

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INDUCTEV, INC.
Petitioner,

v.

WITRICITY CORPORATION,
Patent Owner.

Case IPR2024-00105
Patent 10,027,184

PATENT OWNER'S RESPONSE

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<i>Phillips v. AWH Corp.</i> , 415 F.3d 1303, 1312-14 (Fed. Cir. 2005) (en banc)	12

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EXHIBIT LIST

Ex.	Description
2001	U.S. Patent No. 9,442,172
2002	File History of U.S. Patent No. 9,442,172
2003	U.S. Patent Application Publication No. 2008/0211320 (“Cook-320”)
2004	U.S. Provisional Patent Application No. 61/102,602 (“Fells-602 Provisional”)
2005	Declaration of Mark Horenstein, Ph.D. (“Horenstein Decl.”)
2006	Curriculum Vitae of Mark Horenstein, Ph.D.
2007	Excerpts from Carstens, ELECTRICAL SENSORS AND TRANSDUCERS (1993) (“Carstens”)
2008	Excerpts from Staugaard, 8-BIT MICROPROCESSOR INTERFACING AND APPLICATIONS (192) (“Staugaard”)
2009	Excerpts from Petruzella, PROGRAMMABLE LOGIC CONTROLLERS (4th ed. 2011) (“Petruzella”)
2010	Excerpts from Rabiee, PROGRAMMABLE LOGIC CONTROLLERS: HARDWARE AND PROGRAMMING (2nd ed. 2009) (“Rabiee”)
2011	Excerpts from Carr, SENSORS AND CIRCUITS (1993) (“Carr”)
2012	Excerpts from McGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS (6th ed. 2003) (“McGraw-Hill Dictionary-2”)
2013	Excerpts from Wiley, ELECTRICAL AND ELECTRONICS ENGINEERING DICTIONARY (2004) (“Wiley Dictionary-2”)
2014	Excerpts from MERRIAM-WEBSTER’S COLLEGIATE® DICTIONARY (10th ed. 2000) (“Merriam-Webster Dictionary”)

2015	Zoom Deposition of Mark Allen, Ph.D. (“Allen Depo.”)
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I. INTRODUCTION

In its Petition (Paper 2, “Pet.”) for *inter partes* review of U.S. Pat. No. 10,027,184 (Ex. 1001, “the ’184 patent”), Petitioner asserts that claims 1-13 and 16 (“the challenged claims”) are unpatentable under pre-Leahy-Smith America Invents Act (pre-AIA) 35 U.S.C. § 103(a) as being obvious over the prior art, including U.S. Pat. Pub. No. 2010/0084918 (Ex. 1005, “Fells”), U.S. Pat. Pub. No. 2009/0299918 (Ex. 1006, “Cook”), U.S. Pat. No. 6,075,433 (Ex. 1007, “Ono”), and Chwei-Sen Wang, *Design Considerations for Inductively Coupled Power Transfer Systems* (2004) (Ph.D. thesis, University of Auckland) (Ex. 1008, “Wang Thesis”)

In particular, Petitioner asserts that claims 1, 8 and 11 are unpatentable as being obvious over Fells (Ground 1). Petitioner asserts that claims 2-7, 9, 10 and 16 are unpatentable as being obvious over Fells and Cook (Ground 2). Petitioner also asserts that claim 12 is unpatentable as being obvious over Fells alone or with Ono (Ground 3), and Petitioner asserts that claim 13 is unpatentable as being obvious over Fells and Cook and/or Wang Thesis (Ground 4). However, Petitioner fails to demonstrate that the claims are unpatentable as being obvious over the prior art.

First, Ground 1 fails because Fells does not disclose “wherein the at least one magnetic field sensor is positioned within the magnetic field of the wireless energy transfer system.” The Petition alleges that Fells discloses a Hall Effect

sensor and an inductive proximity sensor that each correspond to the recited magnetic field sensor. But an inductive proximity sensor is not a magnetic field sensor, and nowhere does Fells disclose that its Hall Effect sensor is positioned within the magnetic field of its wireless power supply. Fells' Hall Effect sensor is in fact not responsive to the magnetic field of the wireless energy transfer system. And Fells' stated goal of detecting foreign objects in the "vicinity" of the wireless power supply does not require that the Hall Effect sensor is positioned within the magnetic field of the wireless energy transfer system.

