground 1 Element [16c] above (discussing magnetic coupling in other embodiments). .

5. Element [17d]: High Quality Factor

Like Element [16d] this element recites “wherein $\sqrt{Q_1 Q_2}$ is greater than 100.” Cook-554 taught this element for the same reasons and as further explained below.

Cook-554 taught in the Wireless Power Bridge that the transmit antenna unit and receive antenna units have a “high Q-factor (typically >200).” Cook-554 10:32-45; CProv 40. Additionally, Cook-554 taught that quality factors should be as high as possible for efficiency and to improve the distance of power transfer. *See* Ground 1 Element [16d].

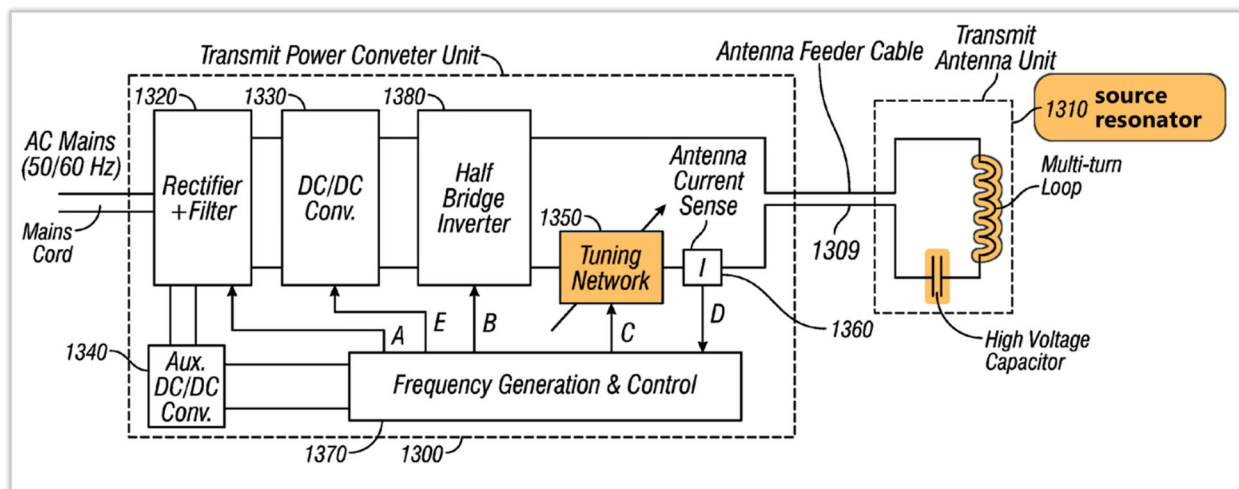
When both Q_1 and Q_2 are greater than 200, the “ $\sqrt{Q_1 Q_2}$ is greater than 100,” as claimed. Allen Decl. 172-173.

6. Element [17e]: Planar Coils And Capacitors

These elements recite:

wherein at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors,
 wherein the plurality of turns are in a common plane.

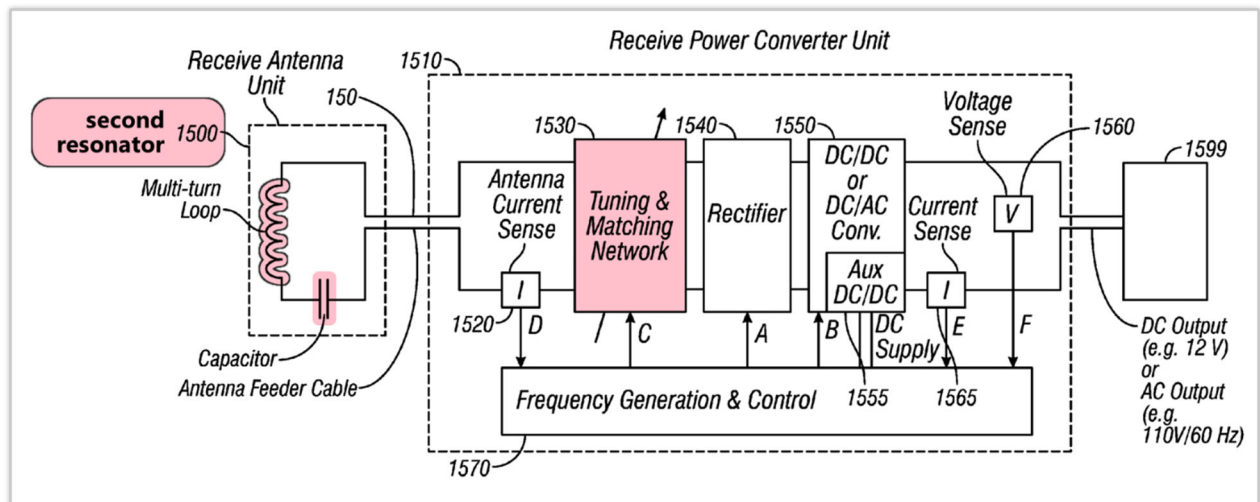
Cook-554 taught these elements, explaining the Wireless Power Bridge embodiment includes a transmit antenna unit (source resonator) having a “multi-turn loop (coil)” made from conductive “copper wire.” Cook-554 13:12-16; *see also* Cook-554 4:39-42; CProv 26, 42; Allen Decl. 174-175. That conductive copper coil is connected to a “network of capacitors,” the “high-voltage capacitor” and “tuning network”:



Allen Decl. 175 (annotating Cook-554 Fig. 13 (CProv Fig. 4-11)); Cook-554 13:14-16, 13:49-51, Fig. 1; CProv 42-43, Figs. 4-11, 4-13. The transmitter “tuning network” can be a “[c]apacitor bank.” Cook-554 17:41-45; CProv 52 (“common method of tuning of a resonant transmit antenna circuit uses a set of capacitors (capacitor bank)”); *see also* Cook-554 4:61-67, Fig. 1 (CProv Fig. 3-1); CProv 27.

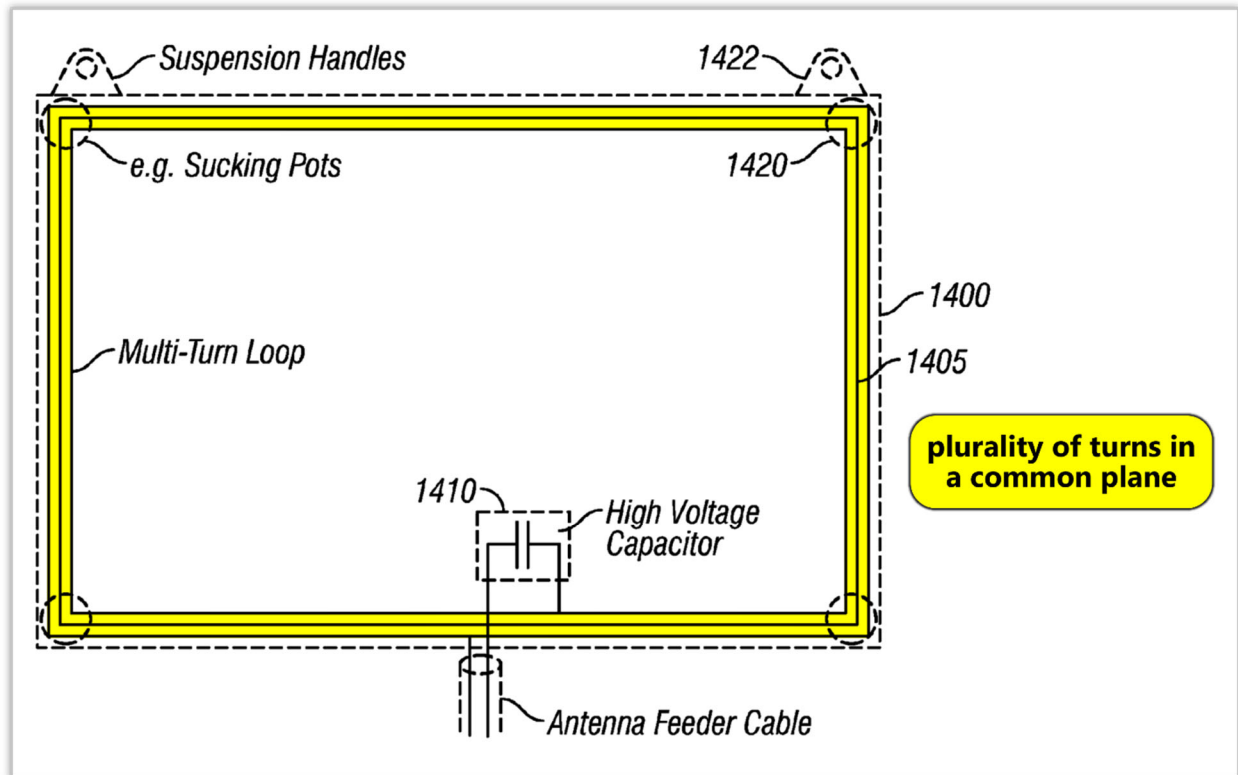
Cook-554 shows an exemplary implementations of capacitor bank tuning in Figure 16 (CProv Fig. 5-1). Cook-554 17:46-51; CProv 52; Allen Decl. 175.

Cook-554's second resonator also includes a conductive copper coil having a plurality of turns because the "receive antenna unit" may be "identical to the transmit antenna unit." Cook-554 13:46-54; CProv 42-43; Allen Decl. 176. The coil is further connected to a "capacitor" and a "tuning and matching network" that can be a "bank of capacitors."



