

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Inter Partes* Review of:)
U.S. Patent No. 8,912,687)
Issued: Dec. 16, 2014)
Application No.: 13/288,589)
Filing Date: Nov. 3, 2011)

For: **Secure Wireless Energy Transfer For Vehicle Applications**

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,912,687**

TABLE OF CONTENTS

I.	Introduction.....	1
II.	Identification of Challenges (37 C.F.R. § 42.104(b))	2
III.	Background.....	2
	A. The '687 Patent (Ex. 1001)	2
	B. Prosecution History	6
	C. Person of Ordinary Skill in the Art	6
	D. Claim Construction	7
IV.	The '687 Patent is Entitled to an Effective Filing Date No Earlier Than April 24, 2009.....	7
V.	Claims 1-18 are Obvious over Cook in view of Bennett	10
	A. Cook (Ex. 1007)	11
	B. Bennett (Ex. 1005)	14
	1. Overview	14
	2. Bennett is entitled to its Provisional Application's filing date	17
	3. The Bennett Provisional Supports Claim 14 Of Bennett.....	17
	a. 14[pre] Preamble	17
	b. 14[a] Authentication	18
	c. 14[b] Power Transmission By A Non-Radiated Magnetic Field	19
	d. 14[c] Power Transfer At The Target Resonant Frequency	20
	e. 14[d] Recharging A Battery	20
	4. Bennett's relevant disclosures are supported by the Bennett Provisional.....	21
	C. Motivation to Combine	21

D.	Independent Claim 13 Is Obvious In View Of Cook And Bennett.....	30
1.	Element 13[pre]: Preamble	30
2.	Element 13[a]: Power Supply	30
3.	Element 13[b]: First Electromagnetic Resonator And Characteristics.....	31
a.	Element 13[b][i]: Electromagnetic Resonator Coupled to Power Supply	32
b.	Element 13[b][ii]: Resonant Frequency ω_1	34
c.	Element 13[b][iii]: Intrinsic Loss Rate Γ_1	35
d.	Element 13[b][iv]: First Q-factor $Q_1 = \omega_1 / 2\Gamma_1$	37
e.	Element 13[b][v] Housed In A Housing	37
4.	Element 13[c]: Load Configured To Power The Drive System Of A Vehicle	39
5.	Element 13[d]: Second Electromagnetic Resonator	41
a.	Element 13[d][i]: Electromagnetic Resonator Housed Upon the Vehicle and Coupled to the Load	41
b.	Element 13[d][ii]: Resonant Frequency ω_2	43
c.	Element 13[d][iii]: Intrinsic Loss Rate Γ_2	44
d.	Element 13[d][iv] Second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$	44
6.	Element 13[e]: Wirelessly Coupled	45
7.	Element 13[f]: Authorization Facility	47
E.	Independent Claims 1 and 7 Are Obvious In View Of Cook And Bennett.....	50
1.	Claim 1 – Wireless Receiver.....	50
2.	Claim 7 - Power Source	53
F.	Dependent Claims	56
1.	Claims 2, 8, and 14: Public Key Infrastructure	56
2.	Claims 3, 9, and 15: Secure Communication Channel	60

3.	Claims 4-5, 10-11, and 16-17: Communication Channel	63
4.	Claims 6, 12, and 18: A Safety Condition	65
VI.	The Board Should Reach the Merits of This Petition	67
A.	Section 325(d) does not warrant denial.....	67
B.	<i>Fintiv</i> does not warrant denial.....	67
VII.	Mandatory Notices under 37 C.F.R. § 42.8.....	68
A.	Real Parties-in-Interest	68
B.	Related Matters.....	68
C.	Grounds for Standing	68
D.	Lead and Backup Counsel and Service Information.....	69
E.	Fee for Inter Partes Review	70
VIII.	Conclusion	70

TABLE OF AUTHORITIES

Page(s)

CASES

<i>Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH,</i> IPR2019-01469, Paper 6 (P.T.A.B. Feb. 13, 2020).....	67
<i>Apple Inc. v. Fintiv, Inc.,</i> IPR2020-00019, Paper 11 (Mar. 11, 2020)	67
<i>Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.,</i> 800 F.3d 1375 (Fed. Cir. 2015)	7, 17
<i>InductEV Inc. v. Witricity Corp.,</i> IPR2021-01165, Paper 41 (Mar. 6, 2023)	4
<i>InductEV Inc. v. Witricity Corp.,</i> IPR2021-01166	68
<i>Koninklijke Philips N.V. v. Google LLC,</i> 948 F.3d 1330 (Fed. Cir. 2020)	59
<i>KSR Int’l Co. v. Teleflex Inc.,</i> 550 U.S. 398 (2007).....	60
<i>Lockwood v. Am. Airlines, Inc.,</i> 107 F.3d 1565 (Fed. Cir. 1997)	8
<i>Motorola Mobility v. Maxell, LTD,</i> IPR2023-00110, Paper 7 (June 15, 2023).....	17
<i>Penumbra, Inc. v. RapidPulse, Inc.,</i> IPR2021-01466, Paper 34 (Mar. 10, 2023)	7
<i>Rsch. Corp. Techs., Inc. v. Microsoft Corp.,</i> 627 F.3d 859 (Fed. Cir. 2010)	7
<i>Tronzo v. Biomet, Inc.,</i> 156 F.3d 1154 (Fed. Cir. 1998)	8

<i>Volkswagen Grp. of Am., Inc. v. Michigan Motor Techs. LLC</i> , IPR2020-00452, Paper 12 (Sept. 9, 2020).....	67
--	----

<i>WiTricity Corp., v. InductEV, Inc.</i> , C.A. No. 2:23-cv-01099-CMR (E.D. Pa.)	68
--	----

STATUTES

35 U.S.C.	
§ 102(e)	11, 14
§ 103.....	2
§ 112.....	8
§ 119.....	17
§ 120.....	8
§ 325(d).....	67

REGULATIONS

37 C.F.R.	
§ 42.8.....	68
§ 42.8(b)(3)	69
§ 42.8(b)(4)	69
§ 42.10(a)	69
§ 42.15(a)	70
§ 42.104(b).....	2

OTHER AUTHORITIES

U.S. Patent & Trademark Office, Applicant-Admitted-Prior-Art Memorandum (June 9, 2022).....	59
--	----

Exhibit List

Ex.	Description
1001	U.S. Patent No. 8,912,687 B2 (“’687 patent”)
1002	U.S. Patent No. 8,912,687 B2 File History (“’687 FH”)
1003	Declaration of Mark Allen in Support of Petition for <i>Inter Partes</i> Review (“Allen Decl.”)
1004	Curriculum Vitae of Mark Allen
1005	U.S. Patent Publication No. 2010/0036773 A1 (“Bennett”)
1006	U.S. Provisional Application No. 61/086,380 (“Bennett Provisional” or “BProv”)
1007	U.S. Patent Application Publication No. 2009/0299918 A1 (“Cook”)
1008	U.S. Patent Application Publication No. 2003/0115467 A1 (“Aull”)
1009	U.S. Patent No. 8,266,075 B2 (“Ambrosio”)
1010	U.S. Patent No. 7,602,143 B2 (“Capizzo”)
1011	U.S. Patent No. 8,547,069 B2 (“Jang”)
1012	U.S. Patent No. 5,462,439 (“Keith”)
1013	U.S. Patent No. 5,821,731 (“Kuki”)
1014	U.S. Patent No. 7,804,272 B2 (“Morita”)
1015	U.S. Patent No. 8,030,888 B2 (“Pandya”)
1016	H. Sakamota et al., <i>Large Air-Gap Coupler for Inductive Charger</i> , 35 IEEE Transactions on Magnetics 3526 (1999) (“Sakamoto”)
1017	Estill I. Green, <i>The Story of Q</i> , in 43 Am. Scientist 584 (1955) (“Story of Q”)

Ex.	Description
1018	Chwei-Sen Wang, <i>Design Considerations for Inductively Coupled Power Transfer Systems</i> (2004) (Ph.D. thesis, Univ. of Auckland) (“Wang”)
1019	U.S. Patent No. 8,880,889 B1 (“Ward”)
1020	Frederick Emmons Terman, <i>Electronic and Radio Engineering</i> (4th ed. 1955) (“Terman”)
1021	U.S. Patent No. 9,774,086 B2 (“Cook-086”)
1022	U.S. Patent No. 8,749,334 B2 (“Boys”)
1023	David H. Staelin et al., <i>Resonators</i> , in <i>Electromagnetic Waves</i> 336 (1994) (“Staelin”)
1024	U.S. Patent No. 5,745,574 (“Muftic”)
1025	U.S. Patent No. 5,815,573 (“Johnson”)
1026	U.S. Patent No. 6,240,187 B1 (“Lewis”)
1027	U.S. Patent No. 6,442,688 B1 (“Moses”)
1028	U.S. Patent No. 6,718,470 B1 (“Adams”)
1029	U.S. Patent No. 7,741,734 B2 (“Joannopoulos”)
1030	<i>InductEV Inc. v. Witricity Corp.</i> , No. IPR2021-01165, Paper 41 (Mar. 6, 2023)
1031	File History for Patent Application No. 13/789,860 (“13/789860 FH”)

I. Introduction

InductEV, Inc., requests *inter partes* review of claims 1-18 of U.S. Patent No. 8,912,687, titled “Secure Wireless Energy Transfer For Vehicle Applications” (“’687 patent”) (Ex. 1001). According to USPTO records, the ’687 patent is currently assigned to WiTricity Corporation.

The ’687 patent generally relates to the allegedly “inventive technique” of using a first resonator to wirelessly transfer energy to a second resonator through their coupled magnetic fields. ’687 patent 3:39-42. This was not new. Wireless power transfer between magnetically coupled resonators was well known and described in textbooks dating back to the 1940s. *See generally* Terman (Ex. 1020) 51-77 (describing series and parallel resonant circuits and energy transfer between mutually coupled resonators). And the ’687 patent describes the alleged invention as “general,” noting that it can be “applied to a wide range of resonators.” ’687 patent 3:42-43. The challenged claims are directed particularly to using resonators to provide wireless power to “vehicles.” *See, e.g.*, ’687 patent cl. 13 (“vehicle wireless power system”). But the ’687 patent merely lists vehicles as one of many possible applications that “one can imagine” could benefit from wireless power. ’687 patent 4:5-17, 6:6-29. And as set forth below, Cook (Ex. 1007) had already detailed how magnetically coupled resonators could be used for wirelessly charging electric-vehicle batteries before the ’687 patent.

The challenged claims further recite “an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.” ’687 patent cls. 1, 7, 13. That too was already known. Cook taught initiating wireless power transfer only to authorized vehicles with an account having charging enabled. With the obvious addition that resonator compatibility can be confirmed before initiating wireless power transfer, as taught by Bennett (Ex. 1005), the independent claims of the ’687 patent are unpatentable. The Cook/Bennett combination renders obvious every dependent claim of the ’687 patent too.

Accordingly, the Board should institute review of the ’687 patent and find all challenged claims unpatentable.

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

Claims 1-18 are unpatentable under 35 U.S.C. § 103 over Cook (Ex. 1007) and Bennett (Ex. 1005).

III. Background

A. The ’687 Patent (Ex. 1001)

The ’687 patent includes 168 drawing sheets and nearly 230 columns of description. *See generally* ’687 patent. It generally relates to systems and methods of wirelessly transferring electromagnetic energy from a first resonator to a coupled

second resonator. '687 patent 2:53-54, 3:39-44; Allen Decl. (Ex. 1003) 42.¹ The '687 patent refers to the use of “coupled electromagnetic resonators” as the “inventive technique.” '687 patent 3:39-42. But coupled resonators for wireless power transfer were well known. More than fifty years before the '687 patent was filed, Frederick Terman explained that resonant circuits were discussed “in every book on alternating currents” (Terman 45) and detailed how magnetically coupled resonators could transfer energy wirelessly. Terman 51 (“fundamental relations of a parallel resonant circuit are derived in every introductory book on a-c circuit theory”), 63-77 (describing energy transfer between mutually coupled resonators); Allen Decl. 43-47.

The '687 patent states that its wireless power transfer technique using coupled resonators is “general and may be applied to a wide range of resonators” for charging a “variety of electronic devices.” '687 patent 3:42-44, 3:60-65. In the challenged claims, the resonators are described in terms of three parameters:

- 1) Q – the “Q-factor” or “quality factor,” which “characterizes the energy decay [and] is inversely proportional to the[] energy losses,”
- 2) ω – the “resonant frequency,” which is “the frequency at which the energy stored by the resonator oscillates between that stored by the

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

electric field ... and that stored by the magnetic field ... of the resonator”

and is “determined by [the resonator’s] physical properties,” and

- 3) Γ – the “intrinsic-loss rate,” the rate at which “[t]he energy in the resonators ... may decay or be lost,”

’687 patent 17:26-36, 25:48-50, 26:12-15, cls. 1, 7, 13; Allen Decl. 48-61. As the Board recently found when invalidating an earlier filed patent with overlapping inventors and reciting the same parameters to describe resonators, these parameters were well known. *InductEV Inc. v. Witricity Corp.*, IPR2021-01165, Paper 41 (Mar. 6, 2023) (Ex. 1030) at 4 (claim elements 1[a][ii]-[iv], [b][ii]-[iv]), 16-17 (finding these claim elements undisputedly found in the prior art).

The challenged claims recite that the resonators are used for wirelessly charging a “vehicle” and that the source resonator is “configured to supply power at a rate sufficient to charge the battery of a vehicle.” ’687 patent cls. 1, 7, 13. As the ’687 patent explained, vehicles are one of the many “possible applications” for “[w]ireless energy transfer” along with myriad smaller devices requiring less power, such as charging mobile-phone batteries or robots. *Id.* 4:5-17, 6:6-29. For any of these applications, the same general technique of providing power from a source resonator to a second coupled resonator is used, except that the resonators would need to “be sized and configured for the appropriate power levels.” ’687 patent 130:4-8; Allen Decl. 62-63; *see also, e.g.*, ’687 patent 65:63-65, 86:39-41, 88:66-

89:4. The '687 patent contemplates, for example, that the disclosed resonator-based wireless charging could “trickle charge” an electric vehicle battery, potentially providing a few kilowatts of power overnight. '687 patent 97:14-31, 98:4-11; Allen Decl. 64. The '687 patent states that a POSA would “understand” how to select the shape, size, and material composition for the resonators in each application. '687 patent 77:1-13; Allen Decl. 65.

For providing wireless power to a vehicle battery, the '687 patent states that the source resonator is “outside the vehicle,” and the device resonator can be “on, under, alongside, attached to, and the like, a vehicle, for charging a vehicle battery.” '687 patent 148:20-28, 205:19-25. The '687 patent describes virtually every part of a car (inside or outside) as a possible location for a resonator. *See* '687 patent 86:22-34, 205:43-55, 212:33-46; *see also* '687 patent claims 1, 13 (“second electromagnetic resonator adapted to be housed upon the vehicle”); Allen Decl. 64-65.

