

**INDUCTEV INC.,
Petitioner,
v.
WITRICITY CORPORATION.,
Patent Owner**

**IPR2023-01208
Patent 8,912,687**

Petitioner's Demonstratives
Nov. 19, 2024

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

The '687 Patent (Ex. 1001)

US008912687B2

(12) **United States Patent**
Kesler et al.

(10) **Patent No.:** **US 8,912,687 B2**
(45) **Date of Patent:** **Dec. 16, 2014**

(54) **SECURE WIRELESS ENERGY TRANSFER FOR VEHICLE APPLICATIONS**

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Related U.S. Application Data

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H02J 5/00 (2006.01)
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CPC **B60L 11/182** (2013.01); **H03H 7/40** (2013.01); **H02J 5/005** (2013.01); **H02T 10/7055** (2013.01); **Y02T 90/14** (2013.01); **Y02T 90/122** (2013.01); **Y02T 10/7094** (2013.01); **H02J 7/35** (2013.01)
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See application file for complete search history.

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(57) **ABSTRACT**
A vehicle powering wireless receiver for use with a first electromagnetic resonator coupled to a power supply includes a load configured to power the drive system of a vehicle using electrical power, a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, 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 an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

18 Claims, 168 Drawing Sheets

(a) (b) (c) (d)

InductEV, Inc.
Exhibit 1001
Page 001

(10) **Patent No.:** **US 8,912,687 B2**
(45) **Date of Patent:** **Dec. 16, 2014**

Related U.S. Application Data

* * *
provisional application No. 61/172,633, filed on **Apr. 24, 2009**, provisional application No. 61/169,240,

(57) **ABSTRACT**

A vehicle powering wireless receiver for use with a first electromagnetic resonator coupled to a power supply includes a load configured to power the drive system of a vehicle using electrical power, a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, 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 an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

No Dispute: Independent Claim 13 Is Representative

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent) at Claim 13

Patent Owner's Response

resonator the second resonator. Independent claim 13 is representative of all of the challenged independent claims, and is reproduced below:

POR at 4

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

Claim Construction

Claim Term	Patent Owner's Construction	Petitioner's Construction
“confirm compatibility of the resonators and provide authorization for initiation of transfer of power”	“verify that parameters of the resonators will permit power transfer and provide authorization prior to initiating the transfer of power”	Plain meaning

Plain Meaning

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

Ex. 1001 ('687 Patent), Claim 13

Are the resonators compatible?

Authorize power transfer

Specification: Authenticated Resonators Are Compatible

The source and device may include authentication capability. Authentication may be used to ensure that only compatible sources and devices are able to transmit and receive power. Authentication may be used to ensure that only

Ex. 1001 ('687 Patent) at 102:14-17

Patent Owner's Expert

Q. In the -- in the portion of column 102 that you cite at the top of page 13 of your declaration, do you understand authentication to have the same meaning as authorization?

THE WITNESS: I would say in this context of the patent, they would mean the same thing. I mean, "authentication" is a word used to describe confirmed compatibility of the resonators.

Ex. 1035 (Horenstein Dep. Tr.) at 35:9-17 (objection omitted)

Specification: Many Ways To Authenticate And Confirm Compatibility

power. Authentication may be used to ensure that only authentic devices that are of a specific manufacturer and not clones or devices and sources from other manufacturers, or only devices that are part of a specific subscription or plan, are able to receive power from a source. Authentication may be based on cryptographic request and respond protocols or it may be based on the unique signatures of perturbations of specific devices allowing them to be used and authenticated based on properties similar to physically unclonable functions. Authentication may be performed locally between each

Ex. 1001 ('687 Patent) at 102:17-26

Extrinsic: Authentication Relates To Verifying Identity Of Device

Dr. Allen

11. A POSA would have understood that authentication relates to verifying the identity of a device—in this context, a resonator—before allowing access to a system or resources, and does not require verification of any particular parameters such as physical parameters to “permit power transfer.” Ex. 1037-005. For example, the '687 patent advises against relying on physical parameters

Ex. 1036 (Allen Decl.) at ¶11

Dictionary of Internetworking Terms and Acronyms (2001)

authentication

In security, the verification of the identity of a person or a process.

Ex. 1037-005

POSA Would Have Understood Confirming Compatibility Is Broad

Dr. Allen

Q. And you mentioned a couple of moments ago whether the resonator frequencies are compatible. Is the compatible resonator frequencies, is that an example of what Element 13[f] is saying when it says confirm the compatibility of the resonators?

A. I think that could be one element, sure.

Ex. 2003 (Allen Dep. Tr.) at 54:9-14

Dr. Allen

10. *First*, I disagree that confirming compatibility of resonators requires verifying that parameters of the resonators will permit power transfer. There are multiple ways to confirm compatibility. For example, the '687 patent explains

Ex. 1036 (Allen Suppl. Decl.) at ¶ 10

PO's Construction Reads In Limitations

Patent Owner's Construction

“verify that parameters of the resonators will permit power transfer and provide authorization prior to initiating the transfer of power”

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

Ex. 1001 ('687 Patent), Claim 13

No mention of “parameters”

PO's Construction Is Inconsistent With Dependent Claims

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

Ex. 1001 ('687 Patent), Claim 13

14. The wireless power system of claim 13, wherein the authorization facility uses public key infrastructure.

15. The wireless power system of claim 13, wherein the authorization facility uses a secure communication channel.

Ex. 1001 ('687 Patent) at Claims 14, 15

Dr. Allen

“uses public key infrastructure”). The uses of cryptography algorithms, public key infrastructure, etc., do not require verifying parameters of a resonator.

Ex. 1036 (Allen Decl.) at ¶11

PO's Construction is Ambiguous

Patent Owner's Expert

As part of the compatibility check, the authorization facility may confirm such parameters as resonant frequency, quality factor Q, coupling efficiency, physical dimensions, safety metrics, and manufacturer of the resonators.

Ex. 2001 (Horenstein Decl.) at ¶25

Patent Owner's Expert

Q. So using the example that you just used at the top of page 15 of your declaration, how do I confirm compatibility using the size of the resonators?

A. Well, again, it's going to be a system dependent issue, and it would be up to the designer of the system to decide what is compatible and what is not.

Ex. 1035 (Horenstein Dep. Tr.) at 22:21-23:3

Patent Owner's Expert

Q. In your opinion, to confirm compatibility of resonators, do you have to check every single one of these parameters?

A. No. That's what "such as" means, that you have to confirm the ones that are relevant to being able to transfer power.

Ex. 1035 (Horenstein Dep. Tr.) at 36:12-17

PO's Interpretation Adds Multiple Unclaimed "Checks"

Patent Owner's Expert

27. As the '687 patent explains, the system manages both authorization *and* authentication, where the former ensures that the user is a subscriber or has paid, and latter is validation of resonator compatibility.

30. For the purpose of further discussion, I will refer to the two functions of the claimed authorization facility as the "check for compatible resonator parameters" and the "check for a valid user" requirements, respectively. Details and examples of these two requirements appear in several places in the '687 patent:

Ex. 2001 (Horenstein Decl.) at ¶¶27, 30

Phillips

"[Expert testimony] is generated at the time of and for the purpose of litigation and thus can suffer from bias that is not present in intrinsic evidence."

Phillips v. AWH Corp., 415 F.3d 1303, 1318 (Fed. Cir. 2005)

PO Relies On Non-Limiting Embodiments Not Tied To The Claims

Patent Owner's Expert

26. The second function of the claimed authorization facility, namely that of “providing authorization,” refers to the validation needed for “initiation of transfer of power.” (See, e.g., '687 claims 1, 7, and 13). Such validation will confirm that the user has, for example, a subscription, a user ID, a proper account, and/or means to pay. (See, e.g., '687 patent, 65:24-26; 87:49, 102:17-21).

Ex. 2001 (Horenstein Decl.) at ¶26

through the source input terminals. The source power and control circuits 2302 may include power factor correction circuits and may be configured to monitor power usage for monitoring accounting, billing, control, and like functionalities.

Ex. 1001 ('687 Patent) at 65:24-26

Each solar PV panel with wireless power transfer may have its own inverter, significantly improving the economics of these solar systems by individually optimizing the power production efficiency of each panel, supporting a mix of panel sizes and types in a single installation, including single panel “pay-as-you-grow” system expansions. Reduction of instal-

Ex. 1001 ('687 Patent) at 87:44-49

POSR Is Contradicted By PO's Expert

Patent Owner's Sur-Reply

102:21-31. But just because the specification explains that “authentication” may include other functions beyond confirming resonator compatibility does not render the specification inconsistent with PO’s construction.

POSR at 3

Patent Owner's Expert

Q. In the -- in the portion of column 102 that you cite at the top of page 13 of your declaration, do you understand authentication to have the same meaning as authorization?