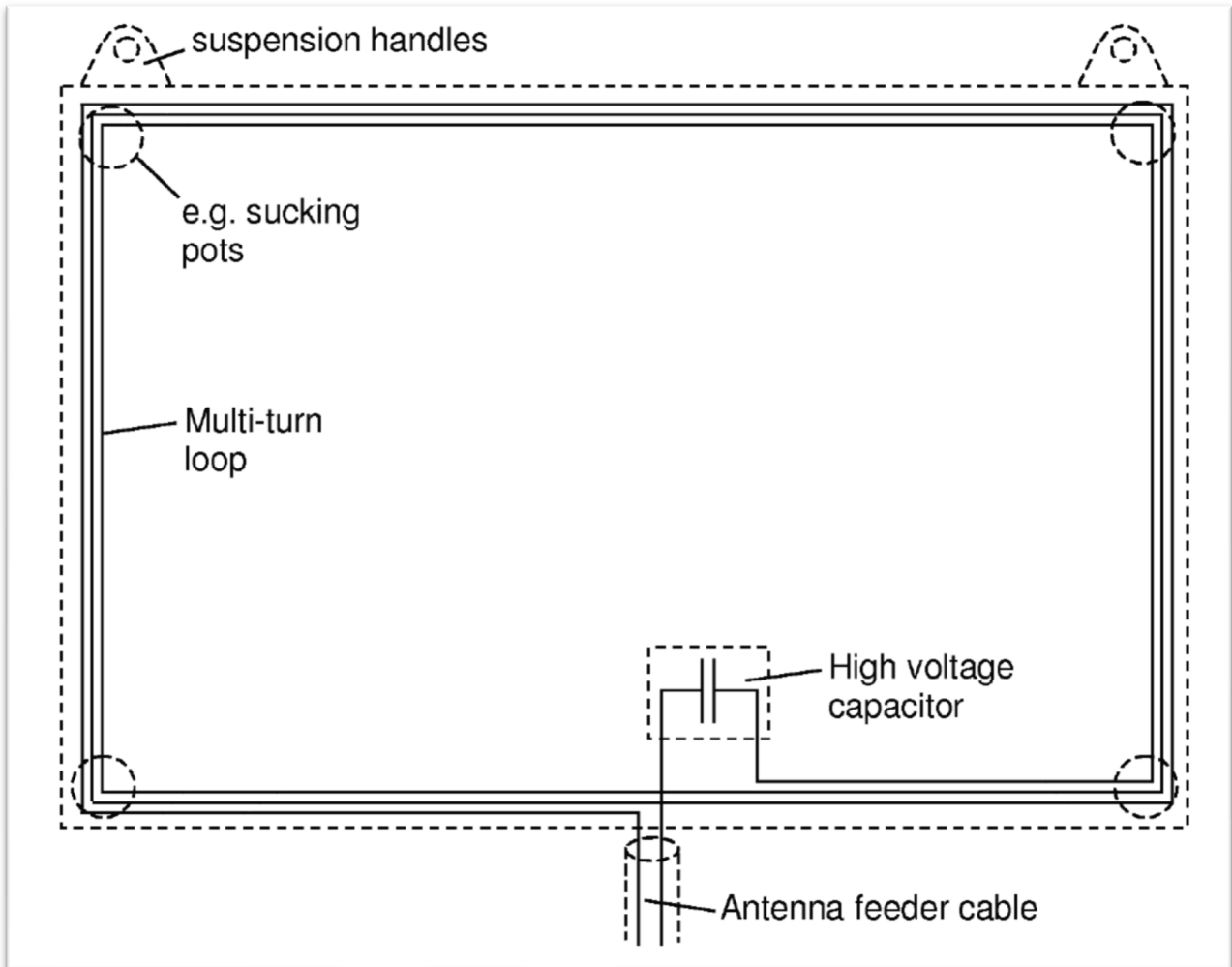
Allen Decl. 176 (annotating Cook-554 Fig. 15 (CProv Fig. 4-12)); Cook-554 6:56-62 (“[c]apacitive tuning may be accomplished by ... [c]apacitor bank”), 17:41-51, 19:1-3, Fig. 2 (CProv Fig. 3-2); CProv 30, 52, 55.

Cook-554 explains that in the Wireless Power Bridge, the transmit and receive antenna units are “flat panel[s].” Cook-554 10:61-65. These “flat panel” antenna units are depicted in Figure 14 below, which include a multi-turn loop with three turns in the same plane:



Allen Decl. 177 (annotating Cook-554 Fig. 14 (CProv Fig. 4-13)); Cook-554 2:38-39, 10:61-65, 10:61-65, 13:31-41, 13:42-45, 13:50-51, 17:19-22, Figs. 11-12 (side views showing that the antenna units are thin and flat in the Wireless Power Bridge (CProv Fig. 4-8)); CProv 40, 42, 51, Fig. 4-13. While three turns are illustrated above, there can be a “larger number of turns.” Cook-554 15:38-54; CProv 49 (“use thin copper wire and a large number of turns”); Allen Decl. 177.

Cook-554’s Figure 14 illustrates the multi-turn loop as non-connecting rectangles, but a POSA would have understood that each turn would be connected to the other in a spiral as shown in Figure 4-13 of the Cook Provisional, which Cook-554 incorporates by reference:



CProv Fig. 14-3; Allen Decl. 178; Cook-554 1:4-6 (incorporating CProv by reference). Indeed, if the rectangles were non-connecting (as in Cook-554 Figure 14) they would form three “single” loops, rather than a “multi-turn loop” as Cook-554 describes and labels. Cook-554 13:12-17, Fig. 14; Allen Decl. 178.

7. Element [17f]: Size And Thickness

This element recites “wherein a characteristic thickness of the at least one of the resonators is much less than a characteristic size of the at least one of the

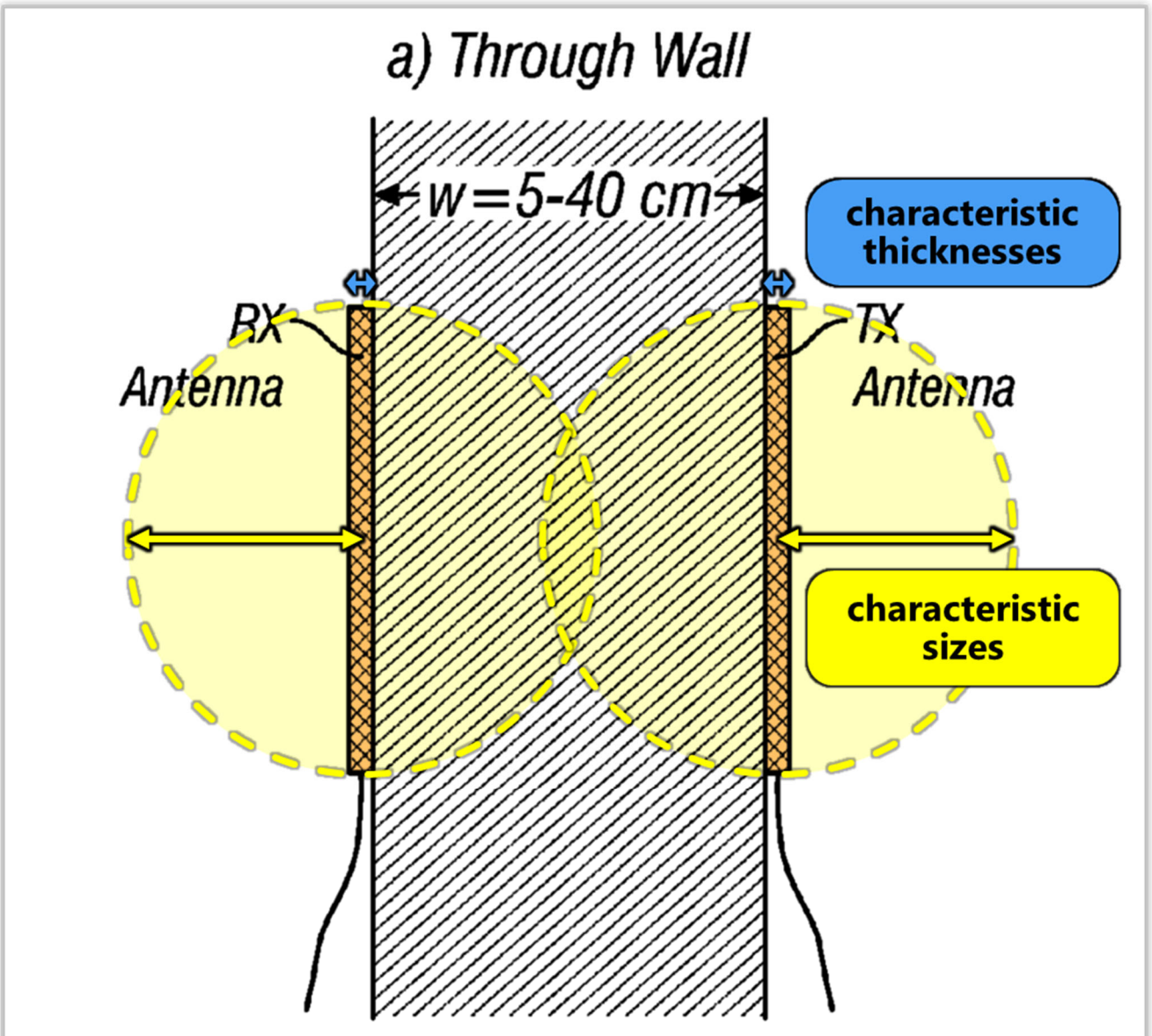
resonators.” Cook-554 taught this element, or at the very least, it would have been obvious.

Cook-554’s source and second resonators have “characteristic sizes” equal to the radius of the smallest sphere containing the inductive element because they are “magnetic resonators.” See Ground 2 Elements 17[a] and 17[b]. As magnetic resonators, the “characteristic thickness” is equal to the highest point of the inductive element measured from the surface it is formed on. Allen Decl. 179-181; see Claim Construction (“characteristic thickness”) above.

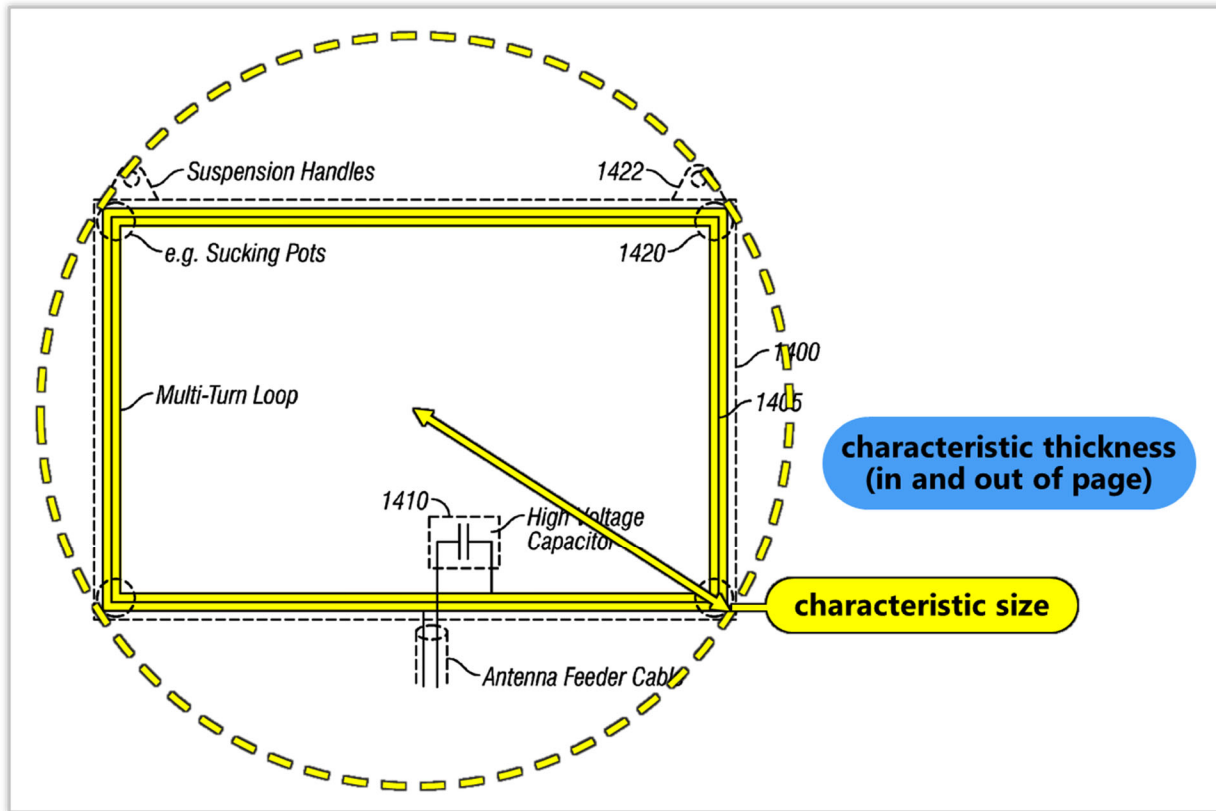
Although Cook-554 does not expressly state dimensions for its Wireless Power Bridge resonators, a POSA would have understood their characteristic thicknesses to be much less than their characteristic size. Allen Decl. 182. At the outset, Cook-554 explains that the resonators are “flat,” which a POSA would have understood to mean “having a relatively broad surface in relation to thickness or depth.” Ex. 1029 (definition of “flat”), Ex. 1030 (flat means “having a broad level surface but little height or depth”); Smith 8:59-65 (“flat spiral transmit resonator” in Fig. 1c), 15:24-39, Fig. 1c (showing “flat” resonator with much larger size than thickness), 15:62-16-13; Allen Decl. 183. Cook-554 further explains that the wires forming the flat coils can be “thin,” and a “large number of turns for the coil” (can be used, with the loop having a “maximum loop size for a given outer contour form factor.” Cook-554 13:30-41, 15:38-54; CProv 43, 49. And the distance the Wireless