In addition to the resonators, the claims recite “an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.” *See, e.g.*, '687 patent cl. 13. The '687 patent explains that this “authentication capability” can apply to any “source and device” to “ensure that only compatible sources and devices are able to transmit and receive power.” *See* '687 patent 102:14-17. For example, authentication can be used to confirm that “only

devices that are part of a specific subscription or plan[] are able to receive power from a source.” ’687 patent 102:20-21; Allen Decl. 66-67.

B. Prosecution History

The ’687 patent issued without any Examiner rejections on the merits. *See* ’687 patent (Ex. 1001) Cover; ’687 FH (Ex. 1002) at 1-771. After receiving the Notice of Allowance, the applicant filed a Request for Continued Examination that included an IDS with additional references. *Id.* 788. The Examiner issued a second Notice of Allowance without comment.

The prior art applied herein, i.e., Cook (Ex. 1007) and Bennett (Ex. 1005), was included in an applicant-submitted IDS, but the Examiner did not address either one. *See generally* ’687 FH (Ex. 1002); *see also* Allen Decl. 77.

C. Person of Ordinary Skill in the Art

A POSA at the relevant time would have had at least a bachelor’s degree in electrical engineering (or equivalent) and at least two 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

The prior art this Petition relies on discloses the subject matter of the challenged claims under any reasonable construction, including their plain meaning.² Allen Decl. 82.

IV. The '687 Patent is Entitled to an Effective Filing Date No Earlier Than April 24, 2009

InductEV bears the ultimate burden of *persuasion* of demonstrating unpatentability. But once InductEV provides invalidating art, the burden of *production* shifts to the Patent Owner to “show that the prior art does not actually invalidate the patent or that it is not prior art because the asserted claim is entitled to the benefit of an earlier filing date.” *Rsch. Corp. Techs., Inc. v. Microsoft Corp.*, 627 F.3d 859, 870 (Fed. Cir. 2010); *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1379-80 (Fed. Cir. 2015) (petitioner satisfied its initial burden “by arguing that [the art] anticipated the asserted claims,” shifting the burden of production to the patentee to show “either [the art] does not anticipate” or the art “is not prior art”); *Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 at 18 (Mar. 10, 2023). Here, InductEV shows that Cook and Bennett render obvious the '687 patent's claims, shifting the burden of production to Patent Owner to come

² Petitioner reserves the right to argue alternative constructions in other proceedings and, where such a defense is available, that the claims are indefinite.

forward with evidence showing either that (1) Cook and/or Bennett are not *prior* art because the '687 patent's claims are entitled to the benefit of an earlier filing date or (2) the art does not actually invalidate the patent. Patent Owner can do neither, as demonstrated below.

The '687 patent purports to claim priority to a provisional application filed September 27, 2008. But each claim of the '687 patent is entitled to the benefit of that earlier-filed application only if the earlier application satisfies the written-description requirement of 35 U.S.C. § 112. *See* 35 U.S.C. § 120; *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1158 (Fed. Cir. 1998). There must also be a continuity of disclosure: “*each* application in the chain leading back to the earlier application must comply with the written description requirement of 35 U.S.C. § 112.” *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571 (Fed. Cir. 1997).³ Further, “[e]ntitlement to a filing date does not extend to subject matter which is not disclosed but would be obvious over what is expressly disclosed.” *Id.* at 1571-72.

Here, no application filed earlier than April 24, 2009, provides written description support for the '687 patent's claims. InductEV does not concede that

³ Unless otherwise stated, all emphases herein are added and internal quotation marks, citations and footnotes are omitted.

the '687 patent is entitled to an April 24, 2009 priority date, but it need not go any later for both Cook and Bennett to be prior art as of their respective filing dates.

Each of the '687 patent's claims requires either directly or indirectly via dependency "an authorization facility to confirm compatibility of the resonators and to provide authorization for initiation of the transfer of power." '687 patent cl. 1, 7, 13. That feature does not have written description support in any applications filed before April 24, 2009, that the '687 patent claims priority to, including any of the following seventeen applications:

- No. 61/169,240 filed April 14, 2009
- No. 61/163,695 filed March 26, 2009
- No. 61/156,764 filed March 2, 2009
- No. 61/152,390 filed February 13, 2009
- No. 61/152,086 filed February 12, 2009
- No. 61/147,386 filed January 26, 2009
- No. 61/142,977 filed January 7, 2009
- No. 61/143,058 filed January 7, 2009
- No. 61/142,796 filed January 6, 2009
- No. 61/142,889 filed January 6, 2009
- No. 61/142,880 filed January 6, 2009
- No. 61/142,885 filed January 6, 2009

- No. 61/142,818 filed January 6, 2009
- No. 61/142,887 filed January 6, 2009
- No. 61/121,159 filed December 9, 2008
- No. 61/108,743 filed October 27, 2008
- No. 61/100,721, filed September 27, 2008

These applications do not support the claims of the '687 patent because none of them contain any disclosure of an authorization facility or authorizing a resonator at all, let alone “an authorization facility to confirm compatibility of the resonators and to provide authorization for initiation of the transfer of power” as every claim of the '687 patent requires. Allen Decl. 78-81. Accordingly, the '687 patent's claims are not entitled to an effective filing date any earlier than April 24, 2009, and Patent Owner cannot meet its burden to show otherwise.

V. Claims 1-18 are Obvious over Cook in view of Bennett

The combination of Cook and Bennett renders obvious claims 1-18. Allen Decl. 106, 216. Cook described the basics of a wireless car charger using magnetically coupled resonators, the transmitting resonator in the ground and the receiving resonator mounted under the vehicle. Bennett provided additional implementation details, teaching wireless energy transfer between magnetically coupled resonators where power transfer is initiated after checking compatibility of the resonators and authorizing power delivery to charge the battery of a “target

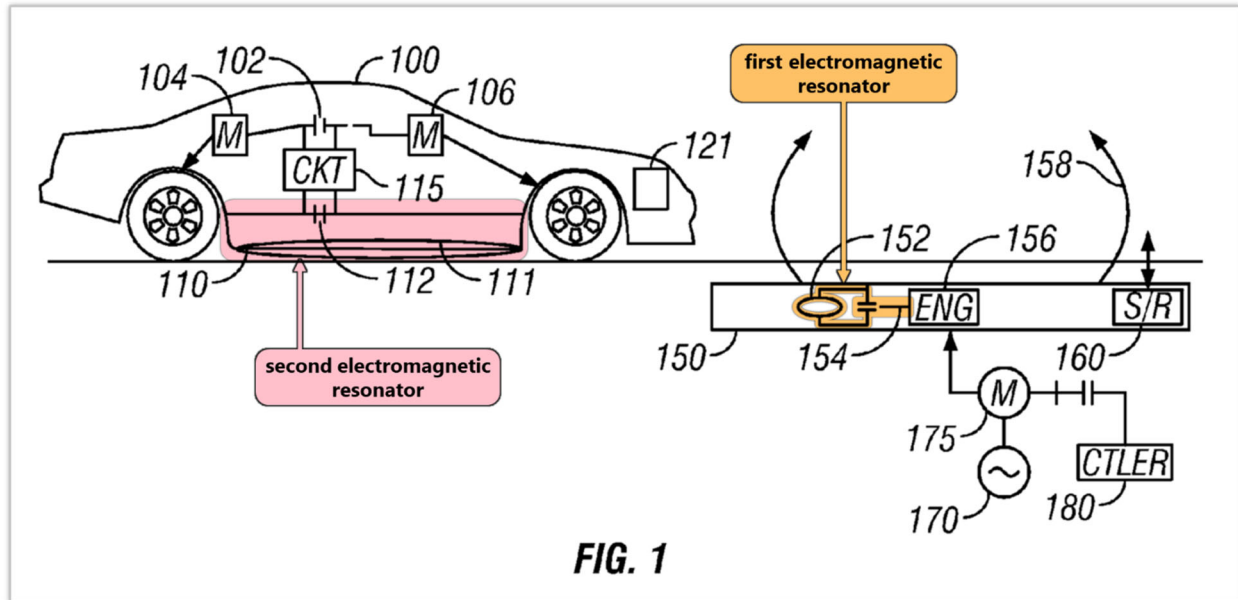
electronic device.” A POSA would have found it obvious to implement Bennett’s system in Cook to provide broader compatibility with multiple vehicles and secure authentication and communication between the charger and the car, rendering claims 1-18 obvious.

The ’687 patent has three independent claims: claims 1, 7, and 13. All three independent claims describe the same system from different perspectives: claim 1 recites the elements of “[a] vehicle powering wireless receiver,” claim 7 recites “[a] power source for wirelessly providing power to a wireless receiver of an at least partially electrically powered vehicle,” and claim 13 covers “[a] vehicle wireless power system” generally. *See* ’687 patent cls. 1, 7, 13; Allen Decl. 68-76 (discussing similarities between claims). Because claim 13 recites the elements of the entire system while claims 1 and 7 are limited to subcomponents of the system, the Petition first addresses claim 13.

A. Cook (Ex. 1007)

Cook is a published patent application and is prior art under at least 35 U.S.C. § 102(e) because it was filed on May 28, 2008, before the earliest provisional patent application that the ’687 patent claims priority to and before the ’687 patent’s effective filing date. *See* Section IV (explaining that the ’687 patent’s effective filing date is no earlier than April 24, 2009).

Like the '687 patent, Cook is directed to “wireless delivery of power” to electric vehicles using electromagnetic resonators. Cook [0001], [0011], [0013], Fig. 1; Allen Decl. 84-85, 89. In particular, Cook explained that, as more car makers introduced electric and hybrid vehicles into the market, “it may be desirable to wirelessly deliver power to an electric powered mobile device, such as an automobile.” Cook [0006]-[0008]. Cook taught that this could be made possible by locating a first electromagnetic resonator for transmitting wireless energy in “the ground near a parking space” and attaching a second electromagnetic resonator for receiving wireless energy on the under carriage of a vehicle. Cook [0012]-[0013]. This application of wireless power transfer is shown in annotated Figure 1 below, such that “whenever an appropriate vehicle comes into range of the magnetic field 158 it may receive power from that magnetic field, and hence be charged thereby.” Cook [0013].



Allen Decl. 86 (annotating Cook Fig. 1); Cook [0011]-[0013] (describing electromagnetic resonators as including inductive loops and capacitors).

Cook taught that the wireless power is used for “charging the battery 102” used to power the motor. Cook [0011]-[0012]. Cook also explained how a POSA could monetize a system for wirelessly powering electric vehicles by dispensing power only to vehicles that are associated with an account that had charging enabled. The system initiates power transfer only for authorized vehicles by verifying the vehicle’s ID using encrypted messaging. Cook [0015]-[0018]; Allen Decl. 87.

Cook incorporates by reference U.S. Patent Application No. 12/018,069 (“Cook-086”) (Ex. 1021) for additional details relating to “[w]ireless delivery of power” using resonators “to provide power to a load.” Cook [0001]. For example, Cook-086 provides details regarding the parameters used to define a resonator

include ω (“angular frequency of resonance”), Q (“Quality factor”), and $\frac{\omega_0}{2Q}$ (“3-db bandwidth”). Cook-086 5:13-22, 12:20-31, 12:32-13:8; Allen Decl. 88. Like Cook itself, Cook-086 also taught that resonators can be used for a “myriad of applications” including “powering or charging electric cars; e.g., by placing or building in a transmitter in the floor of a garage, and placing a receiver on the bottom of the car.” Cook-086 23:59-24:18; Allen Decl. 88.

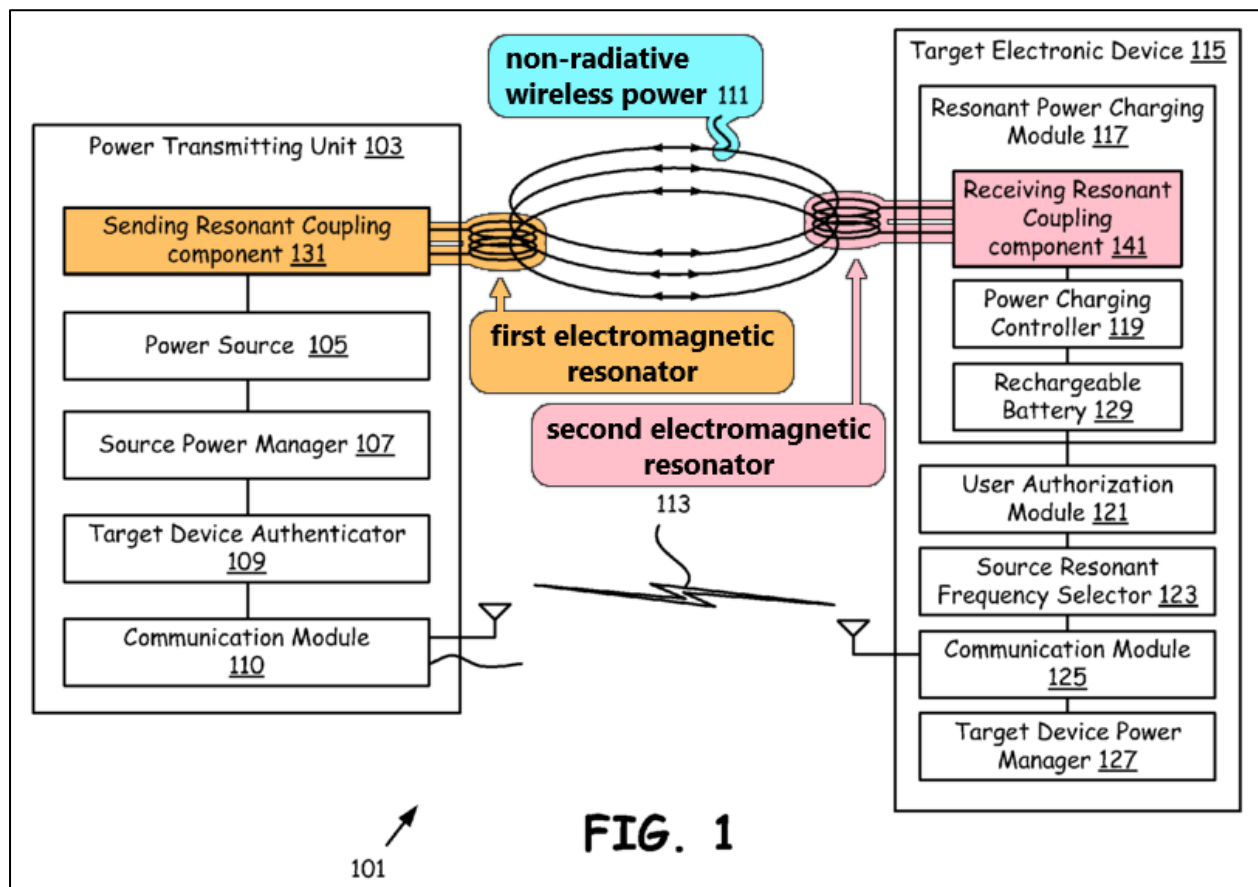
B. Bennett (Ex. 1005)

Bennett is a U.S. patent application publication and is at least § 102(e) prior art because it was filed on September 30, 2008, before the ’687 patent’s effective filing date. *See* Section IV (explaining that the ’687 patent’s effective filing date is no earlier than April 24, 2009). Even if Patent Owner were able to show the ’687 patent was entitled to claim priority to its earliest provisional application on September 27, 2008, Bennett would still be prior art as of the filing of the Bennett Provisional (Ex. 1006), August 5, 2008, as discussed below.