Petitioner also fails to establish obviousness of "wherein the at least one magnetic field sensor is positioned within the magnetic field of the wireless energy transfer system." A POSA would understand that a Hall Effect sensor positioned within the magnetic field of the wireless energy transfer system would itself become a foreign object, which Fells seeks to detect and avoid. A POSA would instead position the Hall Effect sensor outside (but in proximity) of the magnetic field which would satisfy Fells' purpose of detecting a foreign object in "vicinity" of the wireless power supply, and avoid the Hall Effect sensor becoming a foreign object.

Second, Ground 2 fails as to dependent claims 2-7, 9 and 10 because Cook does not cure the deficiencies of Fells with respect to claim 1. Similarly, Ground 3

and Ground 4 fail because Ono, Cook and/or Wang do not cure the deficiencies of Fells.

Third, Ground 2 also fails as to claims 4-6 because Petitioner fails to establish obviousness of “wherein the foreign object debris detection system is configured to perform a health and/or status check of the wireless energy transfer source before the vehicle is positioned over the source resonator.” The Petition alleges that Fells discloses a sense circuit calibration and energy storage element check that each correspond to the recited health and/or status check. But Fells does not disclose calibration of its sense circuit when implemented by a proximity detector (Hall Effect sensor), and a check of the energy level in the energy storage element does not relate to health and/or status of a source resonator.

Ground 2 fails as to claim 16 because Fells and Cook does not disclose “performing a health and/or status check of a source resonator of the wireless energy transfer system.” Again, the Petition relies on Fells disclosing a sense circuit calibration and energy storage element check. But calibration of Fells’ sense circuit does not indicate the health and/or status of a source resonator. Likewise, a check of the energy level in the energy storage element does not relate to health and/or status of a source resonator.

Fourth, Ground 3 also fails because Fells and Ono does not disclose or render obvious “the foreign object debris detection system is integrated into the enclosure.” The Petition equates “integrated into” the enclosure with being “housed” in the enclosure, but in the context of the claim, “integrated into” requires more. In context, “integrated into” means that the foreign object debris detection system is unified with the enclosure to form a functioning or unified whole, which Fells and Ono do not disclose.

For at least these reasons, the Board should enter a final decision affirming the validity of the challenged claims.

II. STATEMENT OF MATERIAL FACTS IN DISPUTE

Petitioner did not submit a statement of material facts in its IPR petition. As such, no response is due pursuant to 37 C.F.R. §42.23(a), and no facts are admitted.

III. STATEMENT OF RELIEF REQUESTED

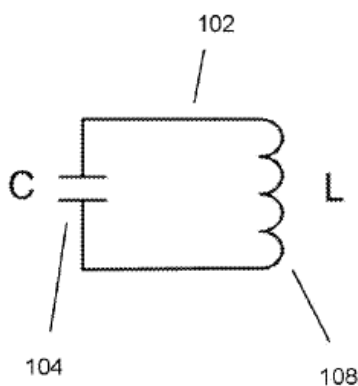
Patent Owner respectfully requests that the Board confirm patentability of the challenged claims.

IV. OVERVIEW OF THE '184 PATENT AND ITS PROSECUTION HISTORY

The '184 patent issued on July 17, 2018, from an application filed on June 1, 2016, and claiming priority from U.S. Patent Application No. 13/608,956, now the '172 Patent (Ex. 2001), which claims priority to a provisional patent application

filed on September 9, 2011. The '184 patent describes a wireless energy transfer system that includes a foreign object debris (FOD) detection system. '184 Patent Abstract.

As described in the '184 patent, a wireless power transfer system may rely on an oscillating magnetic field between coupled resonators. *Id.* 1:36-38. In this regard, as described in an earlier pre-grant publication (Ex. 1013, "Kurs") incorporated by reference into the '184 patent, a resonator is a system that may store energy that oscillates in at least two different forms. U.S. Pat. Pub. No. 2010/010909445 (Ex. 1013, "Kurs") ¶ 85; *see also* '184 Patent 1:21-35 (incorporating Kurs by reference). As illustrated in FIG. 6(a) of Kurs (reproduced below), a resonator may include an inductive element (inductor) having an inductance L , and a capacitive element (capacitor) having a capacitance C . Kurs ¶ 135.