Power Bridge could efficiently transfer power would “depend[] on the size of the antenna.” Cook-554 10:37-44; CProv 40. Taken together, a POSA would have understood that the “characteristic thickness” of Cook-554’s resonators (i.e., the dimension of the conductive coil line) is “much less” than their characteristic size (i.e., the loop radius). Allen Decl. 183-184.

Cook-554’s teaching that the loop should have a “maximum” contour size with a “thin” wire are also reflected in Cook-554’s Figures, which depict the flat panel antenna units in the Wireless Power Bridge embodiment with much smaller characteristic thicknesses than their characteristic size:



Allen Decl. 184 (annotating Cook-554 Fig. 11 (CProv Fig. 3-8));



Allen Decl. 184 (annotating Cook-554 Fig. 14 (CProv Fig. 4-13)).

Although Cook-554 does not state that its figures are drawn to scale, the figures can still be used for what they “reasonably disclose and suggest to one skilled in the art.” *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979); *In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972). Here, the proportional relationship of the characteristic size to the characteristic thickness in Cook-554’s figures clearly show to a POSA that the resonator’s characteristic thickness is much less than its characteristic size, without relying on any precise dimensions. Allen Decl. 184; *see Krippelz v. Ford Motor Co.*, 667 F.3d 1261, 1265, 1268-70 (Fed. Cir. 2012) (using a patent drawing to determine the relative location of a lamp and side

window); *Unified Pats., LLC v. Oceana Innovations LLC*, IPR2020-01463, Paper 27 at 38-51 (Feb. 14, 2022) (using a patent drawing to show two sides longer than a third side); cf *Hockerson-Halberstadt, Inc. v. Avia Grp. Int’l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000) (“patent drawings do not define the *precise proportions* of the elements and may not be relied on to show *particular* sizes”). Additionally, Cook-554’s figures would be read in view of the specification, which as discussed above taught “thin” wires and a “maximum” contour size, together disclosing Element [17f].

To the extent Patent Owner argues Cook-554 does not disclose a thickness that is much less than the characteristic size, it would have been obvious to a POSA implementing Cook-554 Wireless Power Bridge embodiment. Allen Decl. 185. A POSA’s motivation would have come from Cook-554 itself, which taught that the distance of power transfer depends on resonator size but that the resonators should be “flat” so that they could be mounted on a wall or window. Cook-554 10:8-44; CProv 39-40. Thus, when designing the Wireless Power Bridge for thicker walls or windows, a POSA would have been motivated to increase the resonator’s size while keeping it “flat” and thin. Allen Decl. 185. A POSA also would have been motivated to look for exemplary dimensions for the Wireless Power Bridge in Cook-086 (Ex. 1019), which Cook-554 expressly incorporates by reference. Cook-554 12:59-63; Allen Decl. 186. Cook-086 teaches, for example,

simulations of “loop antenna[s]” with a radius (characteristic size) that is more than twelve times greater than the diameter of the wire (characteristic thickness), and that those loop antennas could have a quality factor of 1000. Cook-086 10:55-11:32; Allen Decl. 186. A POSA would have found it obvious to apply similarly sized wires/loops to the Wireless Power Bridge antennas, which Cook-554 taught should have quality factors greater than 200. Cook-554 10:42-44; CProv 36; Allen Decl. 186.

* * *

For the foregoing reasons, claim 17 of the '719 patent is unpatentable in view of Cook-554.

VI. Ground 3: Claim 16 is obvious over Cook-523 and Pohjonen

The combination of Cook-523 and Pohjonen teaches each and every element of claim 16 of the '719 patent. Cook-523 teaches each element of claim 16 except for the “low loss tangent material” enclosing at least one of the resonators, which would have been obvious in view of Pohjonen.

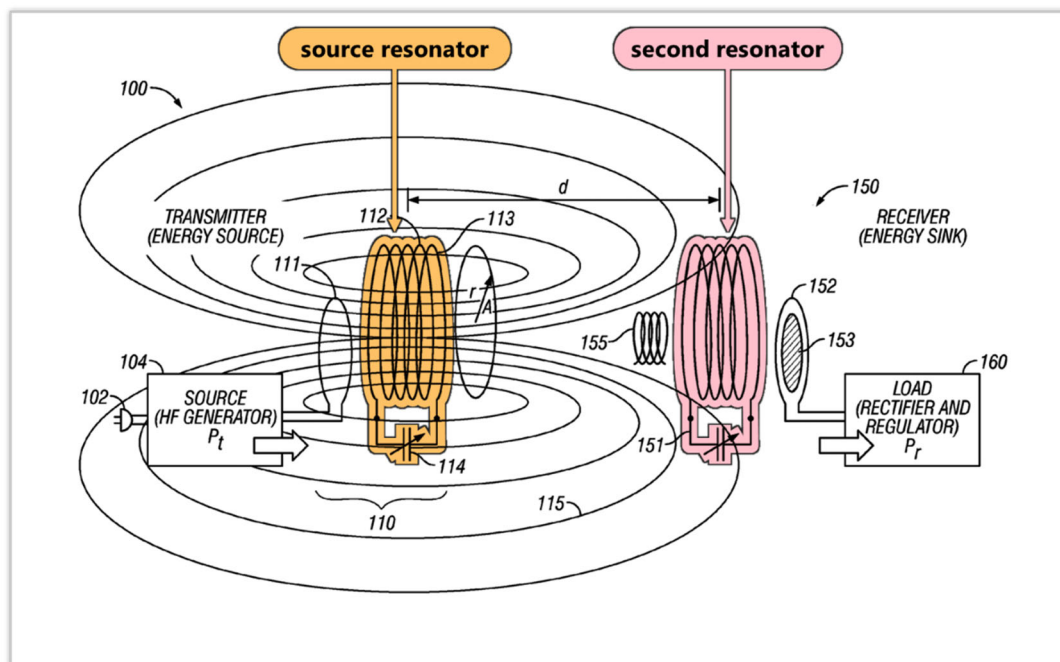
A. Overview of the Prior Art

1. Cook-523 (Ex. 1007)

Cook-523 is a U.S. Patent filed on September 16, 2008, and is prior art under 35 U.S.C. § 102(e). Cook-523 is a continuation-in-part of application No. 12/018,069. Cook-523's parent application, but not Cook-523, is identified on the face of the '719 patent. Cook-523's parent application was not discussed in any

office actions, and also lacks several additional pertinent disclosures relied on in this Ground, including Cook-523's Figures 12-13 embodiments where a second resonator is "integrated" in a mobile device. Allen Decl. 98.

Like the '719 patent, Cook-523 is generally directed to wireless power transfer using magnetically coupled resonators. Cook-523 Title, Abstract; Allen Decl. 99. More specifically, energy transfers wirelessly from a transmitting "resonant antenna" to a receiving "resonant antenna," where each is a resonator comprising an inductive coil and a capacitor.



Allen Decl. 99 (annotating Cook-523 Fig. 1); Cook-523 2:33-45.

Energy is transferred wirelessly from the first resonant antenna to the second resonant antenna via "magnetic field coupling." Cook-523 3:24-26, 3:33-35, 2:49-53. Cook-523 explains "magnetic field coupling" is used, rather than "electric

field coupling,” because it has the advantage of “relatively weak influence from extraneous objects.” Cook-523 3:33-39. Cook-523’s resonant “antennas preferably have Qs that are greater than 1000” and are “preferably of a small size to allow it to fit into a mobile, handheld device where the available space for the antenna may be limited.” Cook-523 1:31-45. For example, Cook-523 teaches that “wireless power may be integrated into portable devices” by forming the inductive coil of the receiving resonant antenna adjacent to the external surface of the portable device. Cook-523 13:17-39; Figs. 12A-C, Fig. 13; Allen Decl. 100.

B. Motivation to Combine

Cook-523 taught each and every claim element except the low loss tangent cover in Element [16e]. A POSA implementing, e.g., a mobile handheld device according to Cook-523 would have enclosed the second resonator antenna with Pohjonen’s low loss tangent cover for similar reasons as in Cook-554 described in Ground 1 above. *See* Ground 1 Motivation to Combine.

Initially, Cook-523 and Pohjonen are analogous art. Cook-523 describes the integration of “antennas” for receiving wireless energy at radio frequencies (e.g., 13MHz) into portable electronic devices, and Pohjonen is directed to “the technology of antennas for portable radio devices and devices including radio functionality.” Cook-523 1:30-37, 3:61-63; Pohjonen 1-2; Allen Decl. 191; ’719 patent 59:40-53, 47:51-56, 3:39-43, 62:27-30. Additionally, both Cook-523 and

Pohjonen describe antennas that are at least partially “radiating” energy and are directed to reducing losses in the area near the antenna. Cook-523 2:48-53 (explaining disclosed antennas are primarily “non-radiative” but “[o]f course, part of the output from the antenna will in fact radiate”), 4:5-7, 4:15-19, 11:55-62, Figs. 4A-4B, Fig. 7B; Pohjonen 1, 9; Allen Decl. 192; *see* ’719 patent 34:53-35:6.

A POSA could have and would have been motivated to enclose Cook-523’s integrated resonant antenna structure in Pohjonen’s low loss tangent cover because it would (1) protect Cook-523’s second resonator from damage during manufacturing or use, (2) improve efficiency of Cook-523’s second resonator while protecting it, and (3) provide increased durability and enable surface treatments like decorative painting. Allen Decl. 193.