THE WITNESS: I would say in this context of the patent, they would mean the same thing. I mean, “authentication” is a word used to describe confirmed compatibility of the resonators.

Ex. 1035 (Horenstein Dep. Tr.) at 35:9-17 (objection omitted)

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

The combination discloses confirming compatibility

A POSA would combine Cook and Bennett

Undisputed limitations

The '687 Patent

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Undisputed limitations

Combination Discloses Limitation 13[f]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent) at Claim 13

**Only
disputed
limitation**

Cook Discloses Authorization Facility Under Plain Meaning

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

Ex. 1001 ('687 Patent), Claim 13

Cook

[0014] The charger 150 also includes an information detecting part. This may be a send and receive portion 160 that wirelessly detects a unique identifier indicative of the vehicle 100. In one embodiment, the vehicle 100 may include an

* * *

e.g. controller 180. This may be at a remote location that stores the vehicle identification information. If the controller verifies the ID as being one that is associated with an account at 205, charging is enabled. This causes power to be delivered from the AC Main, through a meter 175, to the charging device 150. The meter 175 is an integrating meter which

Ex. 1007 (Cook) at ¶¶0014, 0015

Cook

[0018] This cryptographically determines whether the power delivery is accurate by the controller 180. Power is allowed to be dispensed only if an encrypted value properly agrees with the proper encryption code and proper token time.

Ex. 1007 (Cook) at ¶0018

Bennett Discloses Authorization Facility Under Plain Meaning

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

Ex. 1001 ('687 Patent), Claim 13

Bennett

[0037] The user authorization 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. During resonant power delivery the user authorization module 121 exchanges the authentication information with the power transmitting unit 103. The power transmitting unit 103 compares the information (or a computed value thereof) with the subscriber's information in its database accessed by the target device authenticator 109. If the match is determined, then resonant power

delivery is initiated. The authentication is followed by optional frequency selection and directional adjustments of a non-radiated magnetic field in the direction of the target electronic device 115. In a related embodiment, the magnetic field

* * *

communication module 125. A power control signal exchange operation is required for the authentication of the target electronic device 115 before a successful resonant power delivery. The target device power manager 127 man-

Ex. 1005 (Bennett) at ¶¶0037, 0039

POSA Would Combine Cook And Bennett To Achieve Optimum Reception

Bennett

[0038] The source resonant frequency selector 123 provides a tuning mechanism in order to achieve the required resonant coupling effect. For example, it facilitates the tuning of capacitors where capacitors are used for tuning. Some tuning capacitors are voltage controlled, and they are basically, diode varactors. The tuning voltage is automatically adjusted to achieve the optimum reception from an antenna/resonant coupling mechanism such as coils.

Ex. 1005 (Bennett) at ¶0038

Combined System Discloses I3[f] Under PO's Construction

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

Ex. 1001 ('687 Patent), Claim 13

Patent Owner's Construction

“verify that parameters of the resonators will permit power transfer and provide authorization prior to initiating the transfer of power”

PO's Expert Admits Bennett Discloses PO's Construction

Patent Owner's Construction

“verify that parameters of the resonators will permit power transfer and provide authorization prior to initiating the transfer of power”

Patent Owner's Expert

target devices are tuned to the same frequency.” (Bennett at [0023]). Bennett also discloses a system which checks the incoming resonant frequency and tunes the resonance of the receive before initiating power transfer:

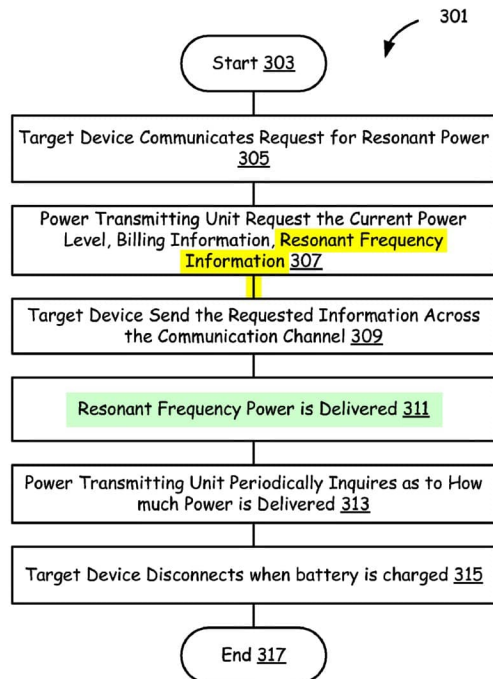
Ex. 2001 (Horenstein Decl.) at ¶48

Bennett Discloses 13[f] Under PO's Construction

Patent Owner's Construction

“verify that parameters of the resonators will permit power transfer and provide authorization prior to initiating the transfer of power”

Bennett



power transmitting unit 103. During this step the target electronic device 115 sends its identity and its (tuned) resonant frequency information to the power transmitting unit 103. At a next block 307 the power transmitting unit 103 requests the current power level, billing information, etc. from the target electronic device 115.

[0058] In response to the request made at the block 307, the target electronic device 115 sends the requested information to the power transmitting unit 103 in the next block 309. The power transmitting unit 103 then generates power employing the requested resonant frequency and delivers it in the form of magnetic field/waves at the next block 311. In one embodi-

Ex. 1005 (Bennett) at Fig. 3, ¶¶0057-58

PO's "Parameters" Include Resonant Frequency

Patent Owner's Response

Moreover, as Dr. Horenstein explains in his declaration, a number of parameters of the resonators may effect whether the resonators are compatible, or able to perform power transfer. *See* Horenstein Decl. ¶¶ 30-41. For example, one parameter is the resonant frequencies of the resonators. Matching the resonant

POR at 9

Patent Owner's Expert

As part of the compatibility check, the authorization facility may confirm such parameters as resonant frequency, quality factor Q, coupling efficiency, physical dimensions, safety metrics, and manufacturer of the resonators.

Ex. 2001 (Horenstein Decl.) at ¶25

POSA Would Be Motivated To Verify Resonant Frequencies In Cook

Cook

[0012] In the embodiment, the battery is automatically charged whenever the antenna 112 comes into range of a wireless charging circuit of appropriate type, e.g. the right frequency. A number of different places, such as parking lots, and more specifically public places, may have appropriate chargers such as 150 in specified locations. In the embodiment, the charger 150 may be located within the ground near a parking space.

Ex. 1007 (Cook) at ¶0012

Patent Owner's Expert

Q. This indicates that in order to automatically charge the battery with an appropriate type, that means than the resonators would be compatible with one another; correct?

A. No. Cook is just saying they have to have the same resonant frequency, which is kind of basic knowledge, but it doesn't talk about all of the other aspects of compatibility that are important to more - more sophisticated systems.

Ex. 1035 (Horenstein Dep. Tr.) at 52:9-17;
see also *id.* 55:7-23, 58:23-59:13

(“Cook just relies on the resonant frequency being the same.”)

Bennett Confirms Compatibility Based On Received Resonant Frequency

Patent Owner's Sur-Reply

Bennett also fails to disclose confirming resonator compatibility. Although “resonant frequency information” is sent to the power transmitting unit, Bennett fails to disclose that the power transmitting unit confirms resonator compatibility based on the received resonant frequency information. Rather, Bennett merely

POSR at 15

Bennett

[0037] The user authorization 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. During resonant power delivery the user authorization module 121 exchanges the authentication information with the power transmitting unit 103. The power transmitting unit 103 compares the information (or a computed value thereof) with the subscriber's information in its database accessed by the target device authenticator 109. If the match is determined, then resonant power delivery is initiated. The authentication is followed by

Ex. 1005 (Bennett) at ¶0037

Patent Owner's Expert

Q. So the -- the phrase “receive authentication information,” do you understand that is referring to the target resonant frequency, the target device, the target device at MD, the target device billing information, target device power receipt level, and power device battery power state?

THE WITNESS: Yes.

Ex. 1035 (Horenstein Dep. Tr.) at 68:11-18 (objection omitted)

PO's Expert Agrees Resonant Frequency Verified Before Power Is Initiated

Patent Owner's Sur-Reply

Dr. Horenstein agreed with the statement that “So when Bennett is looking to authenticate a target device, it is verifying the device’s identification number, the details of the user, and the resonant frequency for the target device.” Horenstein Tr., 74:8-14. But the preceding questions related to paragraph 67 of Bennett,

POSR at 13

Bennett

[0067] The target device identification database 507 consists of the information of all subscribers who have subscribed with the power source 203 of FIG. 2. Typically the database information contains a pre-assigned identification number of the target device, relevant personal details of the user, a preferred magnetic resonant frequency for the target device, etc. When the target device 211 communicates with the power source 203 during the power request it also sends it identity information so that the power source 203 cross-verifies with its target device identification database 507 contents. If the communicated information matches the database 507 contents then the resonant power delivery is initiated.