1. Overview

Like Cook and the ’687 patent, Bennett discloses a “wireless power delivery system” that delivers power from a “power transmitting unit” to a “target electronic device” using “magnetic waves.” Bennett Abstract, [0029]; BProv 8:16-18, 34:1-15 (Abstract); Allen Decl. 90-91, 94. As shown in annotated Figure 1 below, the power transmitting unit includes a first electromagnetic resonator referred to as a “sending

resonant coupling component” that includes a “resonant coil that fills the space around it with a non-radiated magnetic field oscillating at the target resonant frequency.” Bennett [0030]; BProv 9:17-20. The target electronic device includes a second electromagnetic resonator, a “receiving resonant coupling component” that can include a “resonating coil and associated tuning elements such as capacitors.” Bennett [0034]; BProv 10:21-11:2.



Allen Decl. 92 (annotating Bennett Fig. 1, which is same as BProv Fig. 1); Bennett [0030]; BProv 9:6-20; *see also* Bennett Fig. 2 (similar embodiment to Fig. 1 where transmitting and receiving resonators are referred to as “magnetic resonant power

charging circuitry,” and the resonant magnetic field of the transmitting resonator can be used to “transmit power to multiple target devices”), [0048], [0060]-[0061]; BProv Fig. 2, 14:1-11, 17:21-18:16; Allen Decl. 93.

The receiving resonant coupling component “receive[s] the power transmissions” and “employs the received power for operation of the target electronic device,” including by recharging a battery. Bennett [0030]; BProv 9:6-20; Allen Decl. 95. Before initiating power delivery, Bennett’s system checks the identity of the target device and initiates power transfer only if the target device is authorized, compatible, and at a safe battery level for charging. Allen Decl. 96; Bennett Figs. 1-3, 9, [0039]-[0042], [0062]-[0063], [0066]-[0069]; BProv 12:6-13:22, 18:17-19:6, 19:20-20:23, Figs. 1-3, 9. Bennett also details how a communication link used for authorization can be implemented in a magnetic resonant wireless charging system, including transmitting information in the same or different frequency channels as the magnetic field used for power transfer, and securing those communications using token and key based encryption. Bennett [0031], [0042], [0060]-[0063]; BProv 9:21-10:11, 13:14-22, 17:21-19:6; Allen Decl. 96.

Bennett explained that wireless charging could be applied to electronic devices with batteries, and a POSA would have understood that the principles

Bennett described would have been applicable to wirelessly charging electric vehicle batteries. *See* Bennett [0022]; BProv 6:18-7:3; Allen Decl. 97.

2. Bennett is entitled to its Provisional Application’s filing date

Should Patent Owner attempt to antedate Bennett, Bennett is also entitled to the filing date of the Bennett Provisional (Ex. 1006). *See* Allen Decl. 98. Bennett was filed within one year of the Bennett Provisional’s filing date, names at least one inventor in common, and includes a specific reference to the Bennett Provisional. Bennett, Cover, [0001]; *see also* 35 U.S.C. § 119. Further, the Bennett Provisional passes both prongs of the *Dynamic Drinkware* test: it provides sufficient support for at least claim 14 in Bennett, 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, LTD*, IPR2023-00110, Paper 7 at 20 (June 15, 2023) (citing *Dynamic Drinkware, LLC*, 800 F.3d at 1381-82).

3. The Bennett Provisional Supports Claim 14 Of Bennett

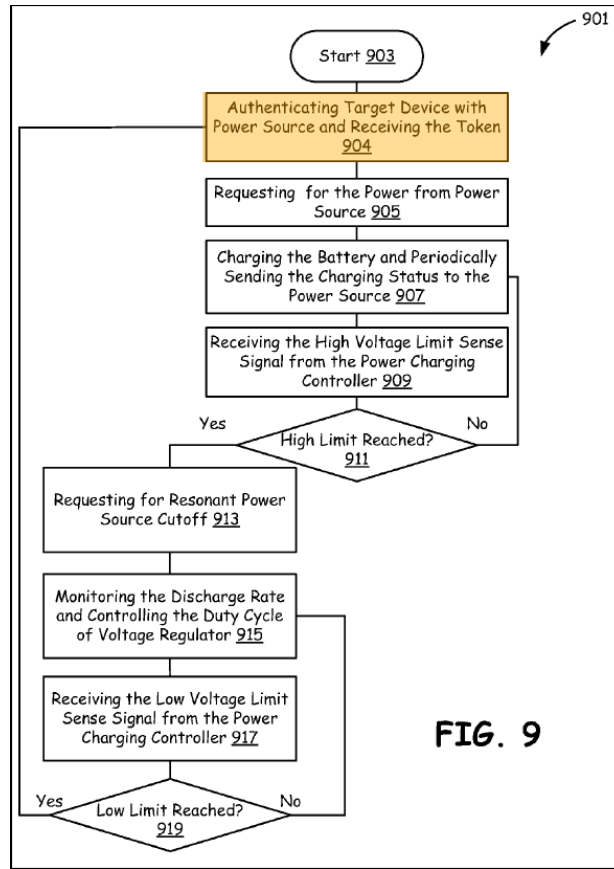
a. 14[pre] Preamble

If Claim 14’s preamble is limiting, the Bennett Provisional supports “[a] method performed by a rechargeable electronic device comprising a rechargeable battery, the method comprising.” The Bennett Provisional taught “[a] rechargeable electronic device, such as the target electronic device 115, typically comprises the rechargeable battery 129.” BProv 13:14-15; *see also id.* 1:7-8 (“The present invention relates generally to charging a rechargeable battery of an electronic

gadget...”), 6:19-21 (“[T]he present invention deals with the battery power charging in-situ from a remote power source (station)”), Figs. 1-3; Allen Decl. 99.

b. 14[a] Authentication

The Bennett Provisional supports claim 14’s “authenticating with a power transmitting unit including receiving a token from the power transmitting unit.” It discloses that “[t]he rechargeable electronic device authenticates with the power transmitting unit 103 and receives a token that is used for subsequent communication and power charging (in one or more charging sessions).” BProv 13:15-17. Further, the flow chart “illustrating actions performed by the target device power manager,” shown in annotated Figure 9 below, includes an “Authenticating Target Device with Power Source and Receiving the Token” step.



Allen Decl. 100-101 (annotating BProv Fig. 9); *see also* Figs. 1, 3-4; pages 17-18 (further describing token exchange).

c. 14[b] Power Transmission By A Non-Radiated Magnetic Field

The Bennett Provisional supports claim 14’s “requesting power transmission by a non-radiated magnetic field from the power transmitting unit.” It taught that “[t]he rechargeable electronic device requests the power transmission unit 103 for power, with the power to be transmitted employing non-radiated magnetic field waves of a target frequency.” BProv 13:17-19; *see also id.* at 6:8-15 (“The present invention ... provides a power transmission unit that employs magnetic means, such

as non-radiated magnetic field waves of a target frequency, to power remote devices”), 21:7-15 (further describing use of non-radiated magnetic fields), Figs. 1-3, 9; Allen Decl. 102.

d. 14[c] Power Transfer At The Target Resonant Frequency

The Bennett Provisional supports claim 14’s “receiving power non-radiated magnetic field at the target resonant frequency from the power transmitting unit.” It taught “[t]he rechargeable electronic device 115 receives power transmitted over non-radiated magnetic field waves of the target frequency from the power transmission unit 103.” BProv 13:20-21; *see also id.* 12:6-7 (“The source resonant frequency selector 123 provides a tuning mechanism in order to achieve the required resonant coupling effect”), 10:21-22 (describing receiving hardware as “resonant power charging module 117 of the target electronic device”), 8:20-22 (“The power delivery system 101 comprises the power transmitting unit 103, the target electronic device 115, and other target devices capable of receiving power being transmitted.”), Figs. 1, 3 (“resonant frequency power is delivered”); Allen Decl. 103.

e. 14[d] Recharging A Battery

The Bennett Provisional supports claim 14’s “recharging a rechargeable battery of the rechargeable electronic device.” It taught “[t]he rechargeable electronic device 115 receives power transmitted over non-radiated magnetic field waves of the target frequency from the power transmission unit 103. It recharges

the rechargeable battery 129 of the rechargeable electronic device 115.” BProv 13:20-22; *see also id.* 11:9-13 (“In one embodiment, voltage multipliers in the resonant power charging module 117 builds up the required voltage across a capacitor array to achieve the recharging of the rechargeable battery 129 of the target electronic device 115.”), Figs. 1, 3; Allen Decl. 104.

4. Bennett’s relevant disclosures are supported by the Bennett Provisional

The discussion below mapping Bennett to the challenged claims also includes parallel citations to identical and/or substantially similar disclosures in the Bennett Provisional that provide sufficient support for the cited Bennett disclosures, with additional discussion as needed. Allen Decl. 105.

C. Motivation to Combine

A POSA implementing Cook at the relevant time would have arrived at the claimed invention. Allen Decl. 107-123. Cook taught wireless charging of a vehicle battery, wherein the battery is “automatically charged” when in range of a “wireless charger circuit of appropriate type, e.g., the right frequency.” Cook [0012]. Cook did not explain how to adjust the transmitting wireless charger circuit to be the “right frequency,” leaving those details to a POSA’s knowledge. *See* Allen Decl. 114. A POSA implementing Cook would have turned to Bennett for details on how to tune Cook’s wireless charging system to different frequencies for compatibility with different vehicles. Bennett [0053]-[0055] (“different frequencies are assigned to a

plurality of the magnetic resonant target devices”); BProv 15:12-16:15; Allen Decl. 113-14.

Cook further disclosed an “information detecting part” that can be used for “detect[ing] the identification of the vehicle” and allowing power only to be dispensed to authorized IDs corresponding to one that has an “account” with charging enabled. Cook [0015]. Cook explained that detection of an ID may require encrypted signals exchanged between the resonators (Cook [0017]-[0018]) but did not detail the communication link that would be used to transmit those encrypted signals in a magnetic resonant charging system. Allen Decl. 115. A POSA would have turned to Bennett for those implementation details, including the use of in-band and out-of-band channels for the communication link, as well as additional compatibility, safety, and security checks that would be useful in a resonant wireless power transfer system like Cook’s. Allen Decl. 113, 116-17.

Cook and Bennett are analogous art—both to each other and to the ’687 patent. Allen Decl. 108-11. Cook and Bennett are each directed to wirelessly charging electronic devices using the non-radiative magnetic fields of electromagnetic resonators, the same wireless energy transfer mechanism employed in the ’687 patent. *See* Bennett Abstract, [0003], [0010], [0021]-[0022], [0029]-[0030], Fig. 1 (discussing the use of “non-radiated magnetic field waves” to transmit energy through a between “a power source and a target device”); BProv 1:6-8, 4:2-

3, 6:2-7:3, 8:16, 9:20, 34:1-15 (Abstract), Fig. 1; Cook [0001], [0002], [0008], [0011]-[0013] (“discussing that “when the antenna 110 comes into range of an appropriate transmitter, it receives a magnetic signal from that transmitter, and the receiving circuit 115 converts that power into output current.”), Fig. 1; ’687 patent Abstract, 2:53-54, 3:36-44 (discussing “non-radiative or near-field wireless energy transfer” using “coupled electromagnetic resonators”), 3:60-65; Allen Decl. 109-110.

A POSA implementing a wireless power transfer system also would have had the initial impetus to look to Cook and Bennett in combination because they describe common objectives and methods of monetizing a wireless power transfer system. Allen Decl. 112. Cook explained initiating power transfer only for authorized vehicles and that “[a] premium over utility costs may also be added to the bill” such that the “system is reselling power from the electricity manufacturer[] to any vehicle with an appropriate account that comes into range of the antenna.” Cook [0016]; Allen Decl. 112. Bennett is similar, explaining its system enables a provider of electrical power to authorize wireless energy transfer only to subscribers and to bill those subscribers based on the amount of power delivered. Allen Decl. 112; *see also* Bennett [0052], [0059], [0069]; BProv 15:12-18, 17:15-20, 20:18-23.

A POSA implementing Cook’s wireless vehicle charging would have implemented it in view of Bennett for the reasons discussed above and because (1)

Bennett’s dynamic frequency tuning would improve the public car charger Cook contemplates; (2) Bennett provided details for how to implement a communication system in a magnetic resonance power transfer system that Cook lacks, (3) Cook and Bennett both described token-based encryption systems, with Bennett providing additional details about how such a system would be implemented, and (4) Bennett’s battery level detection before initiating power transfer would improve safety in Cook’s vehicle charging system. *See* Allen Decl. 113-119.

First, Cook explained that its wireless car charger could be used in public locations, such as a parking space, and encounter “different forms of hybrid automobiles” and “of electric automobiles.” Cook [0006] (describing battery-powered cars), [0007] (describing public chargers), [0013], [0015] (verifying IDs of cars where “charging is enabled”). Cook indicated that different cars could have resonators tuned to different frequencies. *See* Cook [0012] (automobiles in the system receive power only at “wireless charging circuits of appropriate type, e.g. the right frequency”); Cook-086 7:44-56 (describing transmitting antennas at different resonant frequencies). Cook did not, however, describe how to implement a charger that could adjust to different compatible frequencies. Allen Decl. 114. That would have led the POSA to Bennett, which described a “power transmitting unit 103 [that] is capable of dynamically tuning the power transmission to the target resonant frequency associated with the target electronic device 115, wherein the target

resonant frequency is specified dynamically.” Bennett [0029]; BProv 8:16-9:5; Allen Decl. 114. Bennett’s dynamic frequency tuning capability would have improved Cook’s wireless car charger, making it compatible with the different forms of electric automobiles it might encounter. Allen Decl. 114; *see also* Cook [0006]. Bennett also explained how a wireless power transmitting unit, like Cook’s charger, could ensure power was transferred only to target electronic devices, like Cook’s vehicles, with compatible resonators by requiring “[a] power control signal exchange operation” occurring “before a successful resonant power delivery.” Bennett [0039]; BProv 12:11-20; Allen Decl. 114.