First, Pohjonen’s cover would protect Cook-523’s second resonator from damage during manufacturing and hand-held use of the portable device. Allen Decl. 194-196; Cook-523 1:34-36, 13:17-28. Cook-523 depicts its “integrated” antennas as being on the external surface of a “housing,” without any surrounding enclosure, which would leave those components susceptible to damage. Allen Decl. 194. Adding a cover made of a low loss tangent material would “protect the antenna from mechanical damage,” which was a “typical” use for such outer covers. Dabov (Ex. 1016) 10:27-50, 10:43-50; Pohjonen 1-2, 6-7; *see* Ground 1 Motivation to Combine; Tamura (Ex. 1011) 2:19-20, 4:24-27; Wang-041 (Ex.

1013) at 5:67-6:2; Allen Decl. 193-196. This would be nothing more than the application of a known technique (low loss tangent covers) to a piece of prior art (portable devices with integrated antennas) ready for the improvement. *KSR*, 550 U.S. at 416.

Second, Pohjonen's low loss tangent outer cover would maintain Cook-523's antenna efficiency while physically protecting it. Allen Decl. 197. Cook-523 taught "lossy" materials "can have a deleterious effect on high Q resonators." Cook-523 11:55-62; *see* Cook-523 3:61-4:8, 6:62-67, 7:15-20, 11:1-18 (radiative losses decrease Q), 12:51-58; Terman (Ex. 1012) 3; Allen Decl. 197. Thus, a POSA implementing Cook-523 would have looked to an enclosure like Pohjonen's that had low loss tangents to preserve the resonator's Q and efficiency. Allen Decl. 197; Pohjonen 1-2, 6-7, 9-10; *see* Ground 1 Motivation to Combine.

Third, a POSA would have been motivated to enclose Cook's second resonator in low loss tangent materials for durability and aesthetics. Allen Decl. 198. Cook-523 depicts its integrated antenna without any outer cover or enclosure, which would leave exposed conductive coils with ridges on the external surface of the portable electronic device that could catch on a user's clothing and be otherwise damaged. Allen Decl. 198; Cook-523 Figs. 12A-12C. Coils on the exterior surface would also make it more difficult to add logos, decorations, or other designs to the device. Allen Decl. 198. Adding Pohjonen's low loss tangent

outer cover would provide “sufficient mechanical stiffness and durability as well as dimensional accuracy” and could serve “as a good basis for surface treatments such as decorative painting.” Pohjonen 2; Allen Decl. 198.

A POSA would have had a reasonable expectation of success applying Pohjonen’s cover to Cook-523’s second resonator. Allen Decl. 199-201.

Pohjonen explained that its outer cover could be applied to antennas “made of good [] conductor materials,” which is what Cook-523’s inductive component is.

Pohjonen 9; Cook-523 11:50 (“Coil material: Silver plated copper”), 12:50-58,14:4-6 (“Copper and silver are the best conductors”); Allen Decl. 199.

Likewise, Cook-523 taught that its second resonator could be integrated into a portion of a mobile phone that “rotates, slides, or folds away from the case,” which Pohjonen is “equally well applicable to.” Cook-523 13:29-31; Pohjonen 12; Allen Decl. 199. Additionally, Pohjonen taught that its outer cover used standard materials already regularly used for mobile phone covers, indicating a reasonable likelihood of success applied to Cook-523’s mobile device. Cook-523 1:34-36; Pohjonen 1-2, 7; Allen Decl. 199-200; *see* Ground 1 Motivation to Combine.

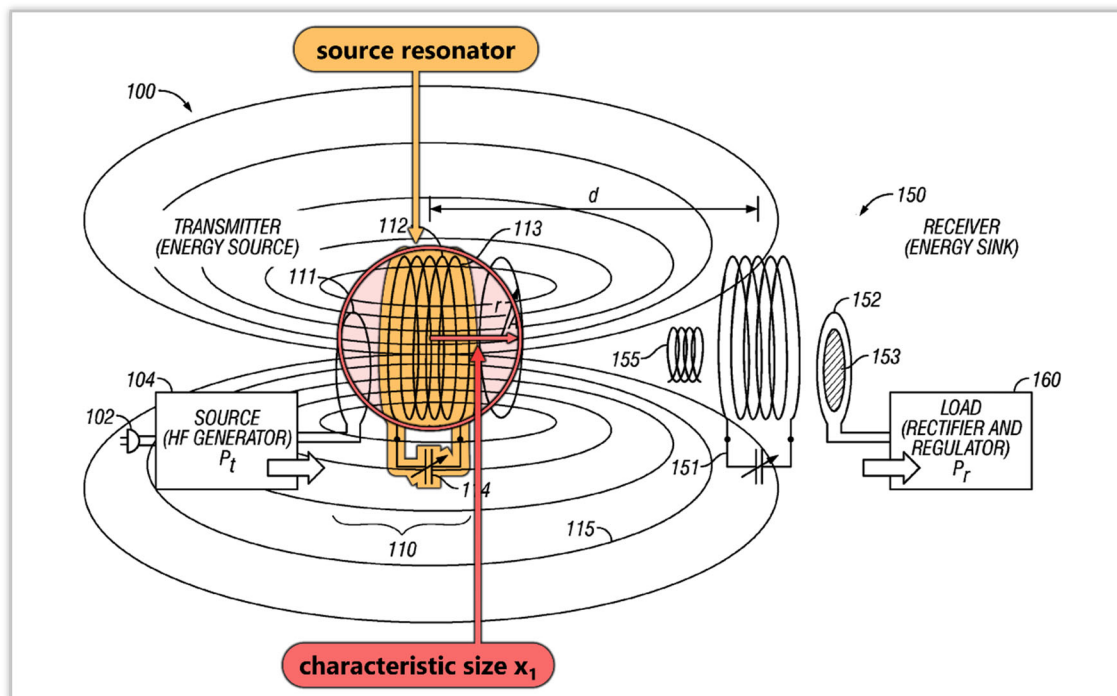
C. Claim 16

1. Element [16pre]⁶ Preamble

To the extent the preamble is limiting, it is disclosed by the combination of Cook-523 and Pohjonen as explained in the following sections.

2. Element [16a] Source Resonator

Cook-523's taught this element by disclosing a "transmitting antenna" with a "high Q resonant antenna part" that corresponds to the claimed "source resonator." Allen Decl. 203-204. As illustrated below, Cook-523's "high Q resonant antenna 112" has a "number N of coil loops 113" connected in series with "[a] capacitor 114":



⁶ See Ground 1 for claim language.

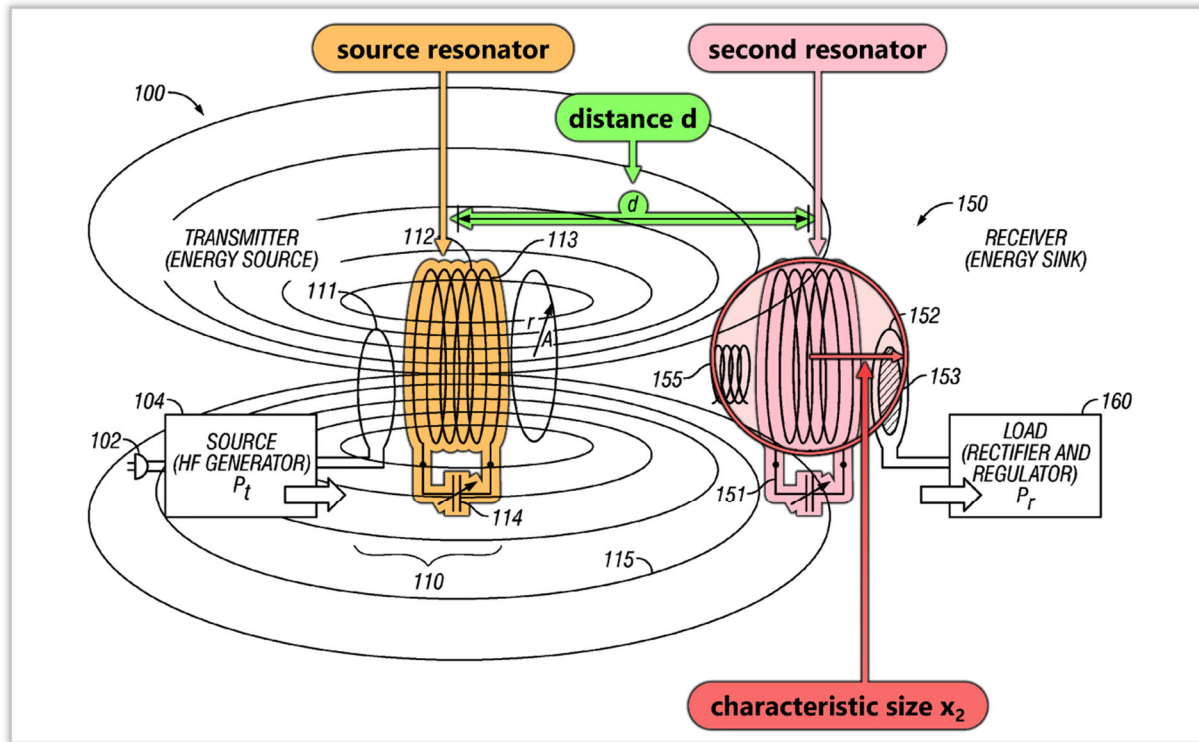
Allen Decl. 204 (annotating Cook-523 Fig. 1), 2:37-40; *see also* Cook-523 3:9-14, Fig. 3, Figs. 4A-B (equivalent circuit diagrams), Figs. 10A-10B. The “capacitor” can be “a totally separate structure from the coil” or it can be the “self capacitance of the wire forming the coil [].” Cook-523 2:42-45.

Cook-523’s source resonator is a “magnetic resonator” because it uses “magnetic field coupling” to transfer energy to secondary resonators, wherein “much of the output of the antenna” is “a magnetic field which is more stationary.” Cook-523 2:49-52, 2:66-3:14; Allen Decl. 205. Accordingly, Cook-523’s source resonator has a “characteristic size x_1 ” corresponding to the size of the coil loops (the inductive element). Cook-523 2:37-40, 3:58-64, Figs. 1, 3; Allen Decl. 205; *see* Claim Construction (“characteristic size”) above.

Cook-523’s source resonator has a “quality factor[.],” also referred to as “ Q_t ,” corresponding to the claimed “Q-factor Q_1 .” Cook-523 1:40-44, 2:38-39 (“high Q resonant antenna”), 4:25-50 (equations for “unloaded Q-factor [Q_t] of transmitter resonator antenna”), 11:51-52, 12:65-13:15, Fig. 7B; Allen Decl. 206.