Ex. 1005 (Bennett) at ¶0067

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

The combination discloses confirming compatibility

A POSA would combine Cook and Bennett

Undisputed limitations

Cook and Bennett Are Analogous Art

Bennett

(57)

ABSTRACT

A power delivery system wirelessly deliver electric power and a communication signal to a target device. The power delivery system includes a power transmitting unit having a power source operable to source alternating current power and a sending resonant coupling component operable to couple the alternating current power to a coil for wireless power transmission by a non-radiated magnetic field at a target resonant frequency. The power transmitting unit is capable of dynamically tuning the wireless power transmission to the target resonant frequency wherein the target resonant frequency is specified dynamically. A communication module couples to the power transmitting unit and is operable to couple the communication signal to the non-radiated magnetic field. Operations may include target device authentication, target resonant frequency information communication, billing, and device management.

Ex. 1005 (Bennett) at Abstract

Cook

(57)

ABSTRACT

A system that automatically detects the presence of an automobile that can operate wirelessly to recharge the battery therein, and detects account information associated with that automobile. When the account information is properly detected, the amount of power delivered is metered, and thereafter the power used by a user is Bill to the user at a markup based on that distributed by the distribution company.

Ex. 1007 (Cook) at Abstract

A POSA Would Have Applied Bennett's Tuning To Cook

Bennett

[0055] An user authorization module **219** delivers the identity of the magnetic resonant target device **211** to the power source **203**, as necessary. The identity is sent on the 'wireless link' **231**. This information is processed by the target device authenticator **209**. On confirming the identity of the magnetic resonant target device **211** the power source **203** delivers the resonant power signal. In one embodiment, different frequencies are assigned to a plurality of the magnetic resonant target devices. The assigned frequency value is configured into the magnetic resonant target device **211**. Sending of this information to power source **203** with a request for power helps in resonant locking/effective resonant coupling by the power source **203** with magnetic resonant target device **211**.

Ex. 1005 (Bennett) at ¶0055

Cook

[0012] In the embodiment, the battery is automatically charged whenever the antenna **112** comes into range of a wireless charging circuit of appropriate type, e.g. the right frequency. A number of different places, such as parking lots, and more specifically public places, may have appropriate chargers such as **150** in specified locations. In the embodiment, the charger **150** may be located within the ground near a parking space.

Ex. 1007 (Cook) at ¶0012

POSA Would Have Combined Cook and Bennett For Details Regarding Encryption

Bennett

[0046] The power transmitting unit may also include a token generator that generates a token for delivery to the target device during a target device registration operation. The power transmitting unit is then operable to authenticate the target device during subsequent power transmission operations based partially on the token. The token generator may include a pseudorandom number generator operable to generate the token. With these operations, the power transmitting unit may be operable to deliver power to the target device only after authenticating the target device.

Ex. 1005 (Bennett) at ¶0046

Cook

[0017] Another embodiment may recognize that the detection of an ID could be cloned, and use encryption techniques to verify the ID. For example, one embodiment might use a real-time token type system. The vehicle has a real time clock which is used to display time. The time is encrypted by the vehicle's private encryption key. The controller has a decryption key that can decrypt the encrypted message. The controller thereby 1) checks whether the value can be decrypted, and 2) checks whether the time is correct (to avoid reuse of a previously-sent message).

Ex. 1007 (Cook) at ¶0017

POSA Would Have Combined Cook And Bennett For Safety

Bennett

[0076] The power charging controller 619 helps in maintaining the rechargeable battery charge at a safer limit for a smooth functioning of the target device 115, 211. The power charging controller 619 has a low voltage sensor 621 and a high voltage sensor 623. The low voltage sensor 621 monitor the low voltage limit of the rechargeable battery and the high voltage sensor 623 monitor the high voltage limit.

Ex. 1005 (Bennett) at ¶0076

Cook

[0012] In the embodiment, the battery is automatically charged whenever the antenna 112 comes into range of a wireless charging circuit of appropriate type, e.g. the right frequency. A number of different places, such as parking lots, and more specifically public places, may have appropriate chargers such as 150 in specified locations. In the embodiment, the charger 150 may be located within the ground near a parking space.

Ex. 1007 (Cook) at ¶0012

Undisputed: POSA Would Have Had A Reasonable Expectation Of Success

Dr. Allen

120. A POSA would have had a reasonable expectation of success in combining Bennett and Cook as described above. As I already explained above, Cook and Bennett described similar systems (transferring wireless power transfer from a source to a device using magnetic resonance) using similar components (a first resonant antenna coupled to a source that transmits power, and a second resonant antenna for receiving power and charging a battery), used for the same purpose of charging a rechargeable battery. *See, e.g., Sections VII.A., VII.B.1; see*

Ex. 1003 (Allen Decl.) at ¶120

Bennett Provides Implementation Details For Cook

Dr. Allen

POSA would not look to or need the details of Bennett. I explained in my first declaration that **Bennett contains** additional details about various aspects of monetizing a wireless power transfer system that are lacking in Cook. Ex. 1003 ¶¶ 114-119, 180-183. These include **details about encryption, communication, and authentication. *Id.*** A POSA would not have found such details redundant to **Cook**, which provides underlying disclosure of a need for these aspects, but does not provide the details that can be found in Cook. *Cf.* Horenstein Decl., ¶¶ 69-72. Ex. 1036 (Allen Suppl. Decl.) at ¶35

KSR

“If a technique has been used to improve one device, and a [POSA] would recognize that it would improve similar devices in the same way, using the technique is obvious.”

KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 417 (2007)

A POSA Would Have Combined Bennett and Cook For Details of Communication Link

Bennett

magnetic field in some embodiments. The 'wireless field' 111 is the power delivery channel and a 'wireless link' 113 is the control signal channel. In one embodiment of the present invention communicating the power and a control signal are conducted employing the same frequency, or in other words, on the same channel, i.e. the wireless field 111. 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. For e.g.

Ex. 1005 (Bennett) at ¶10031

in-band

out-of-band

Cook

[0014] The charger 150 also includes an information detecting part. This may be a send and receive portion 160 that wirelessly detects a unique identifier indicative of the vehicle 100. In one embodiment, the vehicle 100 may include an

* * *

[0015] In operation, the vehicle charging operation may operate as follows. FIG. 2 illustrates a flow chart in which step 200 detects the identification of the vehicle. At 205, a detec-

Ex. 1007 (Cook) at ¶¶0014-0015

Communication Channel Is Used For Compatibility Check

Patent Owner's Response

combine Bennett with Cook. Moreover, whether signals are transmitted using in-band versus out-of-band channels is entirely unrelated to confirming resonator compatibility, which is the feature Petitioner alleges is disclosed by Bennett and would have been obvious to combine with Cook. *See* Horenstein Decl. ¶ 71.

POR at 26

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

Ex. 1001 ('687 Patent), Claim 13

15. The wireless power system of claim 13, wherein the authorization facility uses a secure communication channel.

16. The wireless power system of claim 15, wherein the channel is an in-band communication channel.

17. The wireless power system of claim 15, wherein the channel is an out-of-band communication channel.

Ex. 1001 ('687 Patent), Claims 15-17

PO Mischaracterizes Dr. Allen's Testimony

Patent Owner's Response

Bennett for such details. Pet at 47-48. But at his deposition, Dr. Allen agreed that a POSA would be able to implement an authorization scheme based on Cook, and would not need the details of Bennett. See Ex. 2003 at 49:17-50:3; *see also* POR at 25

Dr. Allen

Q. So just so I'm clear, so what you're saying is a person of skill in the art would be able to implement the authorization function that's described in Cook just based on the description in Cook. Is that what you're saying?

A. I think I'm saying something a little bit more, which is I'm a person of ordinary skill. I read Cook, and I see that oh, there is an authorization scheme here. I will now go to the literature and identify potential authorization schemes like what's described in Bennett that I could use to actually implement the authorization.

Ex. 2003 (Allen Dep. Tr.) at 50:8-19

Physical Combinability Not Required By Law

Patent Owner's Response

Bennett. Moreover, Petitioner does not explain how the “pseudorandom number generator” of Bennett would even be used in Cook, which encrypts the time from the vehicle. Petitioner’s alleged “motivation” to seek “details” from Bennett to

POR at 28

In re Etter

“Etter’s assertions that Azure cannot be incorporated in Ambrosio are basically irrelevant, the criterion being not whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole.”

In re Etter, 756 F.2d 852, 859 (Fed. Cir. 1985)

The '687 Patent

“confirm compatibility” Should Have Its Plain Meaning

Cook and Bennett Render Claims 1-18 Obvious

The combination discloses confirming compatibility

A POSA would combine Cook and Bennett

Undisputed limitations

Cook (Ex. 1007)

US 2009/0299918 A1

(19) United States
(12) Patent Application Publication
Cook et al.