The resonator will oscillate between an electric field energy stored in the capacitor and a magnetic field energy stored in the capacitor.. *Id.* In this regard, as the capacitor discharges, the electric field energy stored in the capacitor is transferred into magnetic field energy stored in the inductor, which is then transferred back into electric field energy stored in the capacitor, and so forth. *Id.*

FOD in the vicinity of a wireless power transfer system may be benign or it may interact with the oscillating magnetic field in a way that may perturb, block or reduce the magnetic field. '184 Patent 1:54-57, 1:67 – 2:5. Examples of FOD that may be benign include “dirt, sand, leaves, twigs, snow, grease, oil, water, and other substances that may not interact significantly with a low-frequency magnetic field.” *Id.* 1:57-60. Examples of other FOD that may interact with the magnetic field include metallic objects that the magnetic field can cause to heat up, such as “tools, coils, metal pieces, soda cans, steel wool, food (chewing gum, burgers, etc.) wrappers, cigarette packs with metal foil, and the like.” *Id.* 1:45-48, 2:5-13.

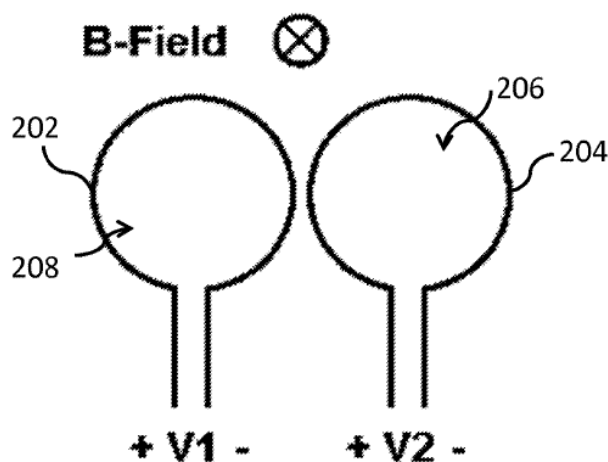
In view of the foregoing, the '184 patent provides techniques for mitigating FOD risks to a wireless energy transfer system. *Id.* 1:17-19, 3:24-26. These techniques include passive mitigation techniques to keep FOD away, and active mitigation techniques to detect and react to the presence of FOD. *Id.* 3:26-31.

Some FOD (e.g., metallic objects) of sufficient size, extent and/or material composition may perturb characteristics of the resonators or the energy transfer. *Id.* 4:39-50. “A FOD object may change the impedance of a resonator for example.” *Id.* 4:50-51. These perturbations and thereby the FOD may be detected by measuring electrical parameters of the resonators and/or characteristics of the energy transfer. *Id.* 4:51-59.

Other FOD may only weakly interact with the magnetic field and perturb the magnetic field between the resonators, and may not be sufficiently detectable by monitoring the electrical parameters of the resonators and/or characteristics of the energy transfer. *Id.* 4:60 – 5:12, 5:25-27. These FOD may instead be detected by “sensors for measuring small changes in the magnetic field in the proximity of the FOD objects.” ’184 Patent 5:25-38; Horenstein Decl. ¶¶ 38-41.

FIG. 2 (reproduced below) illustrates a FOD sensor (magnetic field sensor) that may be realized by two wire loops 202, 204. ’184 Patent 5:39-41. The loops may be placed in the magnetic field generated by the wireless energy transfer system such that the magnetic field passes through the loops. ’184 Patent 2:24-26, 43-45; Horenstein Decl. ¶¶ 38-44. The loops develop respective voltages V1, V2 proportional to the amount of magnetic flux that threads the insides 206, 208 of the loops, and the difference between the voltages is (to the first order) proportional to

the gradient of the magnetic field (B-field) in proximity of the loops. '184 Patent 5:45-49; Horenstein Decl. ¶¶ 43-46.