3. Element [16b] Second Resonator

Cook-523’s “receiver” includes a “high Q resonant coil antenna [.] having a coil part and a capacitor” corresponding to the claimed “second resonator.” Cook 2:57-60, Fig. 1; Allen Decl. 208. Cook-523’s second resonator is “placed a distance D away from” the source resonator:



Allen Decl. 209 (annotating Cook-523 Fig. 1); Cook-523 2:55-60, 1:63 (“FIG. 3 shows wireless transfer using resonant coil antenna”), 3:9-14, 3:51-4:4 (describing “receiver [] receiving power” is “located a transfer distance d away from the transmit antenna”), Figs. 3, 4A-B (equivalent circuit diagrams), 12A-12C.

As with the source resonator in Element 16[a] above, Cook-523’s second resonator is a “magnetic resonator” because it is “magnetically coupled” to the source resonator, and has a “characteristic size x_2 ” as annotated above. Allen Decl. 210; Cook-523 2:55-3:14, Figs. 1, 3.

Cook-523 second resonator has a “ Q_r ” corresponding to the claimed “ Q_2 .” Cook-523 1:40-44, 2:56-60 (“high Q resonant coil antenna”), 4:53-68, 5:25-45 (“ Q_r ”); *see also* Cook-523 11:51-52, 12:65-13:15, 15:46-48; Allen Decl. 211.

4. Element [16c]: Wireless Energy Transfer

Cook-523 taught the “transfer of energy from a power source to a power destination via electromagnetic field coupling.” Cook-523 1:48-52. In particular, the receiving resonant coil (second resonator) is coupled to and receives power from the “magnetic field” wirelessly transmitted from the source resonant coil (source resonator). *Id.* 3:51-4:4, Figs. 1, 3; Allen Decl. 212-213; *see also* Cook-523 3:24-26, 11:55-58 (“magnetic power transmission according to this disclosure”), 13:17-18.

5. Element [16e]: High Quality Factor

Cook-523’s source and receive side “high Q resonant antennas” are resonators having quality factors Q_1 and Q_2 respectively. Cook-523 2:33-45, 2:56-65; *see* Elements 16[a]-[b] above. These resonators “preferably have Qs that are greater than 1000” for “efficient power transfer.” *Id.* 1:37-39; Allen Decl. 215. For example, the “Q factors of the described antennas” can “vary between 1500-2600.” Cook-523 13:65-14:15; *see also e.g., Id.* 11:51-52 (describing theoretical Q-factors of 2780 and measured Q-factors of 1300), Fig. 7B. Because Cook-523’s Q_1 and Q_2 are each greater than 100, “ $\sqrt{Q_1 Q_2}$ is greater than 100” as claimed. Allen Decl. 216.

6. Element [16e] Low Loss Tangent Enclosure Limitation

In the combination, Cook-523's second resonator is enclosed in a low loss tangent outer cover (<0.005) as taught by Pohjonen. *See* Motivation to Combine section above; Cook-523 13:17-39, Figs. 12A-12C, Fig. 13A, Pohjonen 1, 2, 6-7, 10-11; Allen Decl. 217-218. A POSA would have and could have enclosed Cook-523's second resonator in Pohjonen's low loss tangent outer cover because, as discussed above, it would (1) protect Cook-523's second resonator from damage during manufacturing or use, (2) improve efficiency of Cook-523's second resonator while protecting it, and (3) provide increased durability and enable surface treatments like decorative painting. *See* Motivation to Combine above; Allen Decl. 219.

VII. Ground 4: Claim 17 is obvious over Lee and Cook-523

Lee taught each element of claim 17, except it does not expressly quantify the quality factors of its disclosed resonators, i.e., it does not expressly teach "wherein $\sqrt{Q_1 Q_2}$ is greater than 100" as required by Element 17[e]. A POSA implementing Lee, however, would have used high quality factor resonators to achieve Lee's "nearly infinite" impedance at resonance and "drastic" decreases in impedance away from resonance, and would have looked to Cook-523 for exemplary high Q values. In particular, Cook-523 taught that resonators used for

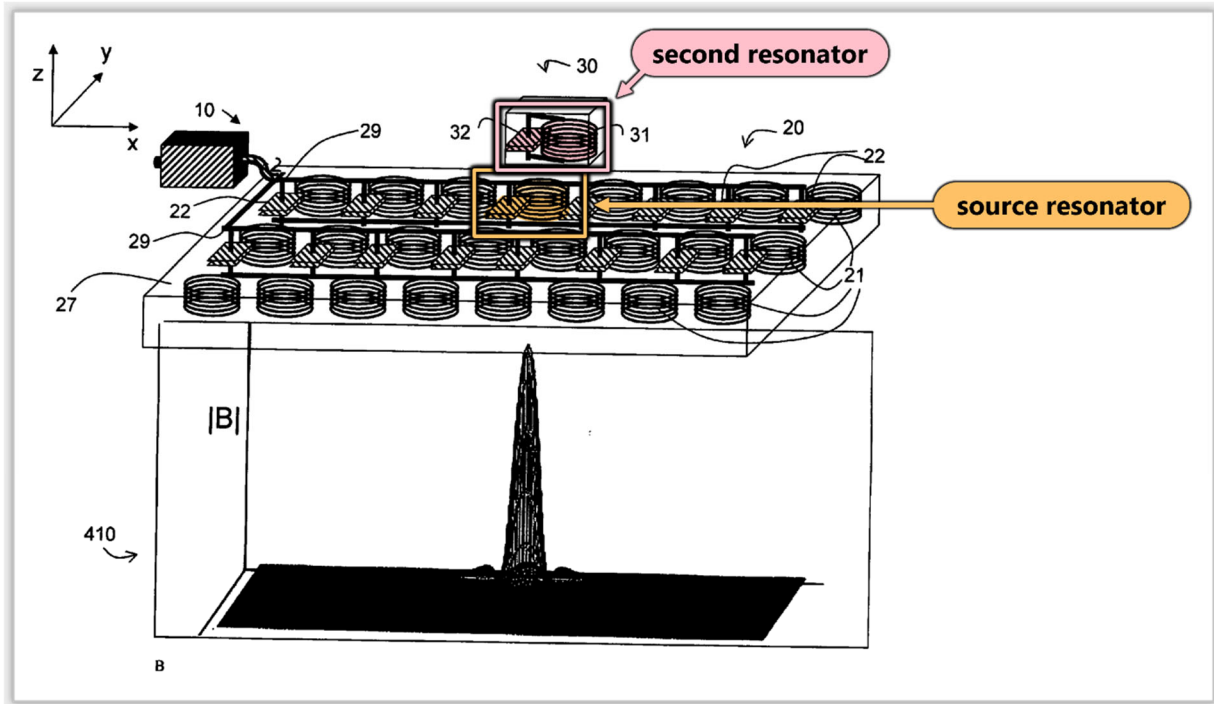
wireless power transfer can and should have high quality factors greater than 100, and preferably over 1000. Allen Decl. 221.

A. Lee (Ex. 1008)

Lee was published on June 28, 2007, and is prior art under 35 U.S.C. § 102(a), (b) and (e). Lee was not considered during prosecution.

Like Cook-523 and the '719 patent, Lee is directed generally to a “system and method for efficient and safe transfer of electrical power without needing conductive contacts.” Lee (Ex. 1008) ¶ 1. Lee explains that “[c]ontact free power has been around a long time” (Lee ¶ 2) including “resonant power transfer” from a source resonator to a device resonator (*id.* ¶ 5), but that prior art techniques did not provide an adequate method to “localize the magnetic field around the secondary devices.” *Id.* ¶ 8; Allen Decl. 102-103.

Lee thus improves on prior art devices by designing the source of wireless power (a “primary unit”) as a two-dimensional array of source resonators, i.e., planar coils connected in parallel with a matching capacitor. Lee 54-56; Allen Decl. 104. Power is transferred wirelessly to a magnetically coupled second resonator, similarly configured as a “parallel LC” circuit, as illustrated below:



Allen Decl. 104 (annotating Lee Fig. 3); Lee ¶ 56.

Lee explains that its use of parallel LC resonators allows localization of the magnetic field as depicted in “graph 410” at the bottom of Figure 3, which shows the magnetic field intensity from the array of source resonators in the presence of a nearby second resonator. Lee ¶¶ 56-57; Allen Decl. 105-109 (describing localization technique); Terman 51 (describing parallel LC resonators).

Lee describes as background that the energy conversion efficiency of a resonator will be impacted by its “Q factor,” but does not expressly quantify the value of Q for its resonators. Lee ¶ 12; Allen Decl. 109.

B. Motivation to Combine

Lee teaches each and every claim element except wherein $\sqrt{Q_1 Q_2}$ is greater than 100. A POSA implementing a wireless power transfer system according to Lee would have and could have implemented resonators with quality factors over 100 as taught by Cook-523.

Lee and Cook-523 are analogous art. Lee describes a “system and method for efficient and safe transfer of electrical power without needing conductive contacts,” where a first resonator structure “generate[s] [an] inductive magnetic field” and a second resonator structure “can resonate with the inductive magnetic field” to transfer power. Lee ¶¶ 1, 54, Fig. 1. Similarly, Cook-523 describes “efficient power transfer” wirelessly between “resonant antennas” via “electromagnetic field coupling.” Cook-523 (Ex. 1007) 1:37-41, 2:33-65, Figs. 1, 3, 4A-4B, 10A-10B; Allen Decl. 223.

Although Lee does not quantity Q of its resonators, a POSA reading Lee would have understood that the system is designed with source and device resonators having a Q as high as possible (“nearly infinite”). Allen Decl. 224-225; *see* Lee ¶ 56.

First, a POSA reading Lee would have understood that its source resonators are designed with Q as high as possible. Allen Decl. 226. In particular, Lee taught that its source resonators have “nearly infinite impedance to the RF source” when

operated at their resonant frequency. Lee ¶ 56. A POSA would have understood that in order to have “nearly infinite impedance” at resonance the circuit would also need a “nearly infinite” Q because Lee’s source resonators are “parallel LC” resonators with an impedance characteristic that increases approximately linearly with Q values:

$$\text{Parallel impedance at resonance} = \frac{(\omega_0 L)^2}{R_s} = (\omega_0 L)Q \quad (3-14)$$

Terman 52; Allen Decl. 227.

Lee also taught that the “nearly infinite” impedance of the source resonators should “decrease[] drastically” in the presence of a compatible second resonator. Lee ¶¶ 55-56. This also means very high Q values because Q alters the “sharpness of[] resonance,” i.e., the slope of impedance change off of resonance is proportional to Q. Allen Decl. 228; Terman 48-49. Higher Qs will have a “sharper” (more drastic) decrease in impedance when the circuit is shifted off resonance. Terman 48-49; Allen Decl. 228. Thus, a “drastic” decrease off of resonance, as taught by Lee, means high Q. *Id.*

A POSA also would have understood Lee’s second resonators are designed with a high Q that is similar to the “nearly infinite” Q of the source resonator. Allen Decl. 229. Lee taught that a device having a “compatible” second resonator (i.e., a parallel LC resonator tuned to the same resonant frequency) should “strongly alter”

the impedance of Lee's source resonator at resonance, whereas "incompatible electronic devices or a foreign object" would not "shift the local resonance enough to cause even a minute amount of power transfer." Lee ¶¶ 55, 57. As discussed previously, Lee's source resonator has a "nearly infinite" impedance at resonance. Allen Decl. 230 For that "nearly infinite" impedance to be "strongly shifted," the impedance of the secondary circuit would also preferably be "nearly infinite." Allen Decl. 230; Terman 63-67 ("coupled impedance" is equal to the "self-impedance of the primary plus whatever impedance of the secondary circuit couples into the primary"). Lee's second resonator is a "parallel LC" circuit and thus to have the desired impedance it would have "nearly infinite" Q. Lee ¶ 57; Allen Decl. 230-231.