Second, Cook disclosed that its “charger 150” containing the power transmitting resonator sends information to, and receives information from, an automobile to verify whether it is authorized to be charged. Cook [0014], [0017], [0018]; Allen Decl. 115. Cook did not, however, describe how these signals would be communicated in the presence of the magnetic field of the resonant wireless power system. Allen Decl. 115. A POSA could have and would have turned to Bennett for those details, which explained how encrypted control signals used for authenticating a target electronic device and initiating power transfer in a magnetic resonant wireless charging system could “employ[] the same frequency” as the “power” signal, or “the power link (such as the magnetic field), the control signal, and the normal communication (i.e. the normal function) operation takes place in

separate channels.” Bennett [0031], [0043], [0070] (“receives power on a single frequency on a wireless power & communication channel 111”), [0084], Fig. 6; BProv 8:16-9:5, 9:21-10:11, 20:1-6, 25:9-15; Allen Decl. 115-16.

Bennett’s alternative communication channels would provide flexibility for Cook’s system. For example, for applications where a POSA was seeking to maintain the quality factor of the resonators as high as possible, the out-of-band communication channel could be used. *See* Bennett [0084] (noting that an in-band communication configuration “will disturb the resonant tuning of target device by lowering the quality factor”); BProv 25:9-15; Allen Decl. 117. Alternatively, an in-band communication channel could reduce the number of necessary components. Bennett [0031], [0084]; BProv 9:21-10:11, 25:9-15; Cook-086 18:39-46; Allen Decl. 117. A POSA would have understood Bennett’s communication links to be applicable to Cook’s system because as detailed above, both describe systems using magnetic fields to transfer power wirelessly. Allen Decl. 120.

Third, Cook taught that an electric vehicle to be charged and the charger used to charge it would exchange encrypted information. Allen Decl. 118; *see also* Cook [0017] (“Another embodiment may ... use encryption techniques to verify the ID.”). Although Cook describes that this encryption could be done using a “real-time token type system” (Cook [0017]), it was missing details regarding how the tokens are generated and subsequently decrypted. Allen Decl. 118. Bennett supplied those

additional details that a POSA would have and could have used for secure implementation of Cook's wireless car charger in public settings, as Cook recommended. Cook [0007]-[0008], [0017]-[0018]; Allen Decl. 118. For example, Bennett described "a token generator" residing in the power transmitting unit, where the token generator "may include a pseudorandom number generator operable to generate the token." Bennett [0046], [0062]; BProv 17:21-18:5 ("The magnetic resonant power charging circuitry 403 ... comprises a token generator 407."); 18:17-23 (describing a pseudo random number generator), 31:20-22 (claiming a "token generator [that] employs a pseudorandom number generator"). The system then delivers the token "to the target device during a target device registration operation," permitting the power transmitting unit to authenticate the target device. Bennett [0046], [0062]; BProv 17:21-18:5; 18:17-23. Bennett also explains how the target electronic device (e.g., Cook's vehicle) would decrypt the generated token using a "key," consistent with Cook's own description. Bennett [0062]-[0063]; BProv 18:17-19:6; Cook [0017]; Allen Decl. 118, 122.

Fourth, a POSA would have been motivated to combine Cook with Bennett for safety reasons. Allen Decl. 119. Cook taught that when an electric vehicle comes into range of an appropriate transmitter it begins charging the vehicle battery "automatically." Cook [0011]-[0012]. Cook does not, however, describe any mechanism for preventing the vehicle battery from being overcharged. Allen Decl.

119. Overcharging was an acute safety risk for electric-vehicle charging because electric cars frequently used lithium-ion batteries, and those batteries had a known problem that overcharging could cause internal pressure of the battery and risk causing explosions or fires. Jang (Ex. 1011) 1:33-54; Bennett [0036] (“The high voltage limit protects the battery”); BProv 11:9-17; Allen Decl. 119. Bennett provided a solution for automatic wireless charging of target electronic devices by first determining whether the battery level of a target device is below a preset/threshold level as a condition for initiating transfer of power. Bennett [0075]-[0077], [0082]; BProv 22:10-23:5, 24:15-21; Allen Decl. 119. A POSA implementing Cook would have looked to Bennett to “maintain[] the rechargeable battery charge” of Cook’s electric vehicle “at a safer limit.” Bennett [0076]; BProv 22:15-19; Allen Decl. 119.

A POSA combining Cook and Bennett would have had a reasonable expectation of success. Allen Decl. 120-123. As discussed above, Bennett and Cook described similar systems (wireless power transfer using magnetic resonance) comprising similar components (a first resonant antenna for transmitting power and a second resonant antenna for receiving power) used for the same purpose of wirelessly charging a battery. *See, e.g.*, Section V.A above (Cook Overview); Section V.B (Bennett Overview); Bennett [0025]; Cook [0011]; BProv 7:16-22; Allen Decl. 108-110, 120. While Bennett and Cook describe different specific

examples of the device receiving wireless power via magnetic fields, e.g., a mobile phone as a “target electronic device” in Bennett and a vehicle in Cook, a POSA would have understood those as merely different types of “battery powered devices” that would be applicable in either system. Bennett [0005], [0021]; BProv 1:10-20, 6:2-17; Cook [0009]-[0012]; Allen Decl. 120. As explained in Cook’s incorporated-by-reference Cook-086, the principles of a “transmitter” and “receiver” in a magnetically coupled resonant system could be used for applications involving “powering or charging portable computers, PMD’s client devices, cellular phones” as well as “powering or charging electric cars.” Cook-086 23:59-24:10; Allen Decl. 121; *see also* Bennett [0005] (“All electronic devices require electrical power to operate”); BProv 1:10-20. And Bennett explained that its system was general and provided techniques for “near field wireless resonance power delivery to a target device,” where the target device is a “battery powered device.” Bennett [0003]; BProv 1:7-8 (“The present invention relates generally to charging a rechargeable battery of an electronic gadget without interrupting its normal functionality.”). A POSA therefore would have reasonably expected that Bennett’s system would be compatible with Cook’s, and Cook’s system compatible with Bennett’s, because “an automobile” is a type of target electronic device in Bennett that can receive “wireless delivery of power.” Cook [0002]; Bennett [0003], [0005]; BProv 1:7-8, 1:10-20; Allen Decl. 121-23.

D. Independent Claim 13 Is Obvious In View Of Cook And Bennett

1. Element 13[pre]: Preamble

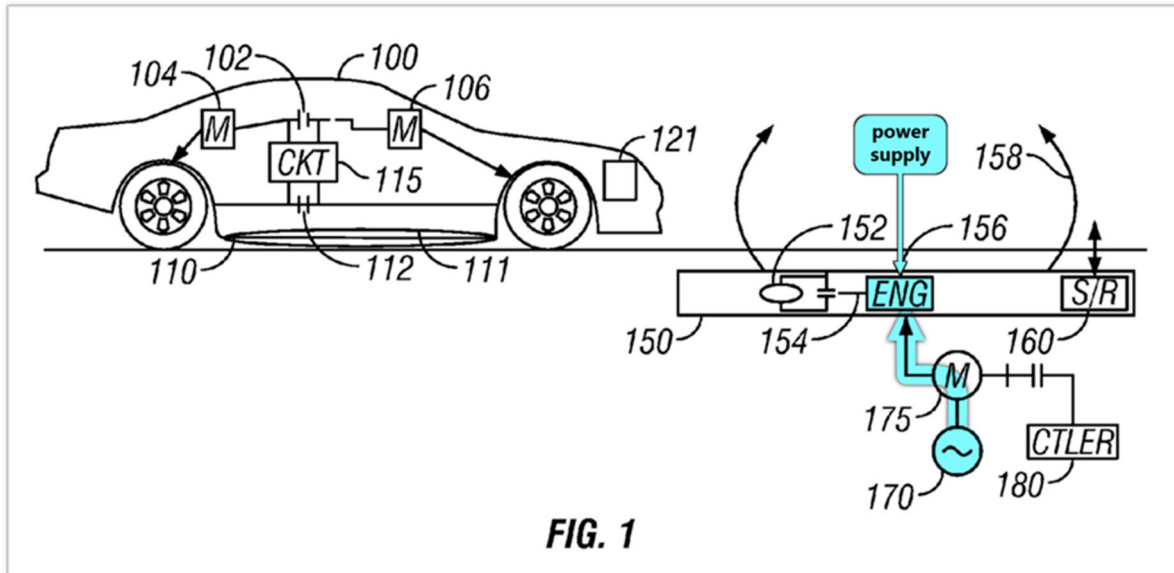
Independent claim 13 recites “a vehicle wireless power system.” To the extent the preamble is limiting, the Cook/Bennett combination taught it. Allen Decl. 124-25.

Cook described wirelessly charging the batteries of “electrically powered automobile[s].” Cook [0001] (“Wireless delivery of power”), [0009]-[0012] (vehicle wireless power system); Allen Decl. 126.

2. Element 13[a]: Power Supply

This element in claim 13 recites: “a power supply, the power supply configured to supply power at a rate sufficient to charge the battery of a vehicle that is driven at least in part by electrical power.” The Cook/Bennett combination taught this element. *See* Allen Decl. 127-29.

Cook taught a “charging circuit 156” that corresponds to the claimed “power supply” because it “produces signal of appropriate frequency for magnetic transmission” as annotated below:



Allen Decl. 128 (annotating Cook Fig. 1); Cook [0013], [0015] (“power delivered from the AC Main, through a meter 175, to the charging device 150”).

Cook explained that the signal is of a sufficient rate that when “an appropriate vehicle comes into range of the magnetic field 158, it may receive power from that magnetic field, and hence be charged thereby.” Cook [0013]. For example, Cook’s power supply is sufficient to provide power to an “electrically powered automobile [that] includes at least one battery 102,” where the “battery 102 is the primary power source of the automobile.” Cook [0009], [0010], [0011] (wirelessly received “power can be used for directly driving the motors 104, 106, but more preferably is used for charging the battery 102”); Allen Decl. 129.

3. Element 13[b]: First Electromagnetic Resonator And Characteristics

This element in claim 13 recites

[b][i] a first electromagnetic resonator coupled to the power supply and having

[ii] a mode with a resonant frequency ω_1 ,

[iii] an intrinsic loss rate Γ_1 ,

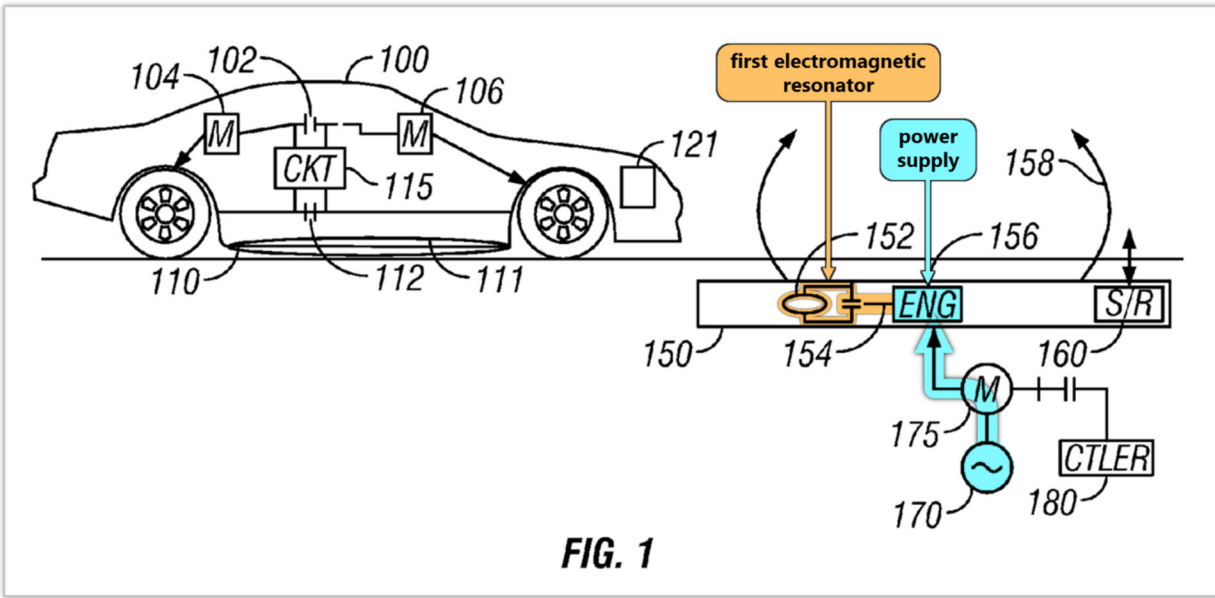
[iv] and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$,

[v] the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle.

The '687 patent claims do not require any particular resonant frequency ω_1 , intrinsic loss rate Γ_1 , or Q-factor Q_1 , any values will do. Allen Decl. 130-31. The Cook/Bennett combination taught each part of this element as detailed below.

a. Element 13[b][i]: Electromagnetic Resonator Coupled to Power Supply

The Cook/Bennett combination taught the claimed “first electromagnetic resonator coupled to the power supply.” *See* Allen Decl. 132-36. Cook disclosed a “charger 150” that includes a “coil 152” and “capacitor 154,” together forming a first electromagnetic resonator, coupled to the charging circuit 156 (power supply):



Allen Decl. 133-134 (annotating Cook Fig. 1); Cook [0013], Cl. 6 (“wirelessly supplying power comprises applying power using a magnetically resonant antenna which includes an inductor and a capacitor”), cl. 13; *see also* Cook [0001] (incorporating Cook-086), Cook-086 4:55-57; 5:13-22 (capacitive element used to “induce resonance in the antenna”). Cook also explained that the charger will “produce a magnetic field” (illustrated as element 158 in Figure 1 above) with enough power to wirelessly charge an electric vehicle battery. Cook [0001], [0011]-[0013]. This makes Cook’s resonator an “electromagnetic resonator” as used in the ’687 patent, which includes “magnetic resonators”—i.e., “designed such that ... the energy stored by the magnetic field is primarily in the region surrounding the resonator.” ’687 patent 3:42-58; Allen Decl. 135.