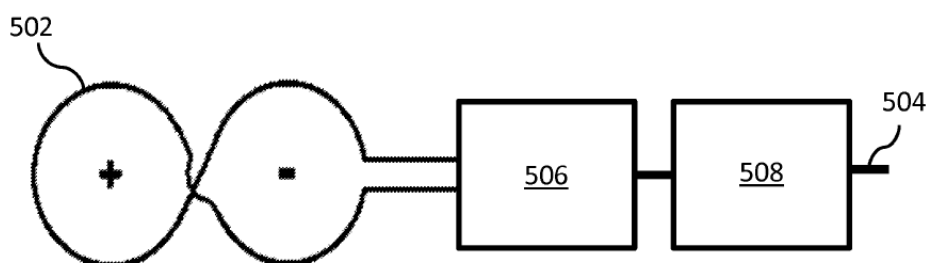


In the absence of FOD, the magnetic field in proximity of the loops may be substantially uniform, and the difference between the voltages may be very small. '184 Patent 5:49-52; Horenstein Decl. ¶ 43. On the other hand, when a FOD is placed so that the FOD partially covers one of the loops but not the other loop, the FOD may deflect and/or absorb some of the magnetic flux, perturbing the magnetic field, and resulting in a larger difference between the voltages. '184 Patent 5:53-63; Horenstein Decl. ¶¶ 44-45.

The '184 patent provides a number of other embodiments in which the FOD sensor may be realized by one loop that is twisted into a number of lobes. '184 Patent FIGS. 3A-3D, 6:43-49. The FOD sensor in these embodiments may output

one voltage measurement that is proportional to the local gradient of the magnetic field. '184 Patent 6:43-47; Horenstein Decl. ¶¶ 42, 47-48.

The '184 patent refers to the two loops as magnetic dipoles, and the multi-lobe configurations as higher-order multipoles (e.g., magnetic quadrupoles, octupoles). '184 Patent 6:60 – 7:7. FIG. 5 (reproduced below) illustrates a FOD detection system in which the FOD sensor is realized by a magnetic quadrupole (loop conductor 502). *Id.* FIG. 3A, 6:60-64. The FOD sensor is shown connected to a readout circuit including, for example, an amplifier 506 and/or analog-to-digital converter 508 to produce a usable output 504. '184 Patent 3:9-10, 8:22-32; Horenstein Decl. ¶ 47.



The '184 patent indicates that FOD detection may be used in many types of wireless energy transfer systems including, for example, a high power (e.g., 3.3+ kW) vehicle charging system. '184 Patent 10:56 – 11:39. In some applications to

vehicle charging, a FOD detection system may operate in a number of possible operation modes:

Low-power diagnostic tests can be performed without the vehicle present to check health and status of the charging station (infrequent) and to check for FOD prior to a vehicle driving over the source (more frequent).

After the vehicle arrives and is positioned over the source module, but prior to high-power charging, the FOD detector may verify that the source is still free of FOD.

During high-power charging the FOD detector can verify that no additional FOD has moved onto the coil.

Id. 11:40-50.

During prosecution of the application that issued as the '184 patent, Patent Owner presented, by preliminary amendment, eighteen claims for examination (i.e., claims 20-37), including independent claims 20 and 35 that correspond to independent claims 1 and 16, respectively. *See* File History for U.S. Patent No. 10,027,184 B2 (Ex. 1002, "'184 FH") 117-122. The USPTO issued a first Office Action in which the Examiner allowed claims 20, 22-31, 33 and 34, objected to claims 21 and 32, and rejected the remaining claims 35 and 36. *Id.* 144-151.

Following an amendment in response to the first Office Action, including an amendment of claim 35, the USPTO issued a Notice of Allowance on March 15,

2018. *Id.* 242-249. In the Notice of Allowance, the Examiner provided the following explanation of the reasons for allowance of independent claims 20 and 35 (now independent claims 1 and 16):

Claims 20-34 are allowed because none of the prior art of record discloses or suggests a foreign object debris detection system comprising: at least one magnetic field sensor; and at least one readout circuit configured to measure one or more electrical parameters of the at least one magnetic field sensor, wherein the at least one magnetic field sensor is positioned within the magnetic field of the wireless energy transfer system, in combination with the remaining claimed features.