A POSA reading Lee would have understood "nearly infinite" means Q as high as practical, which would also improve transfer efficiency. Lee ¶ 12 (acknowledging Q cannot be "infinity" in practice); Allen Decl. 232; Story of Q (Ex. 1010) 592 ("[i]n a majority of situations the desired value of Q is the highest one economically attainable."). *InductEV Inc. v. Witricity Corp.*, IPR2021-01165, Paper 41 at 47-50 (March 6, 2023) (Ex. 1022) (finding prior art taught "increased energy transfer efficiency resulting from higher Qs"). To determine what Q values were practical and attainable, a POSA would have looked to the Q values in other known high Q resonant wireless power transfer systems, which would have led them to

Cook-523. Cook-523, like Lee, taught source and device resonators comprising a planar coil and a capacitive element and implementing device resonators within, for example, a mobile device. Lee ¶¶ 55-57, 76, Fig. 3; Cook-523 Fig. 1, 2:37-65, 13:16-17; Allen Decl. 233. Cook-523 explained that quality factors of a source resonator and a device resonator used for wireless power transfer can be equal, and are preferably “greater than 1000” for “efficient power transfer.” Cook-523 1:37-39, 1:44-45; *see also id.* 6:31 (“doubling transmitter Q-factor doubles efficiency”); 11:55-56 (“magnetic power transmission according to this disclosure may rely on high-Q for improved efficiency”), Figs. 12C (showing planar coil), 13A (same); Allen Decl. 233.

A POSA would have recognized that Cook-523’s resonators are configured as “series LC” circuits with impedance minimized at resonance, whereas Lee’s resonators are “parallel LC” circuits with impedance maximized at resonance. Allen Decl. 234; Lee Figs. 1, 3; Cook-523 2:40-42; 3:10-14. These differences would have been well understood, and a POSA would have known Cook-523’s “series” LC designs achieving Q values in the thousands could still be applied to Lee’s “parallel” LC resonators because “parallel” resonance is “analogous” to “series” resonance. Terman 50-51; *see* Lee ¶ 56 (referring to parallel LC network “anti-resonance frequency” interchangeably with “resonance frequency” applicable to series LC circuits); Allen Decl. 234. Indeed, it was well known that a parallel LC circuit’s

“resonant curve” has the “same shape” as a resonant circuit having “a series configuration with the same inductance, capacitance, and resistances.” Terman 52-53 (“working rules” for series resonance “also apply” to “parallel resonance when the circuit Q is moderate or high” with the “only difference is that the signs of the phase angles are now reversed”); Allen Decl. 234. And Cook explained in other prior art patent applications that a “parallel LC circuit” with a “relatively high Q, for example a Q that is higher than 1000” were known for use in resonant wireless power transfer. Cook-918 (Ex. 1021) ¶ 11, Cls. 6, 13, Fig. 1; Allen Decl. 234-235.

A POSA would have had a reasonable expectation of success implementing Lee’s resonator quality factors in the hundreds or thousands because Cook-523 and other prior art taught that those values were achievable. Cook-523 12:65-13:15 (explaining that “Q factors of the described antennas” can “vary between 1500-2600”); Fig. 7B (showing exemplary Q factors from 2000-4000 for a resonant antenna); Joannopoulos (Ex. 1020) 7:20-26 (resonator with 1cm radius coil for use in a cell phone with $Q=1225$), Cls. 2-5 (first and second resonators with Q_1 and Q_2 greater than 100, 200, 500, and 1000); Cook-554 (Ex. 1005) 2:6-7; CProv (Ex. 1006) ¶ 5; *see also InductEV Inc.*, IPR2021-01166, Paper 35 at 45-46 (finding resonators with Q values >100 and “the square root of the resonator Q times the second resonator Q is greater than 100” invalid as obvious); Allen Decl. 236. A POSA also would have been able to design a circuit to achieve these Q values with

a high degree of success based on well-known formulas that demonstrate high Q values can be achieved by adjusting the RLC components of a parallel LC resonator. Terman 51-52; O'Brien 114-115; *InductEV Inc.*, IPR2021-01165, Paper 41 (Ex. 2022) at 24-26.

C. Claim 17

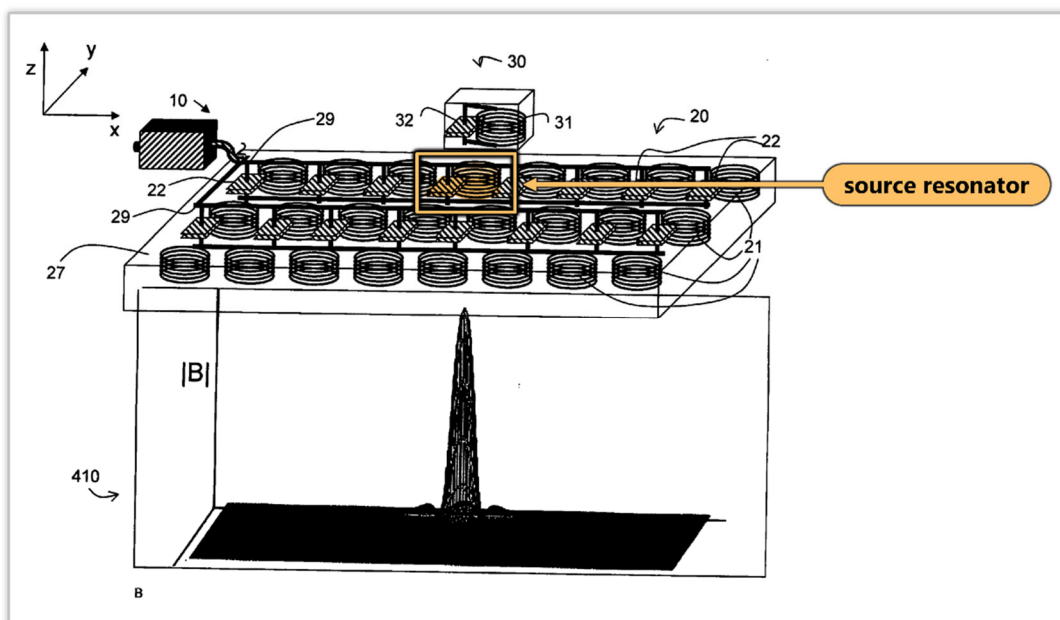
1. Element [17pre]:⁷ Preamble

To the extent the preamble is limiting, the combination of Lee and Cook-523 taught a “system” for the reasons explained in the following sections. Allen Decl. 237.

2. Element [17a]: Source Resonator

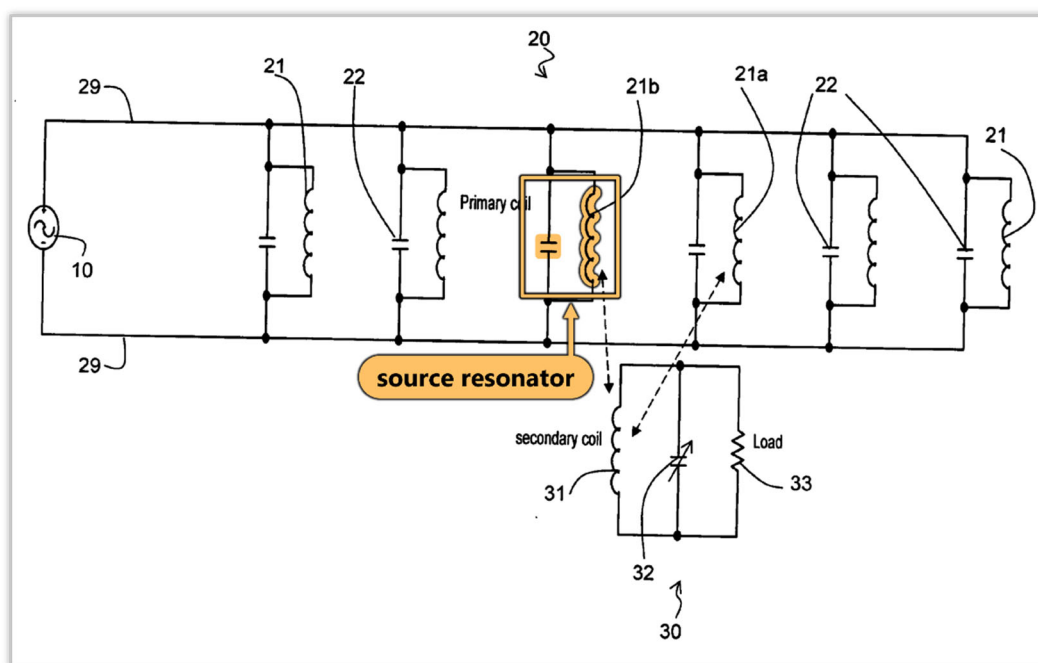
Lee taught this element, including a “primary unit” with an array of “local parallel LC (inductance 21-capacitance 22)” circuits, each with a “resonance frequency” and corresponding to the claimed “source resonator.” Lee ¶¶ 55-57; Allen Decl. 238-239. Figure 3 below shows a primary unit 20 with an array of source resonators, each of which includes inductive field coil 21 and capacitor 22, with the source resonator producing the largest magnetic field intensity annotated:

⁷ See Ground 2 for claim language.



Allen Decl. 239 (annotating Lee Fig. 3); Lee ¶ 56, Figs. 2, 4, ¶¶ 54-55, 57-58.

Lee also provides the following equivalent circuit diagram showing its array of source resonators.



Allen Decl. 240 (annotating Lee Fig. 4); Lee ¶ 58.

Lee's source resonators are "magnetic resonators" because they transmit power primarily through their magnetic field to a second resonator, with a "characteristic size" equal to the radius of a sphere that encompasses its inductive element. Lee ¶¶ 54-55 ("inductive magnetic field of the primary"), 57, 60 ("magnetic coupling of the primary coils 21 to the secondary coil 31"); Allen Decl. 241-245; *see* Claim Construction ("characteristic size") above.