A POSA would have understood that Cook’s source resonator operates in a similar manner as the “sending resonant coupling component” in Bennett, which

Bennett taught “is capable of power transmission employing magnetic waves 111, such as non-radiated magnetic field waves of a specified target resonant frequency.” Bennett [0029], [0030] (sending resonant coupling component “typically ... includes a resonant coil that fills the space around it with a non-radiated magnetic field oscillating at the target resonant frequency that is received by [a] target electronic device”); BProv 8:16-9:20, Fig. 1. These similarities would have indicated to a POSA that the teachings of Bennett could be applied to the teachings of Cook, and vice versa. Allen Decl. 136.

b. Element 13[b][ii]: Resonant Frequency ω_1

The Cook/Bennett combination taught “a first electromagnetic resonator ... having a mode with a resonant frequency ω_1 .” *See* Allen Decl. 137-139. Cook disclosed that its first electromagnetic resonator in the Charger is formed as a “coil” (L) and a “capacitor” (C) that is “resonant,” meaning it has a “resonant frequency.” Cook [0001], [0013], Cls. 6 (“applying power using a magnetically resonant antenna which includes an inductor and a capacitor”), 13; *see also* Cook [0012] (receiving resonator charges when it approaches a “wireless charging circuit of appropriate type, e.g., the right frequency.”); Allen Decl. 138. Cook confirmed this in incorporated-by-reference Cook-086 using the “well known resonance equation $\omega^2 = \frac{+1}{LC}$ where ω denotes the angular frequency of resonance, L the inductance and C the capacitance.” Cook-086 5:12-22; Allen Decl. 139.

c. Element 13[b][iii]: Intrinsic Loss Rate Γ_1

The Cook/Bennett combination taught “a first electromagnetic resonator ... having ... an intrinsic loss rate Γ_1 .” *See* Allen Decl. 140-49.

Cook taught a charger 150 having a resonant frequency (ω_1), as explained for Element 13[b][ii] above, and a Q, as explained for Element [13][b][iv] below, so a POSA would have understood that it also had an intrinsic loss rate Γ_1 . Specifically, the “intrinsic loss rate” could be derived from the relationship recited in claim 1:

$$Q_1 = \frac{\omega_1}{2\Gamma_1}$$

’687 patent cl 1; Allen Decl. 141. Rearranging the claimed formula yields:

$$\Gamma_1 = \frac{\omega_1}{2Q_1}$$

Allen Decl. 141-42. Cook taught this same equation in incorporated-by-reference Cook-086 but using the symbol $\frac{\Delta\omega}{2}$ (the “bandwidth” divided by 2) in place of Γ_1 .

$$\frac{\Delta\omega}{2} = \frac{\omega_0}{2Q}$$

Cook-086 13:1-8 (stating that the “quality factor can also be used to define the bandwidth”); Allen Decl. 143. A POSA would have therefore understood from Cook-086 that half of the half-power bandwidth is interchangeable with the claimed “intrinsic loss rate.” *See also* Allen Decl. 144-49 (explaining that the ’687 patent’s “intrinsic loss rate” is more commonly known in the art as the resonance width equal to one half of the half-power bandwidth); Staelin (Ex. 1023) 359-61; Story of Q 588;

Terman (Ex. 1020) 48.⁴ Cook-086 taught that the “bandwidth” was a property of resonant LC circuits, as in the first electromagnetic resonator in Cook’s charger 150, meaning the electromagnetic resonator in Cook’s charger 150 disclosed the claimed “intrinsic loss rate.” Allen Decl. 143-44; Cook [0011], Fig. 1; Cook-086 at 12:20-30, 13:1-8.

The ’687 patent is consistent with a POSA’s understanding that the claimed “intrinsic loss rate Γ_1 ” is a property of Cook’s first electromagnetic resonator. The ’687 patent explains that intrinsic loss rate Γ_1 refers to “the intrinsic energy decay or loss rate (e.g., due to absorption and radiation losses).” ’687 patent 17:12-25; Allen Decl. 59. Cook similarly explained in Cook-086 that in an inductor-capacitor resonant circuit there will be a “loss resistance (R_l) and a radiation resistance (R_r)” and that a “high resonance frequency increases losses and hence

⁴ The interchangeability of the claimed “intrinsic loss rate” and “resonance width” or half-power bandwidth was also confirmed during prosecution of another application assigned to the assignee of the ’687 patent and directed to similar technology, where the applicant stated “the intrinsic-loss rate Γ for a resonator can equivalently and interchangeably be referred to as the resonance width Γ .” 13/789,860 FH 1392 (Ex. 1031) (describing “the interchangeability between a resonance width and a loss rate” as “common in the art.”).

decreases the quality factor.” Cook-086 11:34-12:5; Cook [0001]; Allen Decl. 144

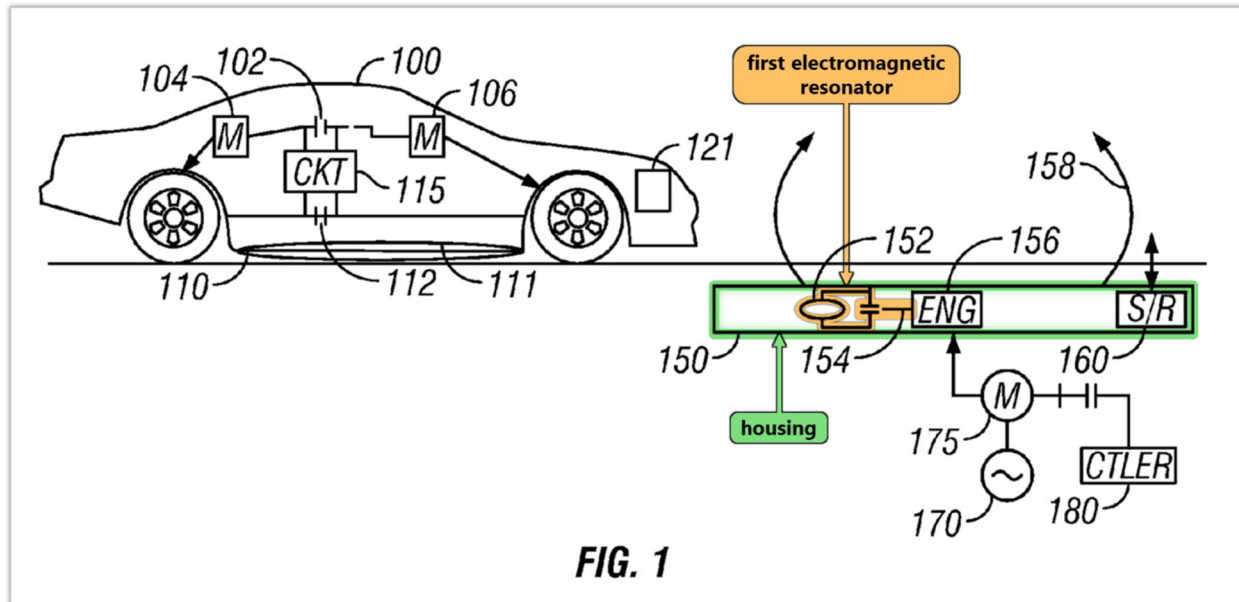
d. Element 13[b][iv]: First Q-factor $Q_1 = \omega_1 / 2\Gamma_1$

The Cook/Bennett combination taught “a first electromagnetic resonator ... having ... a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$.” *See* Allen Decl. 150-55. Cook taught that its source “magnetically resonant antenna which includes an inductor and a capacitor ... has a Q value greater than 1000.” Cook cls. 6, 13; Cook [0013] (“Charger 150 may include a coil 152, a capacitor 154”); Allen Decl. 151. Cook also defined the Q factor of its resonators used for wireless power delivery in Cook-086 using the same equation as recited in the claim, except using the symbol $\frac{\Delta\omega}{2}$ in place of Γ_1 . Cook-086 13:1-8; Cook [0001]; Allen Decl. 151. More generally, a POSA would have understood that any resonator like those Cook described would have had a Q. *See* Allen Decl. 152-155 (explaining the background of quality factors and citing Story of Q at 584, 586, 588; Terman at 30; ’687 patent at 17:26-36); *see also id.* at 172 (explaining that the subscript “1” corresponds to the first electromagnetic resonator rather than a particular value).

e. Element 13[b][v] Housed In A Housing

The Cook/Bennett combination taught, or at the very least rendered obvious, “the electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle.” Allen Decl. 156-159. Cook explained that for wireless battery charging of a vehicle, the resonator used to transmit wireless power can be

“located within the ground near a parking space.” Cook [0012]. This is shown in Cook’s Figure 1, annotated below, wherein the resonator and associated charging circuitry are embedded under the ground within a unitary housing called “charger 150”:



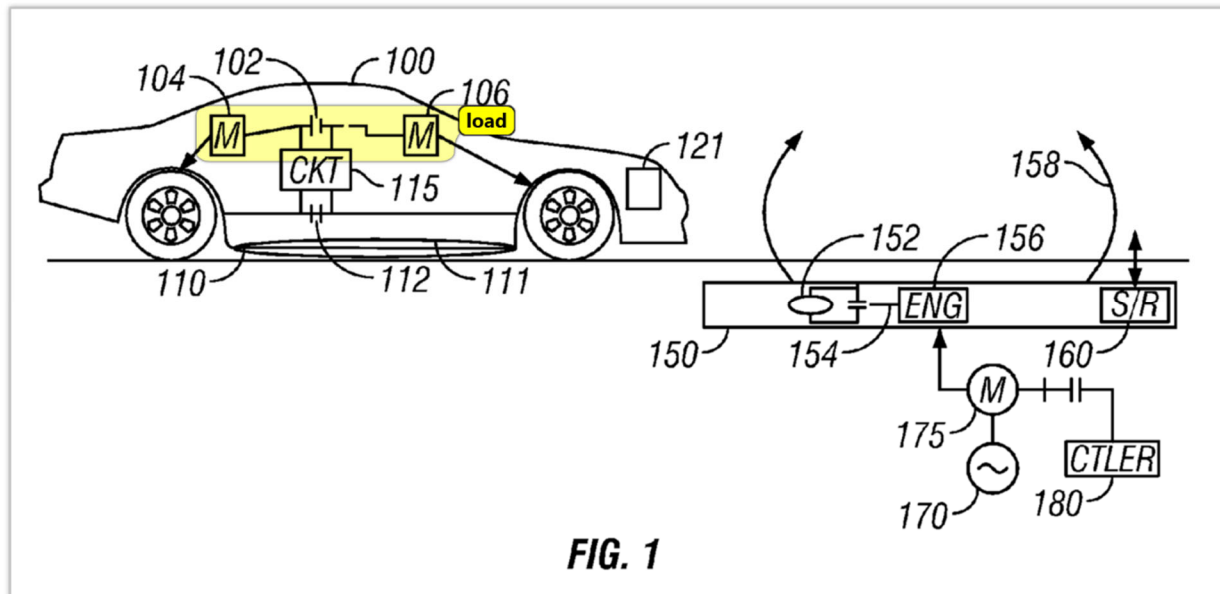
Allen Decl. 157 (annotating Cook Fig. 1); Cook [0012]-[0013] (describing charger 150). When the charger was “located within the ground near a parking space,” the vehicle is within “range of the magnetic field” to charge. Cook [0013]; cl. 8 (“a wireless transmitter, located adjacent to a vehicle parking space, and supplying magnetically resonant power via said wireless transmitter”). The vehicle is charged when it “comes into range of a wireless charging circuit of appropriate type.” Cook [0012]; Allen Decl. 157.

If Patent Owner argues that Cook’s “charger 150” does not disclose a “housing,” a POSA would have found it obvious to house Cook’s electromagnetic resonator in a housing. Indeed, a POSA would have understood that a housing was a well-known method of encasing electronic components to prevent them from malfunctioning, including for wireless charging of electric vehicles. Allen Decl. 158; *see, e.g.*, Boys (Ex. 1022) 8:19-42 (transmitting “charging pad 20” in the ground that produces “magnetic flux” to transmit power wirelessly to a vehicle with an “outer housing”), Figs. 2-3. For example, a housing would protect the coil of the resonant coupling component from contaminants such as dirt and road debris while also shielding the coil and related circuitry from rain and water damage that could cause electrical shorts. Allen Decl. 159. A POSA also would have been motivated to include a housing for the electrical components in Cook’s charger 150, including the inductor 152, capacitor 154, charging circuit 156, and send/receive circuitry 160, to allow those components to be manufactured as a singular unit and transported that way to where it would be installed, e.g., in a “parking space.” Cook [0012]; Allen Decl. 159.

4. Element 13[c]: Load Configured To Power The Drive System Of A Vehicle

This element in claim 13 recites: “a load configured to power the drive system of a vehicle using electrical power.” The Cook/Bennett combination taught this element. *See* Allen Decl. 160-161.

Cook taught that the disclosed electric vehicle “receives a magnetic signal” and “converts that power into output current,” which “can be used for directly driving the motors 104” or “for charging the battery 102,” corresponding to a “load configured to power the drive system” of the vehicle.



Allen Decl. 161 (annotating Cook Fig. 1); Cook [0011], [0009] (“An electrically powered automobile ... the battery 102 may be the primary power source of the automobile”), [0010] (“battery 102 is shown driving an electric motor 104, 106 which may drive vehicle wheels”). The motors and batteries of the vehicle that are operated and charged by the received power comprise a “load” in the electrical sense, as they consume power. Allen Decl. 161. Indeed, Cook described the process of delivering wireless power to an electric vehicle as “delivering power wirelessly to a load.” Cook [0004], Fig. 1. This is consistent with the ’687 patent, which uses the term “load” or “loading object” to refer to any circuit element connected to or

drawing power from a power-receiving resonator, as contrasted with a “generator.” ’687 patent Fig. 3, 8:27-30, 17:61-18:10; Allen Decl. 161.

5. Element 13[d]: Second Electromagnetic Resonator

This element in claim 13 recites

[d][i] a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having

[ii] a mode with a resonant frequency ω_2 ,

[iii] an intrinsic loss rate Γ_2 ,

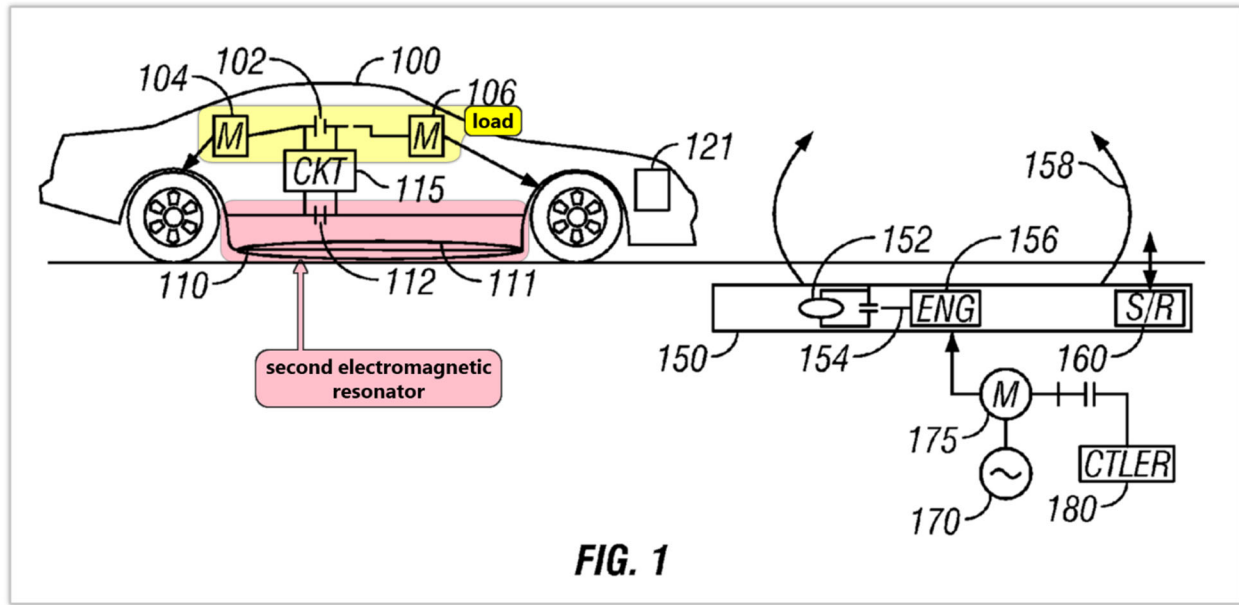
[iv] and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$.