Claim 35 is allowed because none of the prior art of record discloses or suggests performing a health and/or status check of the wireless energy transfer source; and verifying that no foreign object debris has moved onto or over the source resonator, prior to positioning the vehicle over the source resonator, in combination with the remaining claimed features.

Id. 247.

V. CLAIM CONSTRUCTION

Petitioner and its declarant, Dr. Mark Allen, contend that the elements of the challenged claims should be construed according to their plain meaning, and do not provide a construction for any terms. *See* Pet. 6; Allen Decl. (Ex. 1003) ¶¶ 62-63.

A. Claim Terms Are to Be Given Ordinary Meaning in Light of the Specification and Prosecution History

In an IPR proceeding, claim terms are given their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the specification and the prosecution history of the patent. *See* 37 C.F.R. § 42.100(b); *Netflix Inc. v. Divx, LLC*, IPR2020-00646, Paper 66 at 11 (Apr. 17, 2024) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc)).

B. Person of Ordinary Skill in the Art

For purposes of this response only, Patent Owner does not disagree with Petitioner’s definition of the level of ordinary skill in the art, which is 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. Patent Owner does not believe that resolution of the Petition depends on the precise definition of the level of ordinary skill.

VI. PETITIONER FAILS TO MEET ITS BURDEN OF SHOWING THE CHALLENGED CLAIMS WOULD HAVE BEEN OBVIOUS

Petitioner’s obviousness analysis fails for multiple reasons. First, Ground 1 related to claims 1, 8 and 11 fails because Fells does not disclose or render obvious positioning the at least one magnetic field sensor within the magnetic field of the wireless energy transfer system. Second, Ground 2 likewise fails as to claims 2-7, 9

and 10, at least as Cook does not cure the deficiencies of Fells. Similarly, Ground 3 (related to claim 12) and Ground 4 (related to claim 13) fail, at least as Ono, Cook and/or Wang do not cure the deficiencies of Fells.

Third, Ground 2 also fails as to claims 4-6 and 16 because Fells and Cook does not disclose or render obvious performing a health and/or status check of the wireless energy transfer source / source resonator. And fourth, Ground 3 also fails because Fells and Ono does not disclose or render obvious the foreign object debris detection system is integrated into an enclosure housing at least a portion of the wireless energy transfer source.

Thus, for at least these reasons, which are explained in detail below, the prior art does not render the challenged claims unpatentable for obviousness.

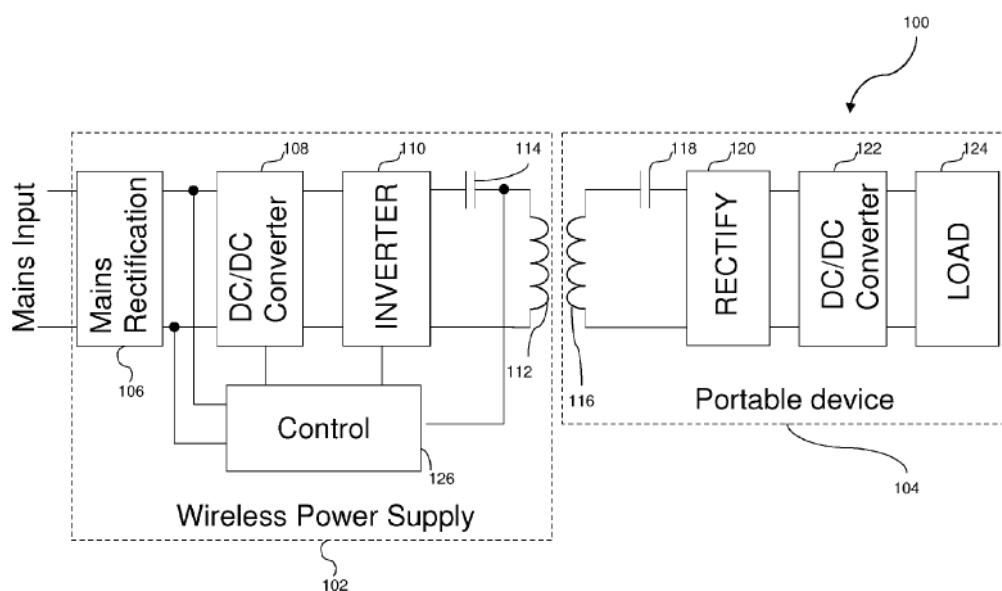
A. Scope and Content of the Prior Art

1. U.S. Pat. Pub. No. 2010/0084918 (“Fells”)

Fells is a U.S. pre-grant publication that published on April 8, 2010. Fells discloses an apparatus and method of reducing power consumption in a wireless power system. Fells ¶ 7; Horenstein Decl. ¶¶ 58-60.