(10) Pub. No.: US 2009/0299918 A1
(43) Pub. Date: Dec. 3, 2009

(54) WIRELESS DELIVERY OF POWER TO A MOBILE POWERED DEVICE

(75) Inventors: Nigel P. Cook, El Cajon, CA (US);
David F. Alfred, Rancho Santa Fe, CA (US)

Correspondence Address:
Law Office of Scott C. Harris Inc
PO Box 1389
Rancho Santa Fe, CA 92067 (US)

(73) Assignee: NIGELPOWER, LLC, San Diego, CA (US)

(21) Appl. No.: 12/128,572

(22) Filed: May 28, 2008

Publication Classification
(51) Int. Cl. G06Q 30/00 (2006.01)
(52) U.S. Cl. 705/412

(57) ABSTRACT
A system that automatically detects the presence of an automobile that can operate wirelessly to recharge the battery therein, and detects account information associated with that automobile. When the account information is properly detected, the amount of power delivered is metered, and thereafter the power used by a user is Bill to the user at a markup based on that distributed by the distribution company.

200
DETECT ID

205
ID HAVE ACCOUNT ?

No
DO NOT CHANGE VEHICLE

Yes
210
METER THE POWER AS DELIVERED
ADD TO BILL

InductEV, Inc.
Exhibit 1007
Page 001

(10) Pub. No.: US 2009/0299918 A1
(43) Pub. Date: Dec. 3, 2009

(22) Filed: May 28, 2008

(57) ABSTRACT

A system that automatically detects the presence of an automobile that can operate wirelessly to recharge the battery therein, and detects account information associated with that automobile. When the account information is properly detected, the amount of power delivered is metered, and thereafter the power used by a user is Bill to the user at a markup based on that distributed by the distribution company.

Bennett (Ex. 1005)

(19) United States
(12) Patent Application Publication
Bennett

(10) Pub. No.: US 2010/0036773 A1
(43) Pub. Date: Feb. 11, 2010

(54) INTEGRATED WIRELESS RESONANT POWER CHARGING AND COMMUNICATION CHANNEL

(75) Inventor: James D. Bennett, Hrozneta (CZ)

Correspondence Address:
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P.O. BOX 160727
AUSTIN, TX 78716-0727 (US)

(73) Assignee: Broadcom Corporation, Irvine, CA (US)

(21) Appl. No.: 12/241,245

(22) Filed: Sep. 30, 2008

Related U.S. Application Data
(60) Provisional application No. 61/086,380, filed on Aug. 5, 2008.

Publication Classification
(51) Int. Cl. H02J 17/00 (2006.01) H04L 9/32 (2006.01) G01R 21/133 (2006.01) H02J 7/00 (2006.01)
(52) U.S. Cl. 705/67; 307/104; 705/412; 320/137

(57) ABSTRACT
A power delivery system wirelessly deliver electric power and a communication signal to a target device. The power delivery system includes a power transmitting unit having a power source operable to source alternating current power and a sending resonant coupling component operable to couple the alternating current power to a coil for wireless power transmission by a non-radiated magnetic field at a target resonant frequency. The power transmitting unit is capable of dynamically tuning the wireless power transmission to the target resonant frequency wherein the target resonant frequency is specified dynamically. A communication module couples to the power transmitting unit and is operable to couple the communication signal to the non-radiated magnetic field. Operations may include target device authentication, target resonant frequency information communication, billing, and device management.

InductEV, Inc.
Exhibit 1005
Page 001

(10) Pub. No.: US 2010/0036773 A1
(43) Pub. Date: Feb. 11, 2010

(22) Filed: Sep. 30, 2008

Related U.S. Application Data

(60) Provisional application No. 61/086,380, filed on Aug. 5, 2008.

(57) ABSTRACT

A power delivery system wirelessly deliver electric power and a communication signal to a target device. The power delivery system includes a power transmitting unit having a power source operable to source alternating current power and a sending resonant coupling component operable to couple the alternating current power to a coil for wireless power transmission by a non-radiated magnetic field at a target resonant frequency. The power transmitting unit is capable of dynamically tuning the wireless power transmission to the target resonant frequency wherein the target resonant frequency is specified dynamically. A communication module couples to the power transmitting unit and is operable to couple the communication signal to the non-radiated magnetic field. Operations may include target device authentication, target resonant frequency information communication, billing, and device management.

No Dispute: Combination Discloses Claim 13 Preamble

13. A vehicle wireless power system, comprising:

- 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;
 - a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
 - a load configured to power the drive system of the vehicle using electrical power;
 - a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
- 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
- an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

[0009] FIG. 1 illustrates a block diagram of a system according to the present application. An **electrically powered automobile** includes at least one battery 102 which may operate at least one electronic mobile system of the automobile.

* * *

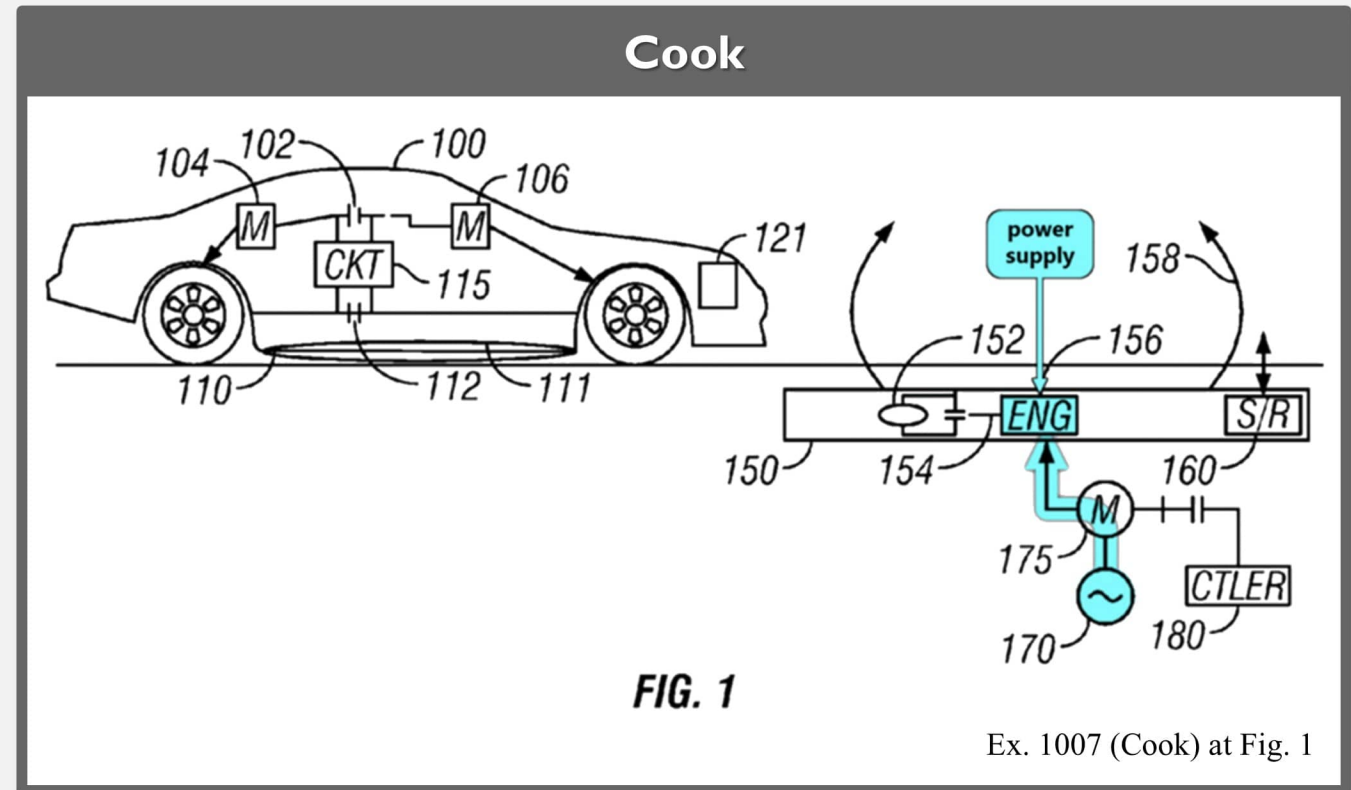
[0012] In the embodiment, the battery is automatically charged whenever the antenna 112 comes into range of a **wireless charging circuit** of appropriate type, e.g. the right frequency. A number of different places, such as parking lots,

Ex. 1007 (Cook) at ¶¶0009, 0012

No Dispute: Combination Discloses Limitation 13[a]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