Second, a POSA would have also understood that each of Lee's source resonators in the array has a quality factor. Allen Decl. 246; Lee ¶¶ 55 ("local resonance nature of the primary RF circuit"), 56, 57. As a POSA would have known, Q applies "to any resonant structure or device." Story of Q 588. This includes Lee's source resonators that form a "local resonance substructure" in the primary unit. Lee ¶ 57; Allen Decl. 243-244. In particular, Lee's source resonators are "local LC" networks connected in parallel, which was a well-known circuit that had a defined Q. Lee ¶¶ 54-55; Allen Decl. 244; Terman 50-52 (Q is a "fundamental relation[] of a parallel resonant circuit"); O'Brien 114 (Ex. 1023) ("parallel resonant circuits" are "elementary" with a "well established" Q characteristic).

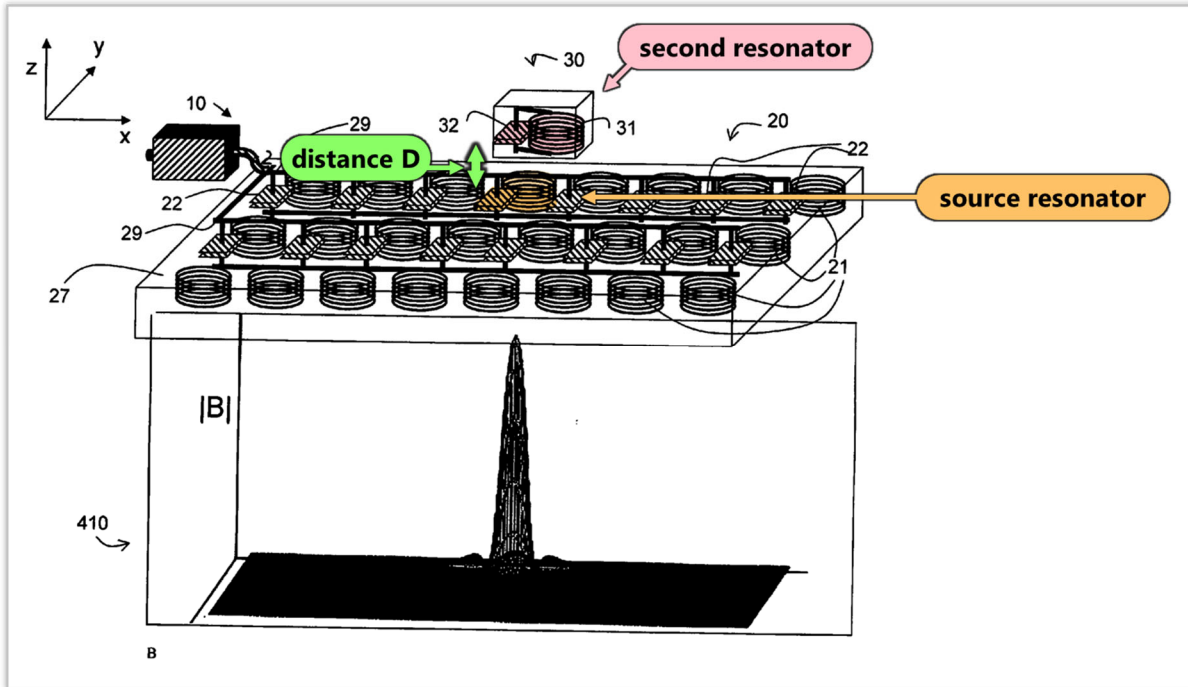
The '719 patent is consistent that a POSA would have understood Lee's source resonator has the claimed "first Q-factor Q_1 " because it is a resonator and therefore some amount of energy decay and loss. '719 patent 11:64-66; Allen

Decl. 245. Multiple examiners during prosecution of Patent Owner's other applications have recognized that quality factors are an inherent property of resonators. 12/649,635 FH (Ex. 1024) 1206; 12/639,963 FH (Ex. 1025) 1226; Allen Decl. 245.

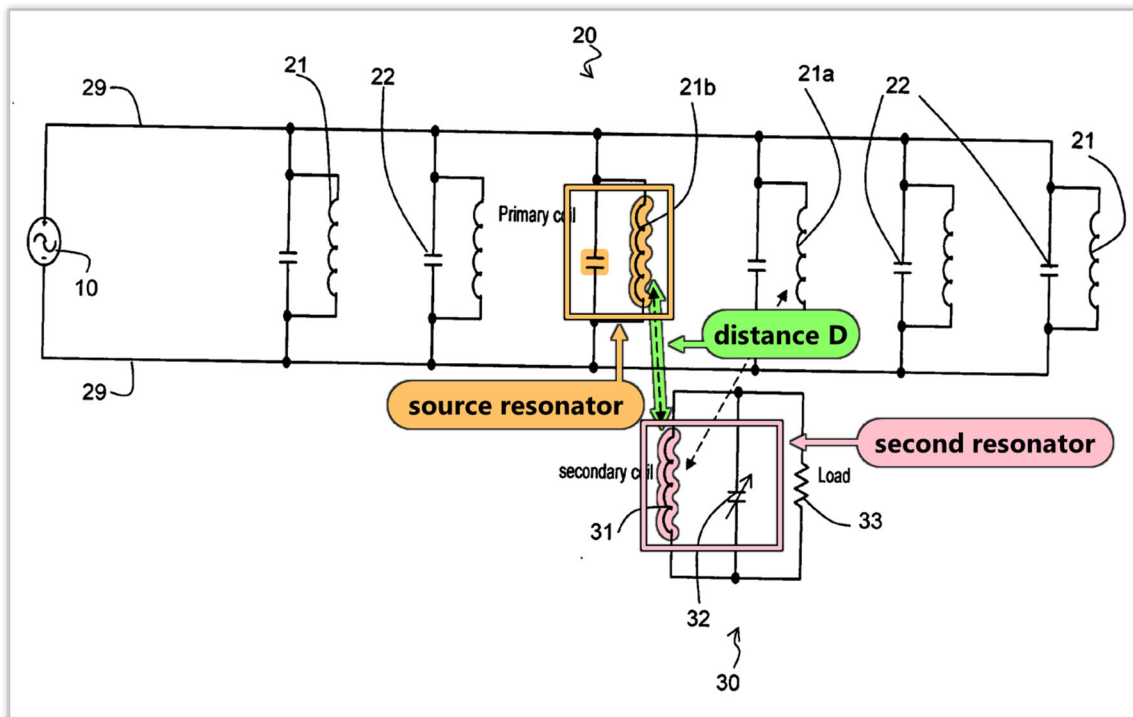
Accordingly, Lee's localized LC resonant circuits in the primary unit have the claimed Q_1 . Allen Decl. 246. Furthermore, in the combination, a POSA would have been motivated to select Q values in view of Cook-523, which also taught that source resonators comprising an inductor, capacitor, and operating at a resonant frequency have a quality factor. Cook-523 1:40-44, 2:38-39, 4:25-50, 11:51-52; *see* Motivation to Combine section above; Allen Decl. 246.

3. Element [17b]: Second Resonator

Lee taught this element, including a "secondary unit" for receiving wireless power includes a receiving coil and a tunable capacitive element that corresponds to the claimed "second resonator." Allen Decl. 247-248; Lee ¶¶ 57, 75. The second resonator is located a distance D from the source resonator that is producing the largest magnetic field intensity for "contact free power transfer":



Allen Decl. 248 (annotating Lee Fig. 3); Lee Title, ¶¶ 54 (“wireless power transfer”), 57 (describing second resonator).



Allen Decl. 248-249 (annotating Lee Fig. 4); Lee Abstract (“contact free power transfer”), ¶¶ 58, 60, 23-35 (summarizing embodiments used for “[transferring/receiving] power wirelessly”), 37, 47, 54-55, 57, 76-78 (describing Figures 12-13 embodiment showing exemplary second resonator with plurality of capacitors), Figs. 1-3, 12-13.

Lee’s second resonator couples with the magnetic field of the source resonator and is therefore a “magnetic resonator” with a characteristic size x_2 equal to the radius of the smallest sphere that would enclose the receiving coil. Allen Decl. 250-251; Lee Fig. 3, ¶¶ 70, 75; *see* Ground 4 Element [17a] above; Claim Construction (“characteristic size”) above.

Lee’s secondary parallel LC circuit also has a “quality factor” because it is a resonator with an inductive element, a capacitive element, and a resonant frequency. Lee ¶¶ 55 (“resonance circuitry within the secondary unit 30”), 57, 60 (“capacitance of the secondary unit is chosen” so there is “parallel LC resonance at the operating frequency of the primary unit 20”); *see* Element 17[a] above (resonators have Q factors); Allen Decl. 252. Furthermore, in the combination, Cook-523 taught that second resonators comprising an inductor, capacitor, and tuned to a resonant frequency have a quality factor. Cook-523 1:40-44, 2:56-60, 11:51-52; Allen Decl. 252-253.

4. Element [17c]: Wireless Energy Transfer

Lee explains that there is “magnetic coupling of the primary coil[] 21” of Lee’s source resonator “to the secondary coil 31” of Lee’s second resonator. Lee ¶¶ 60, 37, 55, 57. This allows the primary unit to “transfer[] power wirelessly” and the “secondary unit” to “receiv[e] power wirelessly.” *See generally* Lee ¶¶ 20, 23-25 (summarizing embodiments “for transferring power wirelessly”), ¶¶ 26-35 (summarizing embodiments “receiving power wirelessly”), Figs. 3, 4, 12; Allen Decl. 254-255.