Like the first electromagnetic resonator in Element 13[b], the ’687 patent claims do not require any particular resonant frequency ω_2 , intrinsic loss rate Γ_2 , or Q-factor Q_2 , any values will do. *See* Allen Decl. 162-63. The Cook/Bennett Combination taught each part of this element for similar reasons as Element 13[b] and as detailed below.

a. Element 13[d][i]: Electromagnetic Resonator Housed Upon the Vehicle and Coupled to the Load

The Cook/Bennett combination taught the claimed “second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load.” *See* Allen Decl. 164-65. Cook disclosed an “automobile” including “at least one magnetic resonant antenna shown as 110 formed from an inductive loop 111 in

parallel with a capacitor 112” corresponding to the claimed “second electromagnetic resonator” as annotated below:



Allen Decl. 165 (annotating Cook Fig. 1); Cook [0011]. The second electromagnetic resonator is “housed upon” the vehicle as claimed, with the loop 111 on the under carriage of the vehicle, and it is coupled to the battery 102 and motors 104 (the “load”). Cook Fig. 1, [0009]-[0012]; Cook-086 23:59-24:18 (“receiver on the bottom of the car”); Allen Decl. 165. Cook’s placement of the second electromagnetic resonator under the chassis of a vehicle was a well-known configuration for housing a receiving resonator in wireless electric vehicle charging applications because it allows charging an electric vehicle by simply driving over and stopping the vehicle above the transmitting resonator. *See, e.g.*, Boys 8:19-42

(“charging pad 20 [] is positioned on the underside of vehicle 10 so that it is substantially directly above charging pad 20 when vehicle 10 is parked”); Sakamoto (Ex. 1016) Fig. 2C (illustrating secondary coil mounted under a car); Allen Decl. 165 (also showing similar configuration in other wireless vehicle charging references including Morita, Wang).

b. Element 13[d][ii]: Resonant Frequency ω_2

The Cook/Bennett combination taught “a second electromagnetic resonator ... having a mode with a resonant frequency ω_2 .” See Allen Decl. 166-67. Cook’s “magnetic resonant antenna” with an “inductive loop 111” (L) “in parallel with a capacitor 112” (C) (second electromagnetic resonator) has the claimed “mode with a resonant frequency ω_2 .” Cook [0011]; Allen Decl. 167. Specifically, it has a resonant frequency equal to $\frac{1}{\sqrt{LC}}$ according to the “well known resonance equation” described in incorporated-by-reference Cook-086. Cook-086 5:12-22, 19:29-46; Allen Decl. 167. In the Cook/Bennett combination, Cook’s electromagnetic resonator would also be coupled with a “source resonant frequency selector,” which allows the resonant frequency of the resonant coupling component to be adjusted via “a tuning mechanism in order to achieve the required resonant coupling effect.” Bennett [0038], [0030]; BProv 9:6-20, 12:6-10; Allen Decl. 114. It could also be connected to a “resonant frequency seeking module” that “tun[es] the frequency of

magnetic coupling” to “receive optimum incoming power.” Bennett [0071]; BProv 21:7-15; Allen Decl. 114.

c. Element 13[d][iii]: Intrinsic Loss Rate Γ_2

The Cook/Bennett combination taught “a second electromagnetic resonator ... having ... an intrinsic loss rate Γ_2 .” *See* Allen Decl. 168-69. As explained above with respect to the first electromagnetic resonator, Cook taught in incorporated-by-reference Cook-086 that resonators having a resonant frequency and a Q, which Cook’s second resonator has, also have a half-bandwidth that is the same as the claimed “intrinsic loss rate.” Cook [0001], [0011]; Cook-086 13:1-8; Section V.D.3.c (Intrinsic Loss Rate Γ_1); Allen Decl. 140-49, 169.

d. Element 13[d][iv] Second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$

The Cook/Bennett combination taught “a second electromagnetic resonator ... having ... a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$.” *See* Allen Decl. 170-72. Cook’s second electromagnetic resonator housed on the automobile is “an LC circuit with a relatively high Q, for example a Q that is higher than 1000.” Cook [0011]; Allen Decl. 171. As discussed with respect to the first electromagnetic resonator limitation, Cook’s “Q” was defined using the same equation as the claimed Q in incorporated-by-reference Cook-086. *See* Section V.D.3.d (First Q-factor $Q_1 = \omega_1 / 2\Gamma_1$); Cook [0001]; *see also* Allen Decl. 172 (explaining subscript “2” corresponds to the second

electromagnetic resonator rather than a particular value different from the subscript “1” in Element 13[b]).

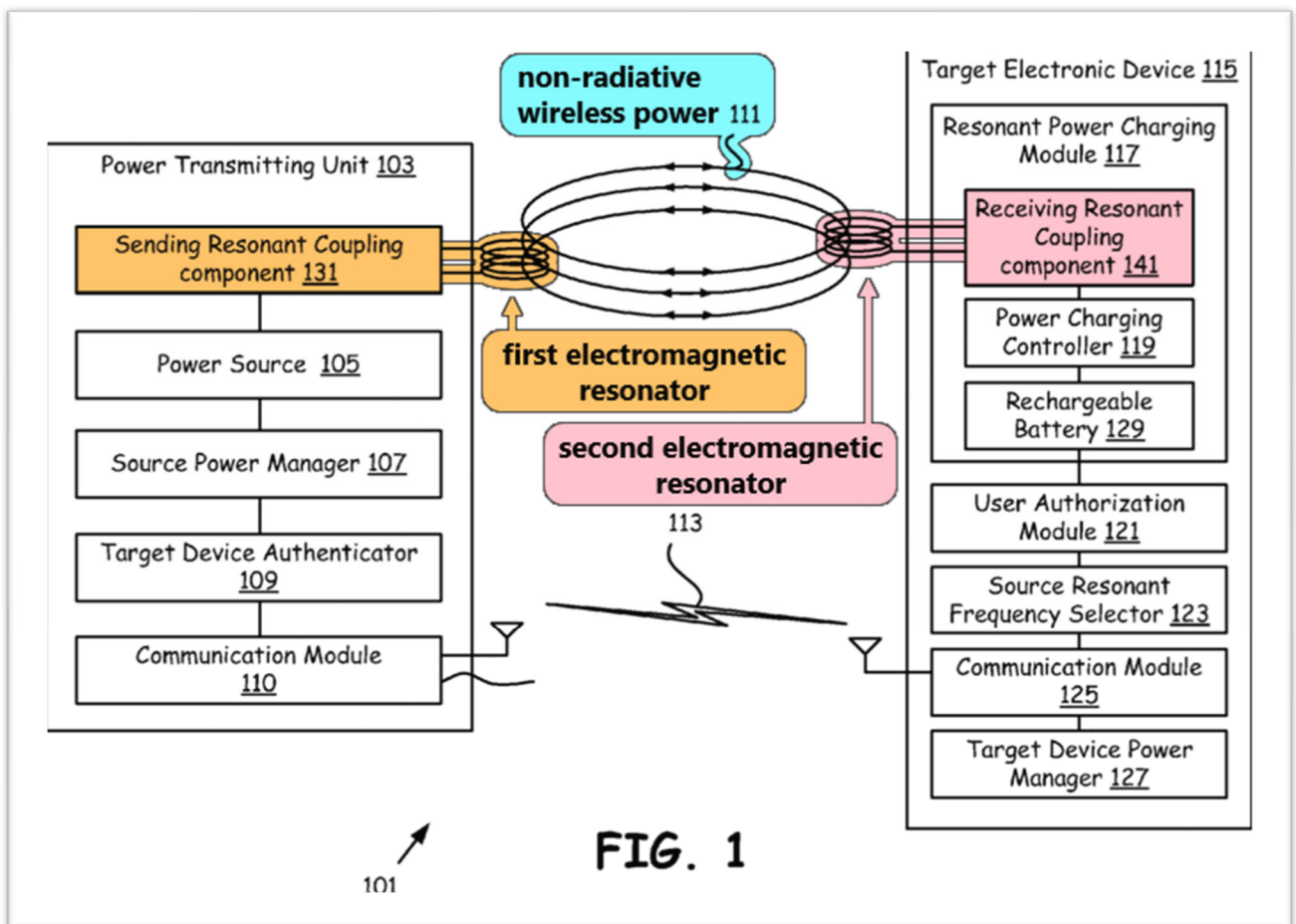
6. Element 13[e]: Wirelessly Coupled

This element of claim 13 recites: “wherein the second electromagnetic resonator is configured to be wirelessly coupled to the first electromagnetic resonator to provide resonant, non-radiative wireless power to the second electromagnetic resonator from the first electromagnetic resonator.” The Cook/Bennett combination taught this element. *See* Allen Decl. 173-78.

Cook explained that when the second electromagnetic resonator on the vehicle comes “into range of the magnetic field” generated by the “charger 150” (first electromagnetic resonator), the vehicle “receive[s] power from that magnetic field.” Cook [0013], [0011]. Cook explained that this “wireless transfer of power” is done by “forming a magnetic field and receiving a magnetic field in a resonant antenna that is resonant with at least one characteristic of a magnetic field.” Cook [0001]; Allen Decl. 174-75. Cook further explained in Cook-086 that “efficient power transfer between two antennas” uses “energy in the **near field** of the transmitting antenna, rather than sending the energy into free space in the form of a travelling electromagnetic wave.” Cook-086 2:61-64 (emphasis added). As the ’687 patent confirms, “near-field” and “non-radiative” had the same meaning to a POSA. ’687 patent 2:55-56; 3:12-13 (“A **known non-radiative, or near field**, wireless energy

transfer scheme”), 100:27-29; Allen Decl. 175-76.

Bennett explains that its system is similarly adapted for non-radiative wireless power transfer between electromagnetic resonators, explaining that the system is designed to “employ magnetic waves 111, such as a non-radiated magnetic field” that “is received by the ... receiving resonant coupling component 141” of a target electronic device. Bennett [0029]-[0030]; BProv 8:16-9:20; Allen Decl. 177. This provides “wireless power transmission.” Bennett [0032]; BProv 10:12-16.



Allen Decl. 177 (annotating Bennett Fig. 1); Bennett [0032] (“power to be

transmitted in a non-radiated magnetic or radiated magnetic mode, employing an essentially 'wireless means' 111 ... the sending resonant coupling component 131 which transmits it, for example, creating a non-radiated magnetic field”), [0022] (“non-radiated magnetic fields” are used for “delivery of power” through “high frequency resonant magnetic coupling”), [0024] (“magnetic coupling between a power transmitting unit and target device enables the power transfer”); BProv 6:18-7:3, 7:8-15, 10:12-16, Fig. 1.

7. Element 13[f]: Authorization Facility

This element in claim 13 recites “an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.” The Cook/Bennett combination taught this element. *See* Allen Decl. 178-83.

Cook taught that its charger includes a generic “controller” with an “information detecting part” to “detect a unique identifier indicative of the vehicle 100” and that power should only be “allowed to be dispensed if an encrypted value properly agrees with the proper encryption code and proper token time.” Cook [0014], [0018]. Cook further contemplated that the wireless power receiver in the vehicle include related authorization components for transmitting an encrypted message indicating that “charging is enabled” for the vehicle (Cook [0015]), indicating that it has a compatible resonator, but left the details of those vehicle-side

components to a POSA. Allen Decl. 179. As described in the Motivation to Combine section, a POSA could have and would have looked to Bennett for implementation details for Cook's vehicle authorization. *See* Section V.C (Motivation to Combine).

Bennett explained that, in a wireless power delivery system using magnetic resonance, the power transmitting unit (Cook's charger 150) includes "a target device authenticator 109," and the target electronic device (Cook's automobile) contains "a user authorization module 121." Bennett [0029], [0030], [0041] ("target device authenticator ... works in coordination with the user authorization module"); BProv 8:16-9:20, 13:7-13. In the combined Cook/Bennett system, the authorization facility would include both of those components. Allen Decl. 180; *see also* Section V.C (Motivation to Combine). The target device authenticator and user authorization module "provide authorization for initiation of transfer of power" as claimed because "[t]he user authentication module 121 *facilitates the authentication* of the target electronic device 115, for resonant power delivery, with the target device authenticator 109 of the power transmitting unit 103." Bennett [0037] (emphasis added); BProv 11:18-12:5; Allen Decl. 181; *see also* Cook [0018]. For example, Bennett described authorizing power transfer after verifying "identity information of the magnetic resonant target device" that confirms whether the user has subscribed to a power-charging service. Bennett [0037], [0052], [0067], [0072],

[0087]; BProv 11:18-12:5, 15:12-18, 20:4-10, 21:16-21, 26:4-10; Cook [0015] (describing power delivery after determining that a vehicle is “associated with an account” where “charging is enabled”); Allen Decl. 181. In that process, “[t]he user authorization module 121” of the target electronic device “exchanges [] authentication information with the power transmitting unit 103.” Bennett [0037], Fig. 3; BProv 11:18-12:5, Fig. 3; Cook [0017]; Allen Decl. 181. The power transmitting unit “compares” that information with “subscriber’s information in its database accessed by the target device authenticator 109.” Bennett [0037]; BProv 11:18-12:5; Cook [0017]-[0018]; Allen Decl. 181.