As described by Fells and shown in FIG. 1 (reproduced below), a wireless power system 100 includes a wireless power supply 102 and a portable device 104. Fells ¶ 189. The wireless power supply in particular receives an AC electrical

mains input that is rectified to DC using a mains rectifier 106. *Id.* ¶ 189. The resulting DC voltage is down-converted to a lower voltage using a DC-DC converter 108, and the down-converted DC voltage is used to drive an inverter 110 that generates an AC voltage, which is applied to a tank circuit (including a capacitor 114 and a primary coil 112). Fells ¶ 189; Horenstein Decl. ¶ 61.

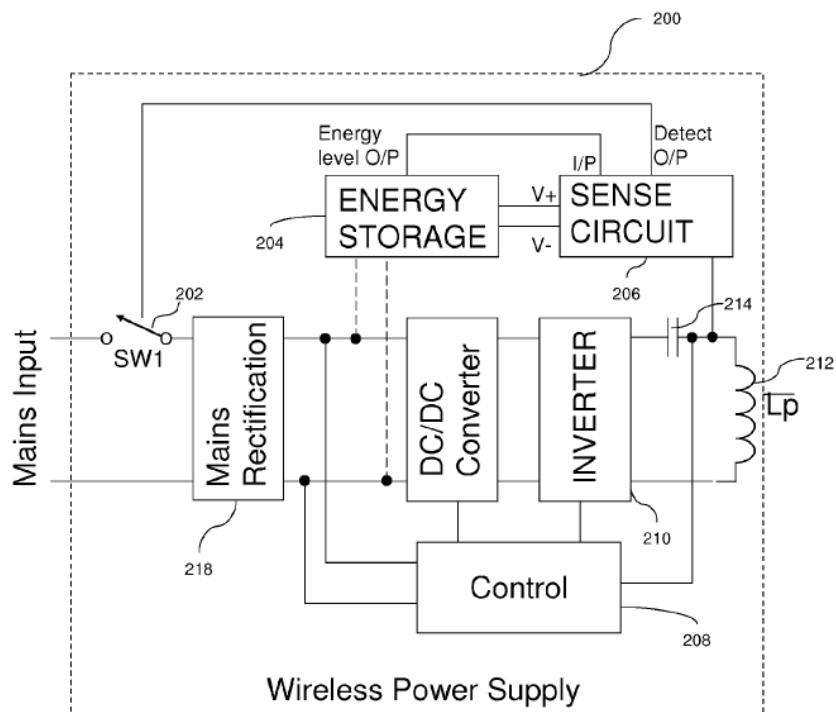


According to Fells, some wireless power supply units have a standby mode in which the wireless power unit periodically transmits pulses of power for a short period to look for a valid portable device. Fells ¶ 2. If the wireless power unit detects a valid portable device and determines there are no foreign objects that would get hot or hinder power transfer in the vicinity, the wireless power unit may come out of standby. *Id.* The periodic transmission of power in these wireless

power units are sufficiently high to power the portable device to communicate back to the wireless power unit, as the portable device's batteries may be fully depleted.

Id. One of the two U.S. provisional patent applications from which Fells claims priority identifies U.K. Pat. Pub. No. GB2414121 (Ex. 1016, "Stevens") as one of these wireless power units. *See* Fells-602 Provisional (Ex. 2004) 1.

In view of the above and other factors that impact low standby power, Fells provides its apparatus and method of reducing power consumption whereby the presence of an object in proximity of the wireless power unit is detected before a pulse of power is transmitted to detect a valid portable device. Fells ¶¶ 8, 9. This is the purpose of Fells. As shown in FIG. 2 (reproduced below), Fells provides a wireless power supply 200 that additionally includes a switch SW1 202, an energy storage element 204 (also referred to as an energy storage unit) and a sense circuit 206. Fells ¶ 191.