5. Element [17d]: High Quality Factor

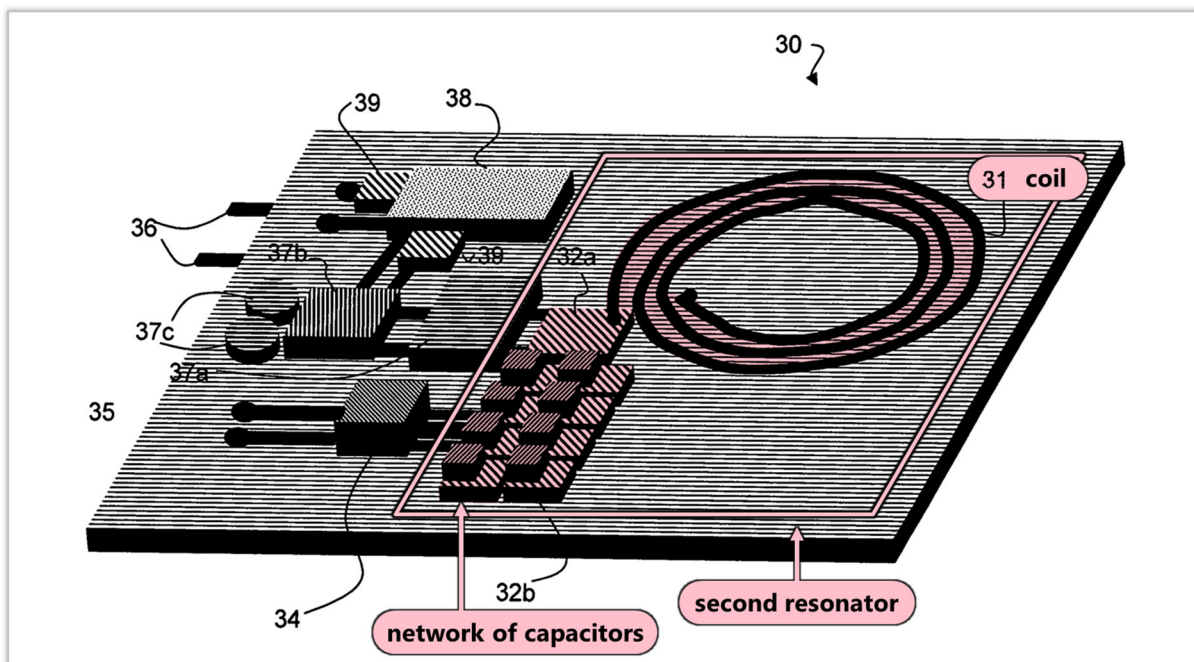
As explained in the Motivation to Combine section, a POSA would have been motivated to implement Lee’s source and second resonators with “nearly infinite” quality factors, and it would have been obvious to design the circuits with Q values greater than 100 and preferably greater than 1000 as taught by Cook-523. *See* Motivation to Combine section above; Cook-523 1:37-39, 11:51-52, 11:55-56, 13:17-19; Allen Decl. 256-257. Cook-523 taught, for example, that antennas comprising a planar coil made of conductive material connected to a capacitor, like those described in Lee, can have “Q factors” that “vary between 1500-2600.” Cook-523 12:65-13:15, 13:17-19. A POSA could have and would have done so to achieve Lee’s “nearly infinite” impedance characteristics at resonance and desired “drastic” change in localized impedance when a second resonator is in proximity to

a source resonator, and for efficient and non-lossy power transfer. Lee ¶¶ 55, 60-61; Cook-523 1:37-39; Allen Decl. 258; *see* Motivation to Combine section above.

When Lee's source and second resonators are each designed with quality factors greater than 100, and preferably greater than 1000, as taught by Cook-523, the " $\sqrt{Q_1 Q_2}$ is greater than 100." Allen Decl. 259.

6. Element [17e]: Planar Coils And Capacitors

Lee's second resonator has "a coil of a plurality of turns of a conducting material connected to a network of capacitors, wherein the plurality of turns are in a common plane" as claimed. Allen Decl. 260-261. The second resonator illustrated below is a "spiral shaped PCB [printed circuit board] trace coil." Lee ¶ 75. The spiral coil has a plurality of turns in the common plane of the PCB surface and it is connected to a network of capacitors (32a and 32b).



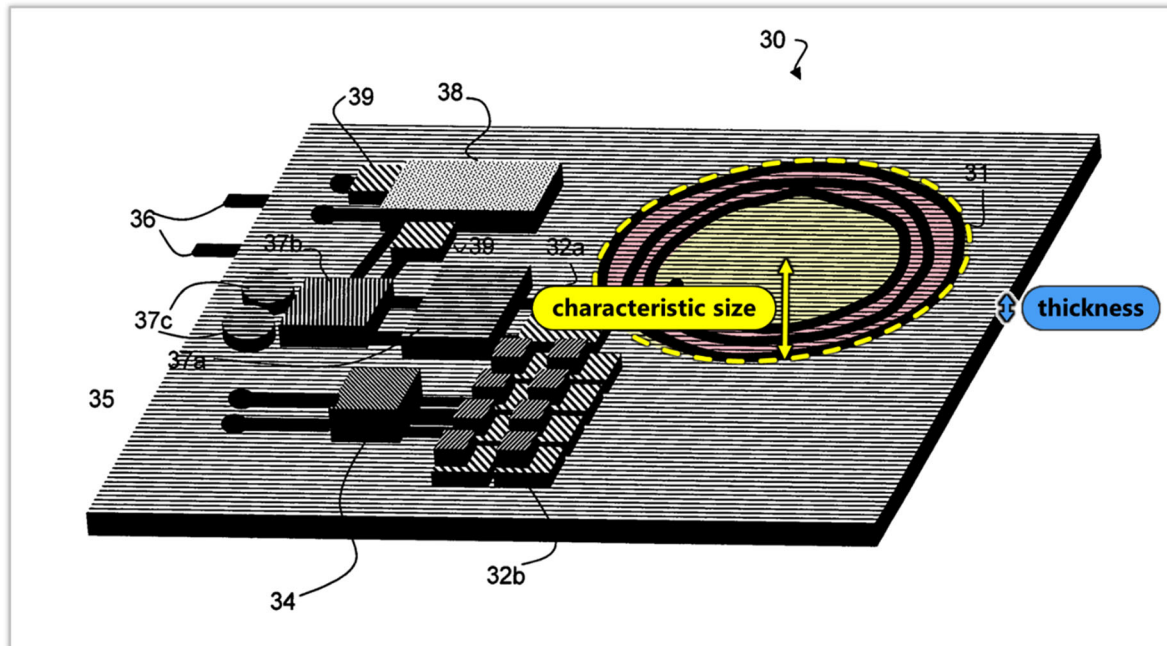
Allen Decl. 261 (annotating Lee Fig. 12); Lee ¶¶ 75 (“a main capacitor 32a in parallel connection with the receiving coil 31, and a bank of switched capacitors 32b”), 78, 26 (secondary coil with “multiple turns” that are “substantially flat”), 27, 86, Figs. 1-4, 13.

The coil 31 is a “conducting material” so that it “can resonate with the inductive magnetic field excited by the primary coils.” Lee ¶¶ 26, 54, 55, 57, Cls. 2 (“secondary unit comprises a conducting structure to generate a radio frequency”), 4 (similar); Allen Decl. 262; *see also* Lee ¶ 2 (contact free power transfer “has been around for a long time” and uses a “secondary conducting coil”).

7. Element [17f]: Size Limitation

Lee taught this element. Its second resonator in Figure 12 is a “magnetic resonator” with a “characteristic thickness” equal to the highest point of the receiving coil measured from the PCB surface. Lee ¶ 75; Allen Decl. 263-264; *see* Ground 4 Element [17b]; Claim Construction (“characteristic thickness”) above. Lee taught that the coils are “substantially flat” with “multiple turns,” and therefore a POSA would have understood that the thickness of the coil is much less than the radius of a sphere that could contain the multiple turns of the coil in a spiral shape. Lee ¶¶ 26, 75; Allen Decl. 264; *see* Exs. 1029 and 1030 (defining “flat”). Lee’s

Figure 12 also clearly discloses the claimed proportional relationship of the characteristic size to the characteristic thickness:



Allen Decl. 264 (annotating Lee Fig. 12); Lee Abstract, ¶¶ 26, 75. Lee does not state that Figure 12 is drawn to scale, but a POSA would not need to rely on any precise proportions of any elements in Lee's Figure 12 to understand that Lee taught element [17f]. Allen Decl. 264; *see Aslanian*, 590 F.2d at 914; *Mraz*, 455 F.2d at 1072; *Krippelz*, 667 F.3d at 1265, 1268-70 (Fed. Cir. 2012); *Unified Patents*, IPR2020-01463, Paper 27 at 38-51.

VIII. The Board Should Reach the Merits of This Petition

Discretionary denial is unwarranted. Should Patent Owner allege otherwise in its POPR, InductEV reserves the right to reply to address Patent Owner's arguments and the law and facts as they stand at that time.

A. Section 325(d) does not warrant denial

The Patent Office has never been presented with the combination of teachings and arguments submitted in Grounds 3 and 4—and thus the 35 U.S.C. § 325(d) analysis fails to meet Step 1 of the *Advanced Bionics* test. *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH*, IPR2019-01469, Paper 6 at 8 (Feb. 13, 2020) (precedential).

As to Grounds 1 and 2, the applicant cited the pre-grant publication of Cook-554 (U.S. Pat. Publ. No. 2009/0243397). The Patent Office was not ever presented, however, the combination of Cook-554 and *Pohjonen*. Therefore, Step 1 of the *Advanced Bionics* test is not satisfied for Ground 1.

Step 2 of the *Advanced Bionics* test also is not satisfied for either Ground 1 or 2 because the record is silent regarding the Examiner’s analysis of relevant teachings from Cook-554’s pre-grant publication. *Cf. Volkswagen Grp. of Am., Inc. v. Mich. Motor Techs. LLC*, IPR2020-00452, Paper 12 at 32-33 (Sept. 9, 2020) (error to overlook relevant teachings in a prior-art reference).

B. *Fintiv* does not warrant denial

Under the current facts, *Fintiv* is not applicable. This Petition was filed less than three months after service of the complaint in the corresponding district court litigation, and no trial date has been scheduled. If Patent Owner argues otherwise,

InductEV will seek permission to reply to address the facts and law as they stand at that time.

IX. Mandatory Notices under 37 C.F.R. § 42.8

A. Real Parties-in-Interest

The real party-in-interest is InductEV, Inc.

B. Related Matters

The '719 patent has been asserted in the following district court case pending in the Eastern District of Pennsylvania: *WiTricity Corp., v. InductEV, Inc.*, C.A. No. 2:23-cv-01099-CMR. Petitioner also expects to file in the near future an IPR challenging U.S. Patent Nos. 8,912,687 (“’687 Patent”) that is also asserted in that district court case.

The '719 patent is also related to U.S. Patent No. 8,304,935, which was the subject of an IPR petition in *InductEV Inc.*, IPR2021-01166. The PTAB found all claims of the '935 patent were invalid as obvious. *Id.*, Paper 35.

C. Grounds for Standing

Petitioner certifies that the '719 patent is available for *inter partes* review and that InductEV is not barred from requesting this proceeding.

D. Lead and Backup Counsel and Service Information

Pursuant to 37 C.F.R. §§ 42.8(b)(3), 42.8(b)(4), and 42.10(a), Petitioner designates the following lead counsel:

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Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney from Petitioner is attached. Petitioner consents to electronic service.

E. Fee for *Inter Partes* Review

The Director is authorized to charge the fee specified by 37 C.F.R. § 42.15(a) to Deposit Account No. 506269.

X. Conclusion

For the reasons set forth above, Petitioner InductEV respectfully requests *inter partes* review of the challenged claims of the '719 Patent.

Respectfully submitted,

Dated: July 17, 2023

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Petition complies with the word count limitation of 37 C.F.R. § 42.24(a)(1)(i) because the Petition contains a total of 13,937 words, which is the sum of 13,800 words calculated by Microsoft Word's word-count feature and 137 words hand-counted in the figures. This total excludes the cover page, signature block, and the parts of the Petition exempted by 37 C.F.R. § 42.24(a)(1).

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CERTIFICATE OF SERVICE

The undersigned certifies that a complete copy of this Petition for *Inter Partes* Review of U.S. Patent No. 8,461,719 and all Exhibits and other documents filed together with this Petition were served on the official correspondence address for the patent shown in Patent Center via Priority Mail Express on July 17, 2023:

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