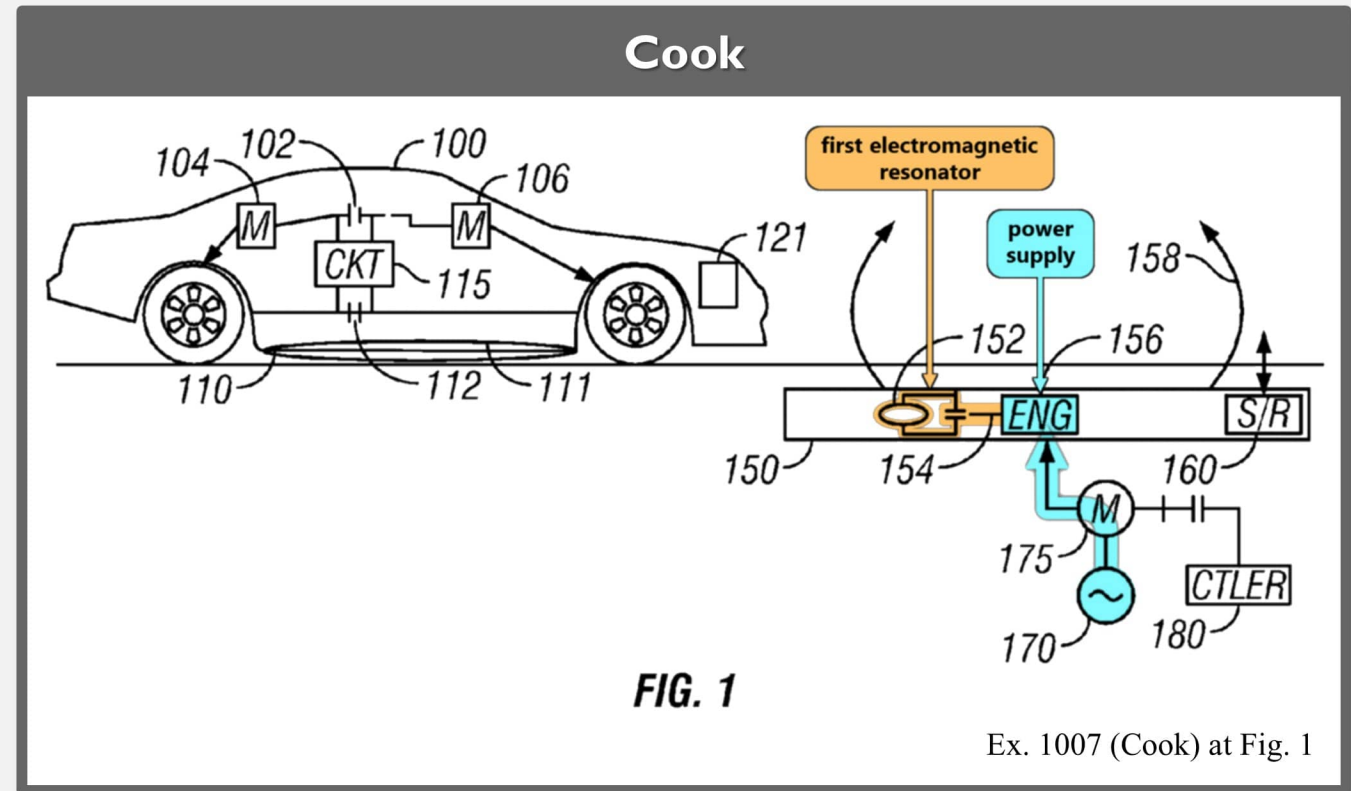
Ex. 1001 ('687 Patent), Claim 13



No Dispute: Combination Discloses Limitation 13(b)(i)

13. A vehicle wireless power system, comprising:
 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;
 a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
 a load configured to power the drive system of the vehicle using electrical power;
 a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
 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
 an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13



Ex. 1007 (Cook) at Fig. 1

No Dispute: Combination Discloses Limitation 13[b][ii]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

[0013] Charger 150 may include a coil 152, a capacitor 154, and a charging circuit 156 that produces signal of appropriate frequency for magnetic transmission. Charger 150 may produce a magnetic field shown generally as 158. 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.

Ex. 1007 (Cook) at ¶0013

Cook-086

other shapes. A capacitor 302 is used with the loop inductive resonator to bring the loop antenna to resonance. The capacitor value may be obtained from 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.

Ex. 1021 (Cook-086) at 5:12-22

No Dispute: Combination Discloses Limitation 13[b][iii]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

6. A method as in claim 1, wherein said wirelessly supplying power comprises applying power using a magnetically resonant antenna which includes an inductor and a capacitor, and has a Q value greater than 1000.

Ex. 1007 (Cook) at Claim 6

Petitioner's Expert

141. A POSA would have understood that Cook's resonator has an intrinsic loss rate Γ_1 . First, as I explained in the Overview of the '687 Patent Section, a POSA would have understood generally that resonant frequencies and quality factors are properties of electromagnetic resonators and that the intrinsic loss rate can be derived from the relationship recited in claim 1:

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

Ex. 1003 (Allen Decl.) at ¶141

No Dispute: Combination Discloses Limitation 13[b][iv]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

6. A method as in claim 1, wherein said wirelessly supplying power comprises applying power using a magnetically resonant antenna which includes an inductor and a capacitor, and has a Q value greater than 1000.

Ex. 1007 (Cook) at Claim 6

Cook-086

The quality factor can also be used to define the bandwidth (like in Equation 2-1)

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

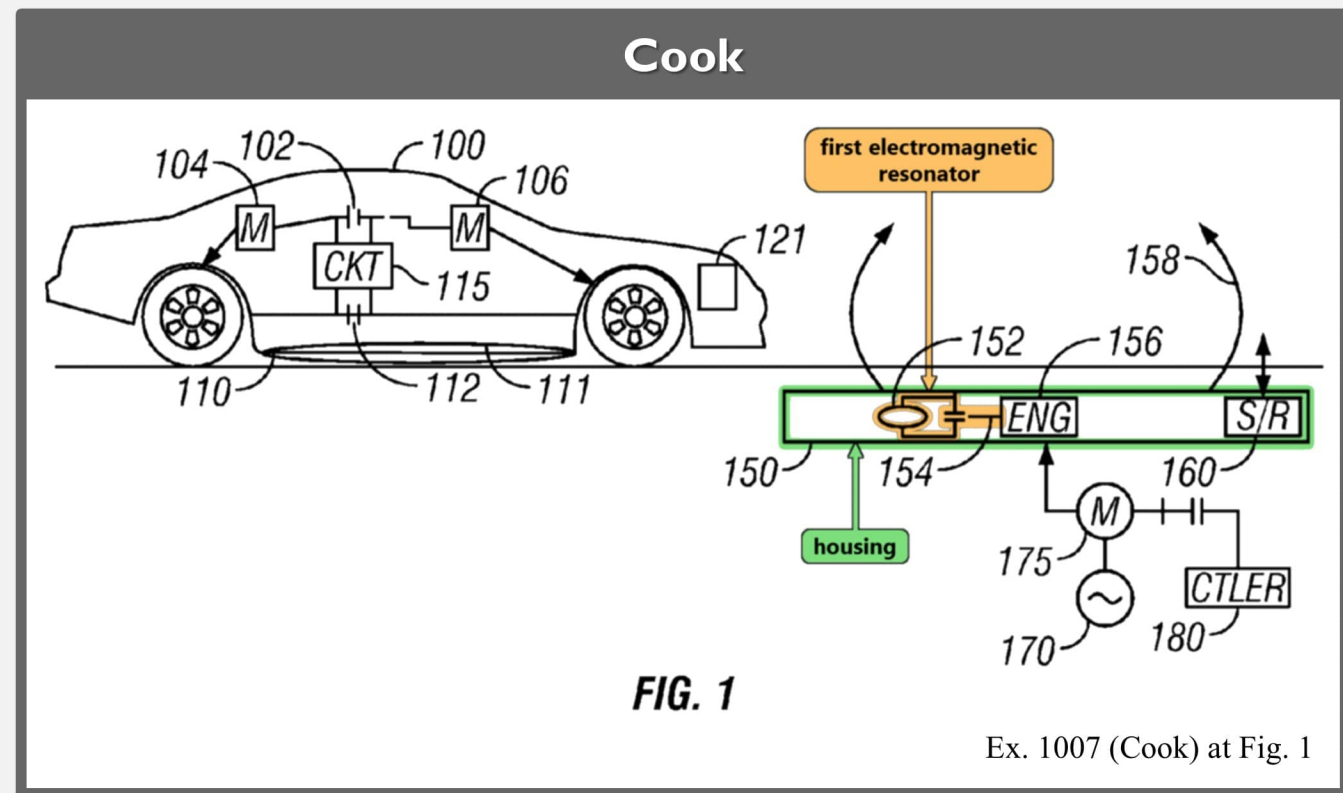
Equation 2-8

Ex. 1021 (Cook-086) at 13:1-5

No Dispute: Combination Discloses Limitation 13[b][v]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