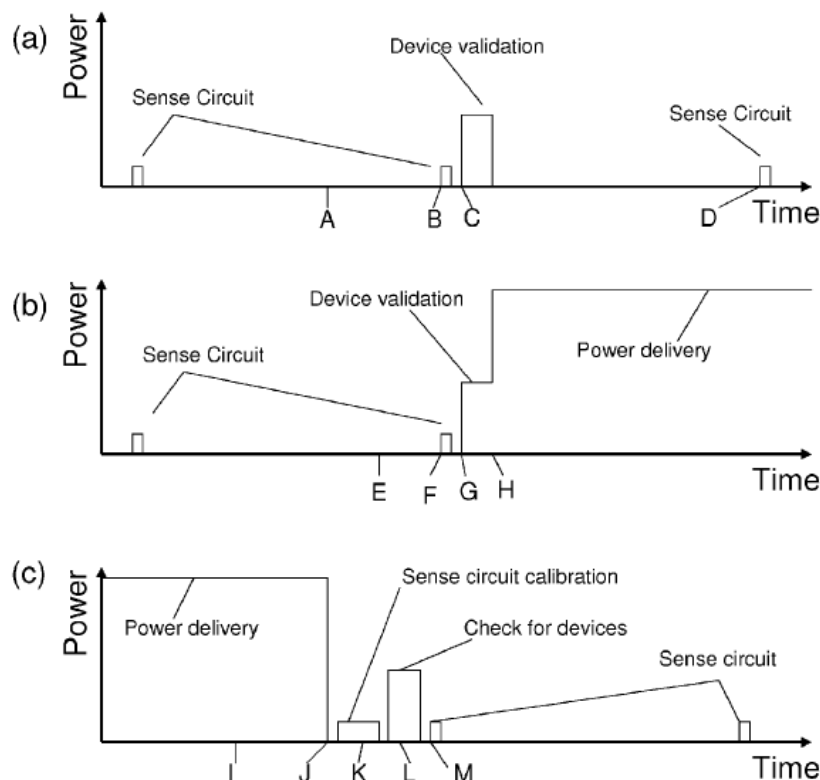
When the wireless power supply is in standby mode (referred to by Fells as ‘Ultra Low Power’ or ULP mode), SW1 is open so that the wireless power supply (tank circuit) does not draw any power from the AC electrical mains input and, therefore, the tank circuit is not producing a magnetic field. Fells ¶ 191; Horenstein Decl. ¶ 62. The sense circuit is instead powered by the energy storage element and detects when an object is placed in (or removed from) proximity of the wireless power supply. Fells ¶ 191; Horenstein Decl. ¶ 62. Notably, the sense circuit “does not determine whether or not the object is a legitimate object, such as a valid secondary device, nor whether or not it desires power.” Fells ¶ 191.

When the sense circuit detects an object, the sense circuit causes SW1 to close, which then allows the wireless power supply to draw power from AC electrical mains input. Fells ¶ 191; Horenstein Decl. ¶ 63. Next, the control unit 208 of the wireless power supply determines whether there is a valid device present that desires power, and whether there is a foreign object present. Fells ¶ 191; Horenstein Decl. ¶ 63. According to Fells, the control unit may determine whether there is a foreign object present using a method according to Stevens in which the wireless power unit periodically transmits pulses of power for a short period to look for a valid portable device. *Id.* ¶¶ 2, 191.

In some embodiments, the sense circuit 206 may be powered by the energy storage element 204, and the energy storage element may be recharged from the main circuit when the AC electrical mains input is switched on. Fells ¶¶ 191, 200, 203, 245, 250. In some of these embodiments, the sense circuit may monitor energy in the energy storage element, and activate the switch SW1 so that the energy storage element may be recharged. Fells ¶¶ 246, 248, 250.