Bennett also taught that a target device authenticator and user authorization module will confirm compatibility of the resonators as part of the authentication process in two ways. Allen Decl. 182. First, “[a] power control signal exchange operation is required for the authentication of the target electronic device 115 before a successful resonant power delivery.” Bennett [0039]; BProv 12:11-20. In Cook, this power exchange operation would occur between the charger and the vehicle, and ensure that power is transferred only to vehicles where “charging is enabled” with a compatible resonator. Cook [0015]; Allen Decl. 182. Second, Bennett’s taught checking the compatibility of resonators to “automatically adjust” the power transmission frequency “to achieve the optimum reception from an antenna/resonant coupling mechanism.” Bennett [0038]; BProv 12:6-10; Allen Decl. 183. A POSA

would have implemented this in Cook to further “facilitate[] the authentication of” Cook’s vehicle “for resonant power delivery.” Bennett [0037]; *see also id.* [0041] (“[t]he target device authenticator 109 authenticates the resonant power requests made by the target electronic device 115, and works in coordination with the user authorization module 121 of the target electronic device”); BProv 11:18-12:5, 13:7-13; Allen Decl. 183.

* * *

For the reasons set forth above, the combination of Bennett and Cook rendered obvious Independent Claim 13.

E. Independent Claims 1 and 7 Are Obvious In View Of Cook And Bennett

Independent claims 1 and 7 recite substantially the same system as claim 13, but from different perspectives, and are similarly unpatentable. *See* Allen Decl. 184.

1. Claim 1 – Wireless Receiver

Independent claim 1, reproduced below with brackets to identify its elements, describes substantially the same system as claim 13 from the perspective of the receiving device:

1[pre] A vehicle powering wireless receiver for use with
[a][i] a first electromagnetic resonator coupled to a power supply, the first electromagnetic resonator having **[ii]** a mode with a resonant frequency ω_1 , **[iii]** an intrinsic loss rate Γ_1 , and **[iv]** a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the wireless receiver comprising:

[b] a load configured to power the drive system of a vehicle using electrical power;

[c][i] a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having [ii] a mode with a resonant frequency ω_2 , [iii] an intrinsic loss rate Γ_2 , and [iv] a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$;

[d] wherein the second electromagnetic resonator is configured to be wirelessly coupled to the first electromagnetic resonator to provide resonant, non-radiative wireless power to the second electromagnetic resonator from the first electromagnetic resonator; and

[e] an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

As set out above, it recites “A vehicle powering wireless receiver for use with a first electromagnetic resonator coupled to a power supply” and lists a subset of the elements in claim 13 regarding the structure and characteristics of the wireless power system. *See* Allen Decl. 68-71, 73, 185 (showing how Element 1[a][i] maps to Element 13[b][i], 1[a][ii] to 13[b][ii], 1[a][iii] to 13[b][iii], 1[a][iv] to 13[b][iv], 1[b] to 13[c], 1[c][i] to 13[d][i], 1[c][ii] to 13[d][ii], 1[c][iii] to 13[d][iii], 1[c][iv] to 13[d][iv], 1[d] to 13[e], and 1[e] to 13[f]).

Cook in view of Bennett rendered obvious every element of claim 1 as discussed above. The only portion of claim 13 not substantively the same as an element of claim 1 is the preamble reciting a “vehicle powering wireless receiver.” To the extent that the preamble is limiting, the Cook/Bennett combination taught “a vehicle powering wireless receiver.” *See* Allen Decl. 186. As described above,

Cook taught a wireless car charger that includes placing a receiving antenna on the car. *See* Sections V.D.1 (Claim 13 Preamble), V.D.5.a (Second Electromagnetic Resonator). Power is wirelessly transmitted from the charger and received at the vehicle, where it charges the battery and powers the motors of the vehicle. *See* Elements 13[pre], 13[d] (second electromagnetic resonator); 13[e] (wireless coupling). Allen Decl. 186-187.

The remaining elements of claim 1 are identical to those already discussed for claim 13, and the Cook/Bennett combination rendered them obvious for the reasons discussed above. *See* Section V.D (Independent Claim 13); Allen Decl. 187. In short, Cook implemented in view of Bennett rendered obvious a vehicle powering wireless receiver (Cook's "magnetic resonant antenna" mounted on a vehicle coupled to the battery and motors (together the "load")) that is for use with a first electromagnetic resonator (the "coil 152" and "capacitor 154" in Cook's "charger 150"). *See* Elements 13[b][i], 13[d][i] above. Cook's charger resonator is coupled to a power supply ("charging circuit") and has a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q factor $Q_1 = \omega_1 / 2\Gamma_1$. *See* Elements 13[a][i], 13[b][ii], 13[b][iii], 13[b][iv], 13[b][v] above. The receiving vehicle comprises a load configured to power the drive system of the vehicle (motors and batteries), as well as a second electromagnetic resonator ("magnetic resonant antenna 110 formed from an inductive loop 111 in parallel with a capacitor 112") that has a resonant frequency

ω_2 , an intrinsic loss rate Γ_2 , and a second Q factor $Q_2=\omega_2/2\Gamma_2$. *See* Elements 13[c], 13[d][i]-[iv] above. The two electromagnetic resonators are coupled to each other to wirelessly provide power through a non-radiative magnetic field from the charger to the vehicle. *See* Element 13[e] above. And the receiving vehicle comprises an authorization facility (Bennett’s “user authentication module,” and related components for power exchange operation and resonant frequency selection) to confirm compatibility of the resonators and provide authorization for transfer of power. *See* Section V.C (Motivation to Combine) and Element 13[f] above; Allen Decl. 187.

2. Claim 7 - Power Source

Independent claim 7, reproduced below with brackets to identify its elements, describes substantially the same system as claim 13 from the perspective of the transmitting power source:

7[pre] A power source for wirelessly providing power to a wireless receiver of an at least partially electrically powered vehicle, the power source comprising:

[a] a power supply, the power supply configured to supply power at a rate sufficient to charge the battery of a vehicle that is driven at least in part by electrical power;

[b][i] a first electromagnetic resonator coupled to the power supply and having **[ii]** a mode with a resonant frequency ω_1 , **[iii]** an intrinsic loss rate Γ_1 , and **[iv]** a first Q-factor $Q_1=\omega_1/2\Gamma_1$, **[v]** the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;

[c] wherein the first electromagnetic resonator is configured to be wirelessly coupled to a second

electromagnetic resonator located on the vehicle and coupled to a load associated with the drive system of the vehicle to provide non-radiative wireless power to the second electromagnetic resonator;

[d][i] the second electromagnetic resonator having [ii] a mode with a resonant frequency ω_2 , [iii] an intrinsic loss rate Γ_2 , and [iv] a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$; and

[e] an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Allen Decl. 72, 188. It claims “a power source for wirelessly providing power to a wireless receiver” and further recites essentially the same elements to claim 13 regarding the structure and characteristics of the wireless power transfer system. *See* Allen Decl. 72, 74-75, 188 (showing how Element 7[a] maps to Element 13[a], 7[b][i] to 13[b][i], 7[b][ii] to 13[b][ii], 7[b][iii] to 13[b][iii], 7[b][iv] to 13[b][iv], 7[b][v] to 13[b][v], 7[c] to 13[e], 7[d][i] to 13[d][i], 7[d][ii] to 13[d][ii], 7[d][iii] to 13[d][iii], 7[d][iv] to 13[d][iv], and 7[e] to 13[f]).

The Cook/Bennett combination rendered obvious every element of claim 7. The only portion of claim 7 that is not substantively the same as an element of claim 13 is its preamble. To the extent that the preamble is limiting, the Cook/Bennett combination taught “a power source for wirelessly providing power to a wireless receiver of an at least partially electrically powered vehicle.” Allen Decl. 189. As described above, Cook’s “charging circuit” provides power in the form of a magnetic field that provides power to an in-range automobile. *See* Elements 13[pre], 13[a], 13[b] (“Charger 150” including a “coil 152” and a “capacitor 154”), 13[e] (wireless

coupling) above. The automobile is at least “partially electrically powered” as claimed because the “primary power source of the automobile” is a “battery 102.” Cook [0009] (also stating that the vehicle can be a “hybrid vehicle” that operates partially on “electric power” and partially on “gas power”), [0010]-[0011]; Allen Decl. 189-190.

The remaining elements of claim 1 are the same as those already discussed for claim 13, and the Cook/Bennett combination rendered them obvious for the reasons discussed above. *See* Section V.D (Independent Claim 13); Allen Decl. 190. In short, the Cook/Bennett combination discloses a power source (Cook’s “charger 150”) for wirelessly providing power to a wireless receiver (Cook’s “magnetic resonant antenna”) of an at least partially electrically powered vehicle. *See* Elements 13[pre], 13[b] (first resonator), 13[e] (wireless coupling) above. The charger contains a power supply (“charging circuit”) that supplies power at a rate sufficient to charge the electric vehicle. *See* Element 13[a] above. It further contains a first electromagnetic resonator (“coil 152” and “capacitor 154”) that has a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q factor $Q_1 = \omega_1 / 2\Gamma_1$. *See* Elements 13[b][i], 13[b][ii], 13[b][iii], 13[b][iv] above. The charger 150 is wirelessly coupled to a second resonator located on the vehicle (“magnetic resonant antenna ... formed from an inductive loop 111 in parallel with a capacitor 112”), which has a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q factor $Q_2 = \omega_2 / 2\Gamma_2$ and is

coupled to a load associated with the drive system of the vehicle (motors and batteries). *See* Elements 13[c], 13[d] above. And the system includes Bennett’s target device authenticator, power manager, communication modules and related components to confirm compatibility of the resonators and provide authorization for transfer of power. *See* Section V.C (Motivation to Combine) and Element 13[f] above; Allen Decl. 190.

F. Dependent Claims

The ’687 patent’s dependent claims are unpatentable for the same reasons as independent claims 1, 7, and 13 and as further explained below. Conversely, each of claims 1, 7, and 13 is each unpatentable for the same reasons as its dependent claims. *See* Allen Decl. 76, 191.

1. Claims 2, 8, and 14: Public Key Infrastructure

Claims 2, 8, and 14 respectively depend from claims 1, 7, and 13 and recite that “the authorization facility uses public key infrastructure.”

Cook and Bennett do not use the term “public key infrastructure,” but a POSA would have found the use of a public key infrastructure obvious in view of the combined Cook/Bennett system with “token” and “key” based encryption and security. Allen Decl. 192-197. To the extent Patent Owner argues otherwise, this element would have been obvious in further view of Applicant Admitted Prior Art (“AAPA”) and the knowledge of a POSA. Allen Decl. 198-199.

The only reference to a “public key infrastructure” in the ’687 patent is to state “[t]hose skilled in the art will appreciate” that “any known security and cryptography protocols and algorithms” can secure a communication channel, including “a public key infrastructure (PKI).” ’687 patent 184:16-23; Allen Decl. 193. While not described in the ’687 patent, a POSA would have understood that a “public key infrastructure” is a “set of policies” that use “cryptographic keys in a manner that allows users to reliably determine the identity of the owner of each public/private key pair.” Aull (Ex. 1008) [0004]; *see also, e.g.*, Ward (Ex. 1019) 1:25-28 (“a technology known as Public Key Infrastructure (PKI) [] enables users to be authenticated to each other by confirming identities”); Allen Decl. 195. That is what was taught by Cook and Bennett.

Cook taught that wireless power delivery is authorized using a “real-time token type system,” where a vehicle’s identification is sent from the vehicle as an “encrypted message” using a “private encryption key” that is decrypted at the charger using a “decryption key.” Cook [0017]; Allen Decl. 194, 196. Power is “allowed to be dispensed only if an encrypted value properly agrees with a proper encryption code.” Cook [0018]. Cook therefore taught the use of “cryptographic keys” that would allow the charger “to reliably determine the identity of the owner of” an automobile, corresponding to PKI. *See* Aull [0004] (describing PKI); Ward 1:25-28 (similar); Allen Decl. 196.

In the Cook/Bennett combination, Bennett also taught the use of cryptographic keys to reliably determine whether a “target electronic device” was authorized for power transfer. Allen Decl. 194, 197. Bennett disclosed that a wireless power transmitting unit (like Cook’s charger) includes “a target device authenticator 109” that “generates a token” and provides it to a target electronic device (like Cook’s vehicle) during registration, and at the target device “a user authorization module 121” uses the token for “subsequent communication and power charging” from the power transmitting unit. Cook [0014]-[0015], [0017]-[0018]; Bennett [0041]-[0042], [0055], [0060], [0062]-[0063]; BProv 13:7-22, 16:7-15, 17:21-18:5, 18:17-19:6; Allen Decl. 197; *see* Element [13f] above; Section V.C (Motivation to Combine). Bennett explains that the token-based system provides “security, confidentiality and non-repudiation” because decryption of the generated tokens requires a “key.” Bennett [0062]; BProv 18:17-19. Bennett taught that the transmitting unit identifies the target device by “comparing the identity data received with the subscription data stored in the database.” Bennett [0072]; BProv 18:17-23. Thus, Bennett taught cryptographic keys used for “to reliably determine the identity of the owner of” a target electronic device, corresponding to a PKI based system. *See* Aull [0004]; Ward 1:25-28; Allen Decl. 197.

Both Cook and Bennett also specifically taught that the use of cryptographic keys and secure identification of a wireless power receiver was part of the process

of initiating power transfer as claimed. Allen Decl. 197. Cook taught initiating power transfer only when the “controller” in the charger can “decrypt the encrypted message” using a “decryption key.” Cook [0017]. Similarly, Bennett taught power transfer is initiated only after the “power transmitting unit” authenticates with the “rechargeable electronic device.” Bennett [0042], [0055] (“On confirming the identity of the magnetic resonant target device 211 the power source 203 delivers the resonant power signal.”); BProv 13:14-22, 16:7-15; Allen Decl. 197.

If Patent Owner argues that the Cook/Bennett combination does not disclose a public key infrastructure, claims 2, 8, and 14 would have been obvious in further view of the knowledge of a POSA as admitted by the '687 patent. As explained above, the '687 admits that “[t]hose skilled in the art will appreciate” “a public key infrastructure (PKI)” was a “known security and cryptography protocol[] and algorithm[]” for securing a communication channel. '687 patent 184:16-23; Allen Decl. 198. These admissions regarding the scope and content of the prior art can, as set forth in the June 9, 2022 U.S. Patent & Trademark Office Applicant-Admitted-Prior-Art Memorandum (“AAPA Memo”), be used in a prior art combination to supply missing claim limitations that were generally known in the art before the invention. AAPA Memo 4; *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1339 (Fed. Cir. 2020) (“[I]t is appropriate to rely on admissions in a patent’s specification when assessing whether that patent’s claims would have been

obvious”). As discussed above, the Cook/Bennett system included “encryption/decryption” of digital data on a communication channel used to authorize a target device. Bennett [0086]; BProv 25:19-26:3; Cook [0017]-[0018]; Allen Decl. 199; Section V.C (Motivation to Combine). Using PKI to encrypt that communication channel would have been a straightforward application of well-known technologies with predictable results. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416-18 (2007). Indeed, systems using PKI for encryption and security were widely used before the ’687 patent. Allen Decl. 198 (discussing additional examples of prior art disclosing PKI as well-known for securing communications, including Muftic (Ex. 1024), Johnson (Ex. 1025), Moses (Ex. 1027), Lewis (Ex. 1026), Adams (Ex. 1028)).