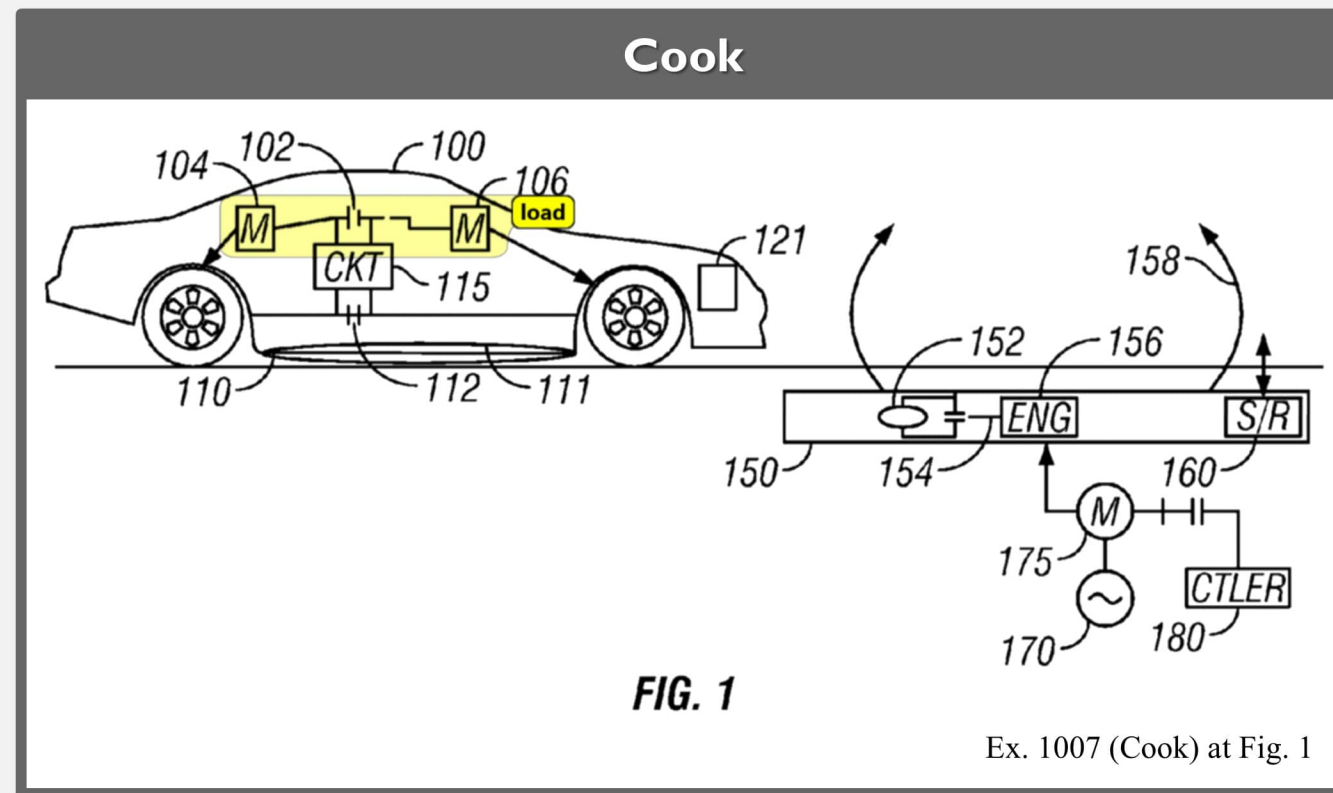
Ex. 1001 ('687 Patent), Claim 13



No Dispute: Combination Discloses Limitation 13[c]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

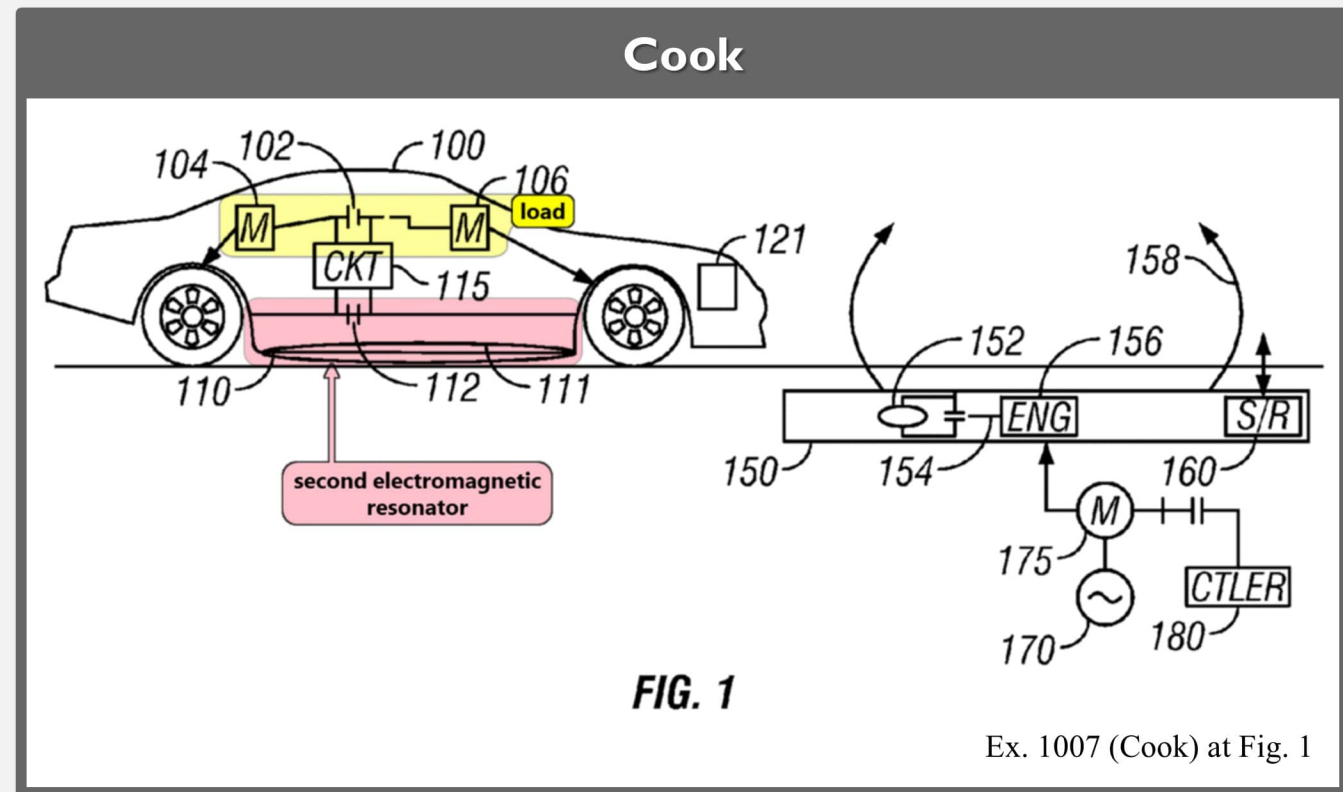
Ex. 1001 ('687 Patent), Claim 13



No Dispute: Combination Discloses Limitation 13[d][i]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13



Ex. 1007 (Cook) at Fig. 1

No Dispute: Combination Discloses Limitation I 3[d][ii]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

[0011] In the embodiment, the automobile also includes at least one magnetic resonant antenna shown as 110 formed from an inductive loop 111 in parallel with a capacitor 112.

Ex. 1007 (Cook) at ¶0011

Cook-086

other shapes. A capacitor 302 is used with the loop inductive resonator to bring the loop antenna to resonance. The capacitor value may be obtained from 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.

Ex. 1021 (Cook-086) at 5:12-22

No Dispute: Combination Discloses Limitation 13[d][iii]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

6. A method as in claim 1, wherein said wirelessly supplying power comprises applying power using a magnetically resonant antenna which includes an inductor and a capacitor, and has a Q value greater than 1000.

Ex. 1007 (Cook) at Claim 6

Petitioner's Expert

141. A POSA would have understood that Cook's resonator has an intrinsic loss rate Γ_1 . First, as I explained in the Overview of the '687 Patent Section, a POSA would have understood generally that resonant frequencies and quality factors are properties of electromagnetic resonators and that the intrinsic loss rate can be derived from the relationship recited in claim 1:

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

Ex. 1003 (Allen Decl.) at ¶141

No Dispute: Combination Discloses Limitation I 3[d][iii]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

6. A method as in claim 1, wherein said wirelessly supplying power comprises applying power using a magnetically resonant antenna which includes an inductor and a capacitor, and has a Q value greater than 1000.

Ex. 1007 (Cook) at Claim 6

Cook-086

The quality factor can also be used to define the bandwidth (like in Equation 2-1)

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

Equation 2-8

Ex. 1021 (Cook-086) at 13:1-5

No Dispute: Combination Discloses Limitation 13[e]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13

Cook

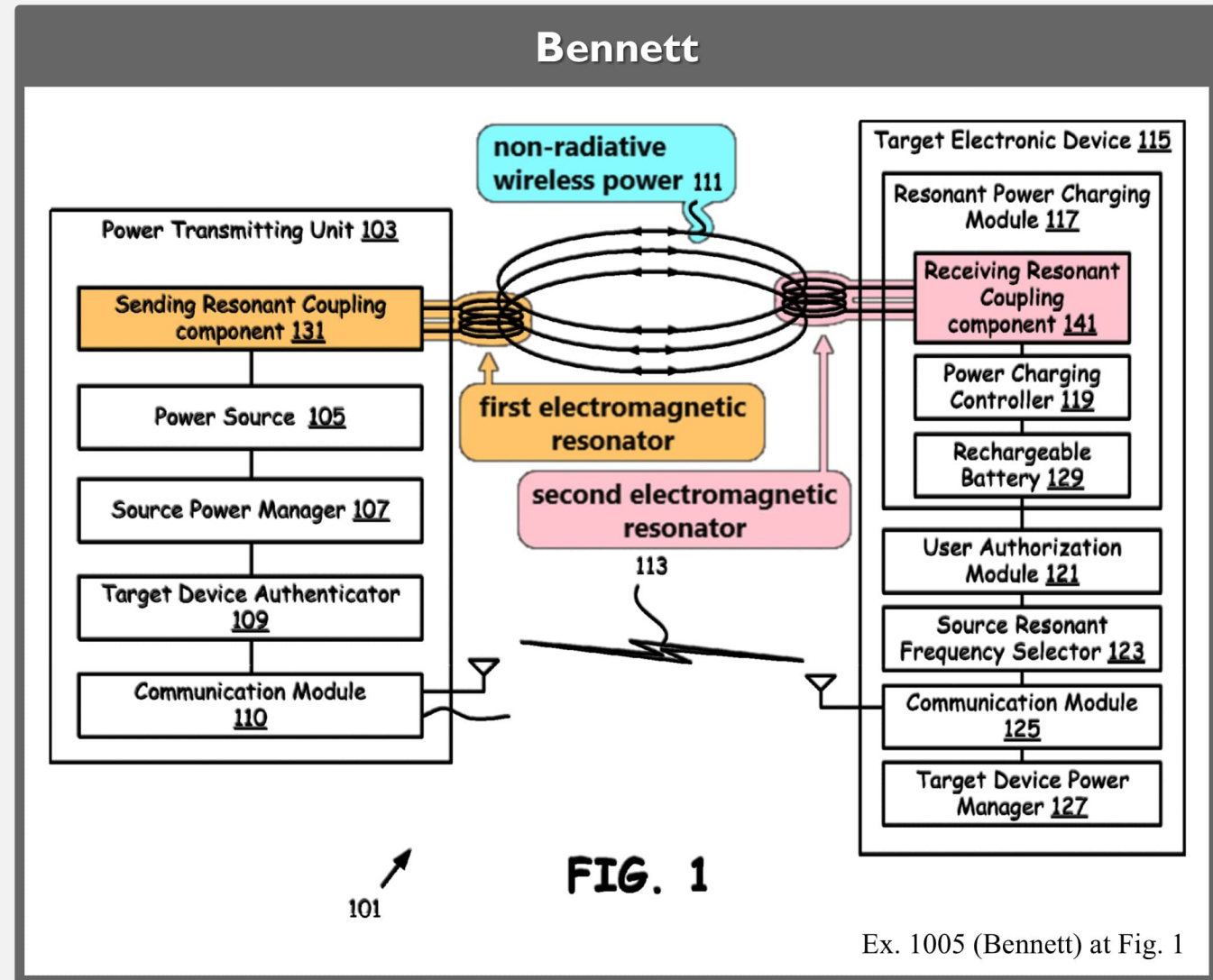
[0013] Charger 150 may include a coil 152, a capacitor 154, and a charging circuit 156 that produces signal of appropriate frequency for magnetic transmission. Charger 150 may produce a magnetic field shown generally as 158. Whenever an appropriate vehicle comes into range of the magnetic field 158, it may receive power from that magnetic field, and hence be charged thereby.

Ex. 1007 (Cook) at ¶0013

No Dispute: Combination Discloses Limitation 13[e]

13. A vehicle wireless power system, comprising:
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;
a first electromagnetic resonator coupled to the power supply and having a mode with a resonant frequency ω_1 , an intrinsic loss rate Γ_1 , and a first Q-factor $Q_1 = \omega_1 / 2\Gamma_1$, the first electromagnetic resonator housed in a housing configured to be disposed in proximity to the vehicle;
a load configured to power the drive system of the vehicle using electrical power;
a second electromagnetic resonator adapted to be housed upon the vehicle and configured to be coupled to the load, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$,
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
an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13



Ex. 1005 (Bennett) at Fig. 1

Combination Renders Claim I Obvious

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

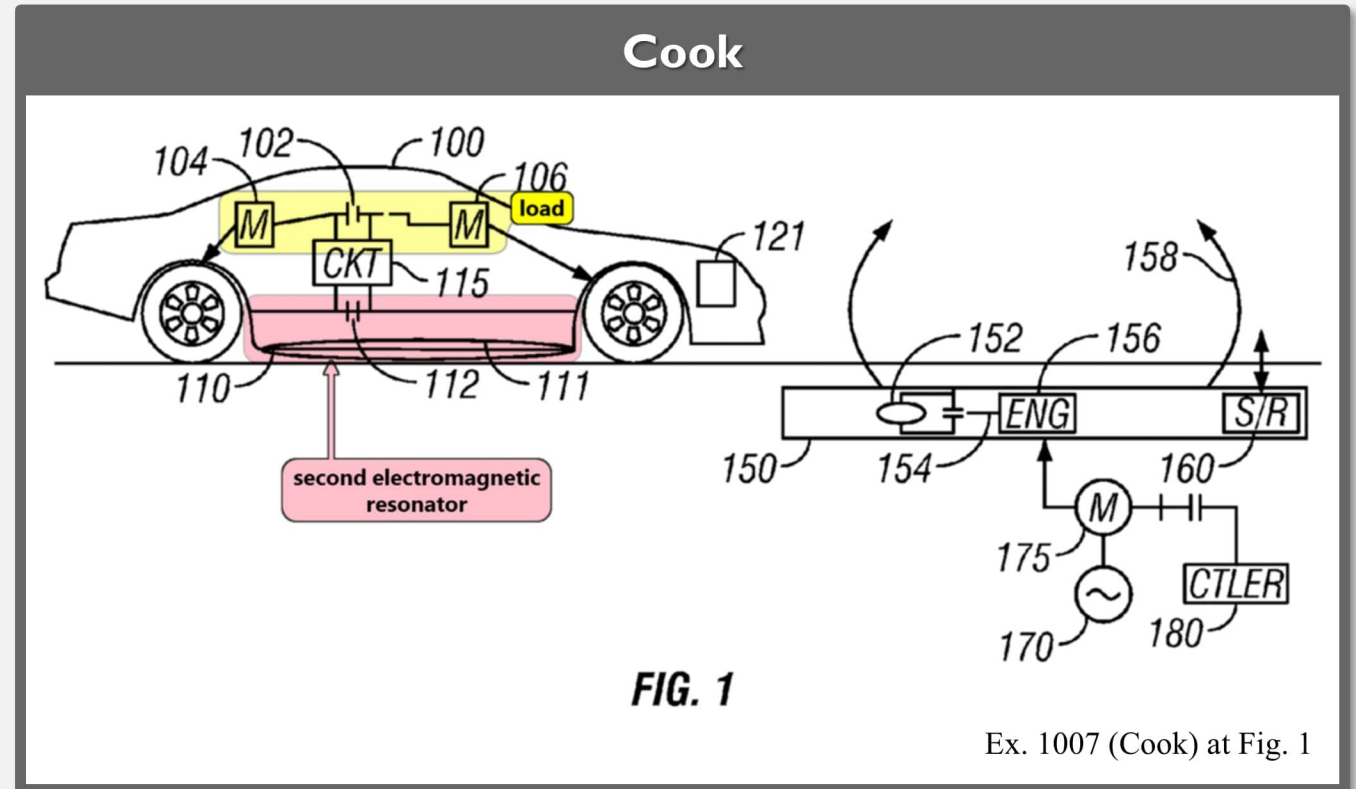
a load configured to power the drive system of a vehicle using electrical power;