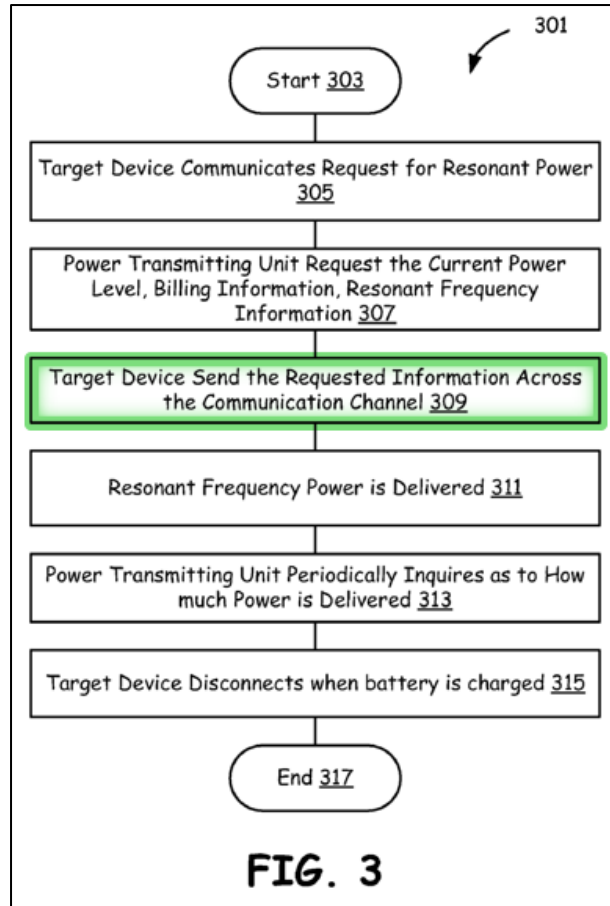
2. Claims 3, 9, and 15: Secure Communication Channel

Claims 3, 9, and 15 respectively depend from claims 1, 7, and 13 and further recite that “the authorization facility uses a secure communication channel.” The Cook/Bennett combination taught this element. *See* Allen Decl. 200-203.

Cook taught that authorization of power transfer included “encryption” and “decryption” of wirelessly transferred information to “cryptographically determine[] whether the power delivery is accurate.” Cook [0017]-[0018]. A POSA would have understood that “wirelessly” means there is a “communication channel” and that the use of encryption and decryption means that the communication channel is secure.

Allen Decl. 201; *see also* '687 patent 184:10-13 (stating that a “secure” channel is one that uses any type of “encryption,” “authentication” or “security”).

A POSA implementing Cook also would have looked to Bennett’s security features protecting communications between Cook’s charger and the electric car. *See* Section V.C (Motivation to Combine); Allen Decl. 202. Bennett taught that authentication information is exchanged between a target electronic device and the transmitting unit on a “communication channel” that “includes encryption/decryption of the digital data.” Bennett [0086]; BProv 25:19-26:3. As described in the flowchart of Bennett’s Figure 3, for example, the target electronic device sends information relating to “billing information” across “communication channel 309.”



Allen Decl. 202 (annotating Bennett Fig. 3); Bennett [0057]-[0058] (“FIG. 3 is a flowchart illustrating resonant power transfer operations performed using the power system of FIG. 1”); BProv 16:20-17:14, Fig. 3.

The communication channel is “secure” because it uses encryption/decryption. Bennett [0062] (tokens are exchanged for “security, confidentiality and non-repudiation”), [0086] (“communication module ... includes encryption/decryption of the digital data”); BProv 18:17-23, 25:19-26:3; Cook [0018] (“Power is allowed to be dispensed only if an encrypted value properly agrees with the proper encryption code and proper token time.”); *see also* ’687 patent

184:10-13 (“[t]hose skilled in the art will appreciate a signaling and communication channel capable of transmitting messages may be secured with any number of encryption, authentication, and security algorithms.”); Allen Decl. 203.

3. Claims 4-5, 10-11, and 16-17: Communication Channel

Claims 4, 10, and 16 respectively depend from claims 3, 9, and 15 and further recite that “the channel is an in-band communication channel.”

Claims 5, 11, and 17 also respectively depend from claims 3, 9, and 15 and further recite that “the channel is an out-of-band communication channel.”

The Cook/Bennett combination taught these claims elements. *See* Allen Decl. 204-210.

Bennett taught that that a communication channel used for transmitting data, including authentication and control information, can be on the same frequency with the “wireless field” used to transfer power between resonators. Bennett [0031], [0084] (“antenna 831 is used for both resonant power charging and normal communication operation”), Fig. 8; BProv 9:21-10:11, 25:9-15, Fig. 8. This means that the communication channel is “an in-band communication channel” as described in the ’687 patent. Allen Decl. 206, 208; ’687 patent 180:44-49 (stating a “communication [is] in-band” when “at least some part of a magnetic resonator used to exchange power is also used to exchange information, and the carrier frequency of the information exchange is close to the resonant frequency used in the power

exchange.”). A POSA would expect Bennett’s in-band communication channel to be compatible with Cook’s resonators based on incorporated-by-reference Cook-086, which taught that the “magnetic field of the transmitter” resonator can be “impressed with information so as to transfer information, along with power.” Cook-086 18:39-43. A POSA would have been motivated to use an in-band communication channel in Cook when “simplifying the system” because it does not require a “separate data or communications link.” Cook-086 18:43-46; *see* Motivation to Combine Section above; Allen Decl. 205, 207.

Bennett also taught that a communication channel can be “out of band” (on a different frequency) from the magnetic field used for wireless charging. Bennett [0031] (“In another embodiment, the power link (such as the magnetic field), the control signal, and the normal communication (i.e. the normal function) operation *takes place in separate channels.*”), [0084] (explaining that out-of-band communication channels may be preferable because in-band channels can lower resonator Q factors); BProv 9:21-10:11, 25:9-15 (noting that an in-band communication configuration “will disturb the resonant tuning of target device by lowering the quality factor”); Allen Decl. 209. In this configuration, the coil/antenna used for wireless power transfer is separate from “another antenna 833 with the wireless link 835 [that] is employed exclusively for communication purposes.” Bennett [0085], Fig. 8; BProv 25:16-18, Fig. 8. Bennett thus taught an authorization

facility using an “out of band communication channel” in the same way described by the ’687 patent. Allen Decl. 210; ’687 patent 180:49-53 (“An out-of-band communication channel may use an antenna and a signaling protocol that is separated from the energy transfer resonator and magnetic fields.”). This is similarly consistent with Cook-086, which contemplates separate data and communications links. *See* Cook-086 18:43-46; Allen Decl. 210. A POSA would have been motivated to implement an out-of-band communication channel in Cook when designing a more sensitive system where Q should be preserved. *See* Section V.C (Motivation to Combine); Bennett [0084], 25:9-15; Allen Decl. 205.

4. Claims 6, 12, and 18: A Safety Condition

Claims 6, 12, and 18 respectively depend from claims 1, 7, and 13 and further recite that “the authorization facility further determines a safety condition for initiation of transfer of power.”

The Cook/Bennett combination taught this element, wherein Bennett explained that a power transmitting unit (e.g., Cook’s charger) only initiates wireless power transfer after a “target device power manager 127” in the target electronic device (e.g., Cook’s vehicle) determines that the battery is at a safe level for charging, corresponding to the claimed “safety condition.” Bennett [0039]-[0041]; BProv 12:11-13:13 (“The target device power manager 127 manages the battery level of the rechargeable battery 129 by regulating the battery discharge and by initiating

resonant power charge operation.”); Allen Decl. 211-213. Bennett disclosed the use of a “low voltage sensor” in the target electronic device that determines when a target device’s battery level “falls below a threshold limit” or “preset value,” where power transfer should be initiated. Bennett [0075] (“When the voltage falls below a preset value the power request module 611 communicates with the power source 203”), [0076], [0077], [0082]; BProv 11:9-17 (“The high voltage limit protects the battery”), 22:10-19, 22:-23:5; Allen Decl. 214. The threshold limit where power transfer is initiated is below the “maximum allowable battery voltage,” which is the level where Bennett’s system will “initiate[] a termination of power delivery.” Bennett [0026], [0076], [0087]-[0090] (“high voltage limit” is monitored and there is “resonant power cutoff” when it is exceeded); BProv 8:1-9 , 22:15-19, 26:4-27:5. The power transmitting unit initiates power transfer after determining that the target device has sent a “power request” indicating that the battery level of the target device is at a safe level for charging. Bennett [0075] (“Subsequent to the power request made by the power request module 611 the resonant power delivery starts”), [0082]-[0083]; BProv 22:10-14, 24:15-25:8 Allen Decl. 213.

As described in the Motivation to Combine section above, a POSA could have and would have implemented Bennett’s battery monitoring as a safety condition for initiation of transfer of power in Cook’s wireless charging system to prevent overcharging of Cook’s vehicle battery, which could cause explosions or fires, and

“maintain[] the rechargeable battery charge at a safer limit for a smooth functioning of the target device.” Bennett [0076]; BProv 22:15-19; Section V.C (Motivation to Combine); Allen Decl. 215.

VI. The Board Should Reach the Merits of This Petition

Discretionary denial is unwarranted here. Should Patent Owner allege otherwise in its POPR, InductEV reserves the right to reply to the POPR 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

Although Bennett and Cook are listed on the face of the ’687 patent, Step 2 of *Advanced Bionics* is not satisfied because the record is silent regarding the Examiner’s analysis of relevant teachings from Cook’s pre-grant publication, incorporated-by-reference Cook-086, or Bennett. *Cf. Volkswagen Grp. of Am., Inc. v. Michigan Motor Techs. LLC*, IPR2020-00452, Paper 12 at 32-33 (Sept. 9, 2020) (error to overlook relevant teachings in a prior-art reference). Furthermore, this Petition presents Bennett and Cook in combination and is supported by the declaration of Dr. Allen that explains why a POSA would have combined the teachings of Bennett and Cook, which is evidence that was not presented during prosecution.

B. *Fintiv* does not warrant denial

Should Patent Owner seek denial under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (Mar. 11, 2020) (“Fintiv”) (precedential), InductEV will seek

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

VII. 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

WiTricity has asserted the '687 patent against InductEV 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 has also filed, or will file in the immediate future, IPRs challenging U.S. Patent No. 8,461,719 that is also asserted in the same case.

The '687 patent is also related to U.S. Patent No. 8,304,935, which was the subject of an IPR petition in IPR2021-01166. The PTAB found all claims of the '935 patent were invalid as obvious. *Id.*, Paper 35.

C. Grounds for Standing

InductEV certifies that the '687 patent is available for *inter partes* review and that it 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:

- Jonathan M. Strang (Reg. No. 61,724), jonathan.strang@lw.com, Latham & Watkins LLP; 555 Eleventh Street, NW, Ste. 1000, Washington, D.C. 20004-1304; 202.637.2362 (Tel.); 202.637.2201 (Fax).

Petitioner also designates the following backup counsel:

- Charles H. Sanders (Reg. No. 47,053), charles.sanders@lw.com, Latham & Watkins LLP; 200 Clarendon Street, Boston, MA 02116; 617.948.6022 (Tel.); 617.948.6001 (Fax).
- Blake R. Davis (*pro hac vice* motion to be filed), blake.davis@lw.com, Latham & Watkins LLP; 505 Montgomery Street, Ste. 2000, San Francisco, CA 94111-6538; 415.395.8033 (Tel.); 415.395.8095 (Fax).
- Jeffrey G. Homrig (*pro hac vice* motion to be filed), jeff.homrig@lw.com, Latham & Watkins LLP; 300 Colorado St., Suite 2400, Austin, TX 78701; 737.910.7344 (Tel.); 737.910.7301 (Fax).
- David A. Zucker (Reg. No. 74,095), david.zucker@lw.com,

Latham & Watkins LLP; 555 Eleventh Street, NW, Ste. 1000,
Washington, D.C. 20004-1304; 202.637.2219 (Tel.); 202.637.2201
(Fax).

- Jacob Vannette (Reg. No. 72,228), jake.vannette@lw.com, Latham & Watkins LLP, 555 Eleventh Street, NW, Ste. 1000, Washington, D.C. 20004-1304; 202.350.5187 (Tel.); 202.637.2201 (Fax).
- David J. Hlavka (*pro hac vice* motion to be filed), david.hlavka@lw.com, Latham & Watkins LLP, 555 Eleventh Street, NW, Ste. 1000, Washington, D.C. 20004-1304; 202.654.7217 (Tel.); 202.637.2201 (Fax).

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.

VIII. Conclusion

For the reasons set forth above, Petitioner InductEV respectfully requests *inter partes* review of the challenged claims of the '687 Patent.

Respectfully submitted,

Dated: July 17, 2023

By: / Jonathan M. Strang /

Jonathan M. Strang (Reg. No. 61,724)
jonathan.strang@lw.com

Petition for *Inter Partes* Review of USP 8,912,687

Latham & Watkins LLP
555 Eleventh Street, NW, Ste. 1000
Washington, DC 20004-1304
Telephone: 202.637.2200
Fax: 202.637.2201

Counsel for Petitioner
InductEV

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 13,564 words, which is the sum of 13,524 words calculated by Microsoft Word's word-count feature and 40 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).

By: / Jonathan M. Strang /

Jonathan M. Strang (Reg. No. 61,724)
jonathan.strang@lw.com
Latham & Watkins LLP
555 Eleventh Street, NW, Ste. 1000
Washington, DC 20004-1304
Telephone: 202.637.2200
Fax: 202.637.2201

Counsel for Petitioner
InductEV

CERTIFICATE OF SERVICE

The undersigned certifies that a complete copy of this Petition for *Inter Partes* Review of U.S. Patent No. 8,912,687 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:

S. Ludwig
Robert Sullivan
P. Musselman
J. Fasse
David Goren
Janis Fraser
Anita Meiklejohn
John Phillips
Fish & Richardson P.C. (BO)
P.O. Box 1022
Minneapolis, MN 55440-1022

By: / Jonathan M. Strang /

Jonathan M. Strang (Reg. No. 61,724)
jonathan.strang@lw.com
Latham & Watkins LLP
555 Eleventh Street, NW, Ste. 1000
Washington, DC 20004-1304
Telephone: 202.637.2200
Fax: 202.637.2201

Counsel for Petitioner
InductEV