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

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

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

Ex. 1001 ('687 Patent), Claim 13



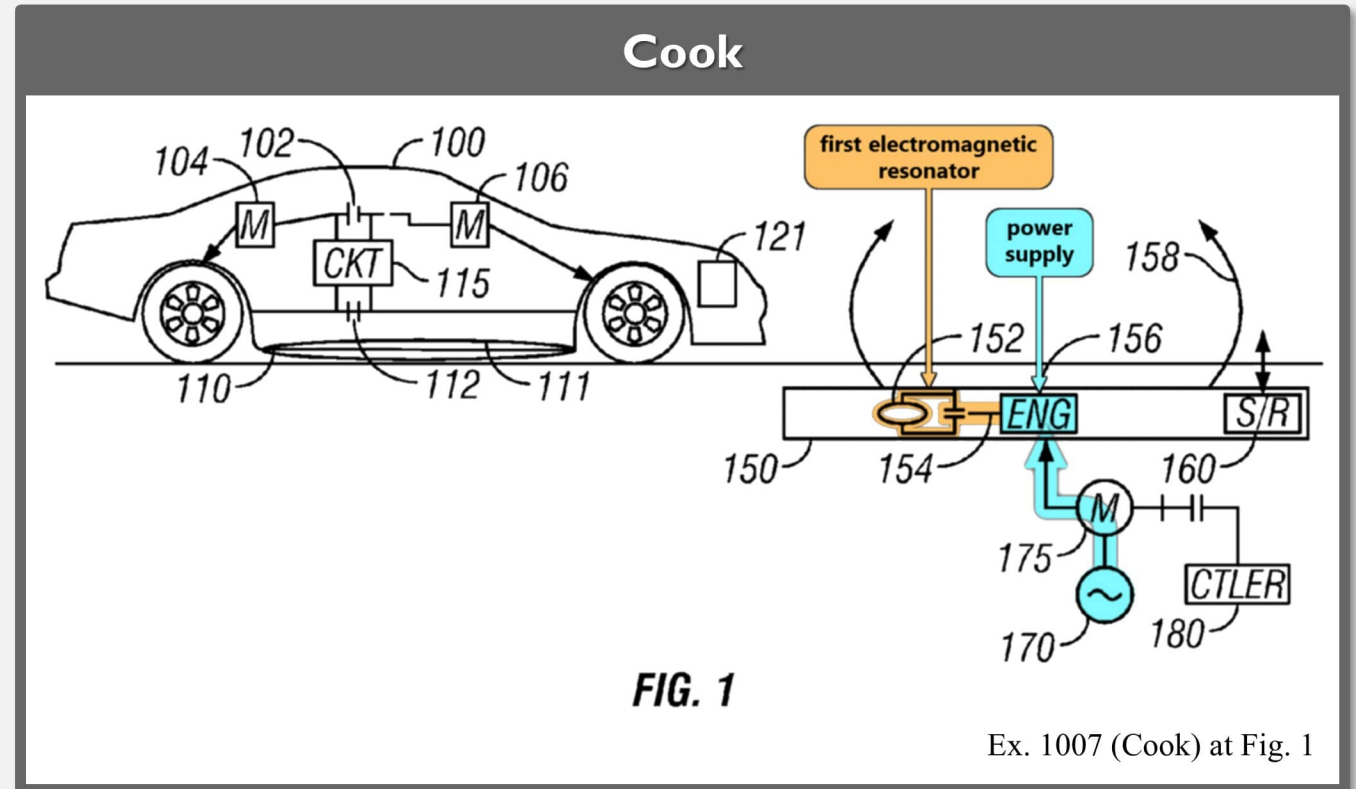
Combination Renders Claim 7 Obvious

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

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

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, the second electromagnetic resonator having a mode with a resonant frequency ω_2 , an intrinsic loss rate Γ_2 , and a second Q-factor $Q_2 = \omega_2 / 2\Gamma_2$; and an authorization facility to confirm compatibility of the resonators and provide authorization for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 13



No Dispute: Combination Renders Obvious “public key infrastructure” (Claims 2, 8, 14)

2. The wireless receiver of claim 1, wherein the authorization facility uses public key infrastructure.

Ex. 1001 ('687 Patent), Claim 2

8. The power source of claim 7, wherein the authorization facility uses public key infrastructure.

Ex. 1001 ('687 Patent), Claim 8

14. The wireless power system of claim 13, wherein the authorization facility uses public key infrastructure.

Ex. 1001 ('687 Patent), Claim 14

Bennett

[0060] FIG. 4 is a block diagram illustrating the magnetic resonant power charging circuitry 205 of FIG. 2 that is used to transmit power to multiple target devices located in a current direction of a non-radiated magnetic field/beam. Each of the target devices use randomly generated unique token for an authenticity check in accordance with one embodiment of the present invention. The magnetic resonant power charging

* * *

[0062] During configuration of a target device for power delivery, a generated token is communicated to the target device 211 employing encryption for security, confidentiality and non-repudiation. The decryption of the generated token at the target device requires a key that is communicated out-of-band or generated using a key generation technique. For

Ex. 1005 (Bennett) at ¶¶0060, 0062

Cook

[0017] Another embodiment may recognize that the detection of an ID could be cloned, and use encryption techniques to verify the ID. For example, one embodiment might use a real-time token type system. The vehicle has a real time clock which is used to display time. The time is encrypted by the vehicle's private encryption key. The controller has a decryption key that can decrypt the encrypted message. The control-

Ex. 1007 (Cook) at ¶0011

No Dispute: Combination Renders Obvious “secure communication channel” (Claims 3, 9, 15)

3. The wireless receiver of claim 1, wherein the authorization facility uses a **secure communication channel**.

Ex. 1001 ('687 Patent), Claim 3

9. The power source of claim 7, wherein the authorization facility uses a **secure communication channel**.

Ex. 1001 ('687 Patent), Claim 9

15. The wireless power system of claim 13, wherein the authorization facility uses a **secure communication channel**.

Ex. 1001 ('687 Patent), Claim 15

Bennett

[0086] The sub-modules of the communication module 817 are the channel acquiring module 819, an RF communication module 821, an analog baseband processing module 823, and the digital processing module 825. The channel acquiring module 819 facilitates the function of acquiring different communication channel as in a mobile phone. The RF communication module 821 performs the function of modulation, demodulation, amplification of RF signal, etc. The analog baseband processing module 823 processes the baseband signal. The digital processing module 825 performs the digital signal processing functionality, which includes **encryption/decryption of the digital data**, etc.

Ex. 1005 (Bennett) at ¶0086

No Dispute: Combination Renders Obvious “secure communication channel” (Claims 3, 9, 15)

4. The wireless receiver of claim 3, wherein the channel is an **in-band** communication channel.

5. The wireless receiver of claim 3, wherein the channel is an **out-of-band** communication channel.

Ex. 1001 ('687 Patent), Claims 4-5

10. The power source of claim 9, wherein the channel is an **in-band** communication channel.

11. The power source of claim 9, wherein the channel is an **out-of-band** communication channel.

Ex. 1001 ('687 Patent), Claims 10-11

16. The wireless power system of claim 15, wherein the channel is an **in-band** communication channel.

17. The wireless power system of claim 15, wherein the channel is an **out-of-band** communication channel.

Ex. 1001 ('687 Patent), Claim 16-17

Bennett

control signal channel. In one embodiment of the present invention communicating the power and a control signal are conducted employing the same frequency, or in other words, on the same channel, i.e. the wireless field 111. 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. For e.g.

Ex. 1005 (Bennett) at ¶0031

No Dispute: Combination Renders Obvious A “safety condition” (Claims 6, 12, 18)

6. The wireless receiver of claim 1, wherein the authorization facility further determines a **safety condition** for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 6

12. The power source of claim 7, wherein the authorization facility further determines a **safety condition** for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 12

18. The wireless power system of claim 13, wherein the authorization facility further determines a **safety condition** for initiation of transfer of power.

Ex. 1001 ('687 Patent), Claim 18

Bennett

[0040] In general, the battery charge (power in the battery) of the rechargeable battery 129 has to be replenished before the battery voltage falls below a threshold limit or before its power level falls below an acceptable level. **If the battery voltage falls below a threshold limit, the critical part of the target electronic device 115 is likely to lose power supply, because the battery fails to operate. This situation is avoided with constant monitoring of battery levels and automatic triggering of recharge operations.** Thus battery recharging and voltage restoration is automated and does not require any human intervention charge the rechargeable battery 129. The target device power manager 127 facilitates battery level monitoring and automatic recharge triggering.

Ex. 1005 (Bennett) at ¶0040

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that on this 15th day of November, 2024, a true and correct copy of the foregoing **Petitioner's Demonstratives** was served by electronic mail on Patent Owner's lead and backup counsel at the following email addresses:

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