In the embodiment illustrated in FIG. 2, the sense circuit is connected to the primary coil, and detects an object by a change in inductance across the primary coil. Fells FIGS. 2, 3(a)-3(c), 18-21, ¶¶ 193-196, 248-253; Horenstein Decl. ¶ 64. FIGS. 3(a)-3(c) (reproduced below) illustrate power delivered to the primary coil,

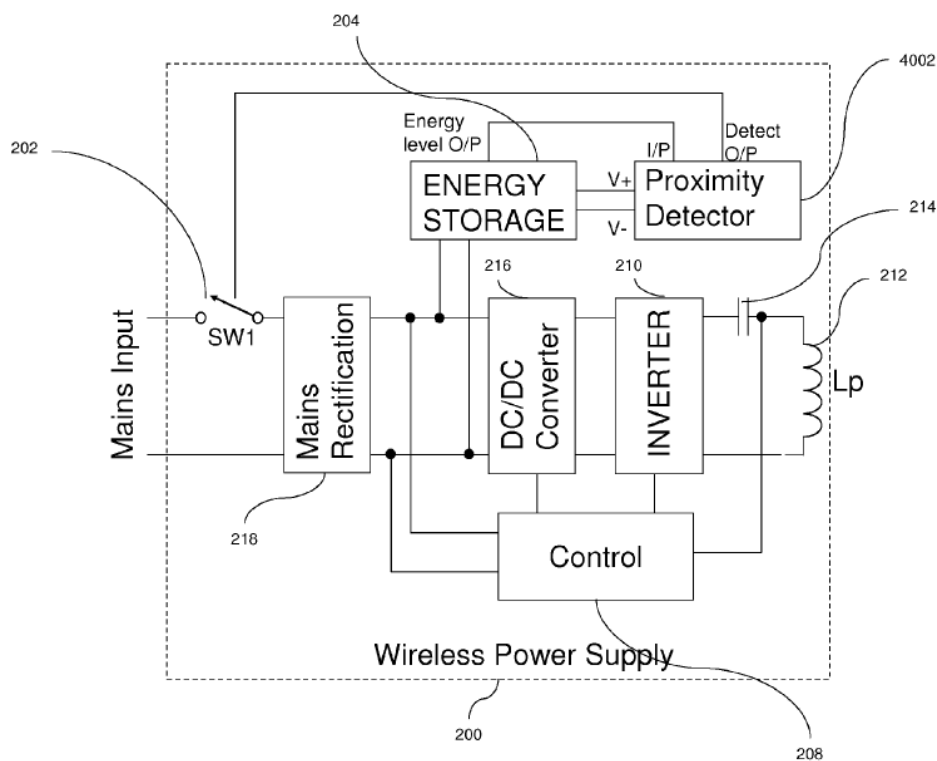
including periodically when the sense circuit delivers power to the primary coil, measures the inductance across the primary coil, and sees if an inductance change has occurred since the previous measurement. Fells ¶¶ 193-196. In this regard, the sense circuit and primary coil simply function as an inductive sensor. Horenstein Decl. ¶ 76; *see also* Carstens (Ex. 2007) 250; Staugaard (Ex. 2008) 8-25; Petruzella (Ex. 2009) 102; Rabiee (Ex. 2010) 75; Carr (Ex. 2011) 191.



Fells in fact discloses a number of embodiments in which the sense circuit detects an object by a change in inductance of the primary coil 212 or a separate coil. *See, e.g.,* Fells FIGS. 2, 4-7, 11-13, 15, 22-24, 26, 28-34, 36-39, 41-45, ¶¶

197, 228. As shown in FIG. 3(c), these embodiments include a sense circuit calibration during which a calibration inductance measurement of the primary coil is performed to determine measurement threshold limits. Fells ¶¶ 196, 207, 223, 232, 237; Horenstein Decl. ¶ 64. When checking for an object, the sense circuit is triggered to switch on the AC electrical mains input when a measured change in the primary coil inductance is outside the measurement threshold limits. Fells ¶¶ 193, 196, 211, 225, 238.

As shown in FIG. 40 (reproduced below), Fells also disclose an embodiment that includes a proximity detector 4002 to detect when an object is placed in (or removed from) proximity of the wireless power supply. Fells ¶ 288. In this embodiment, the proximity detector “is completely separate from the primary coil and therefore not connected to it.” Fells ¶ 288.



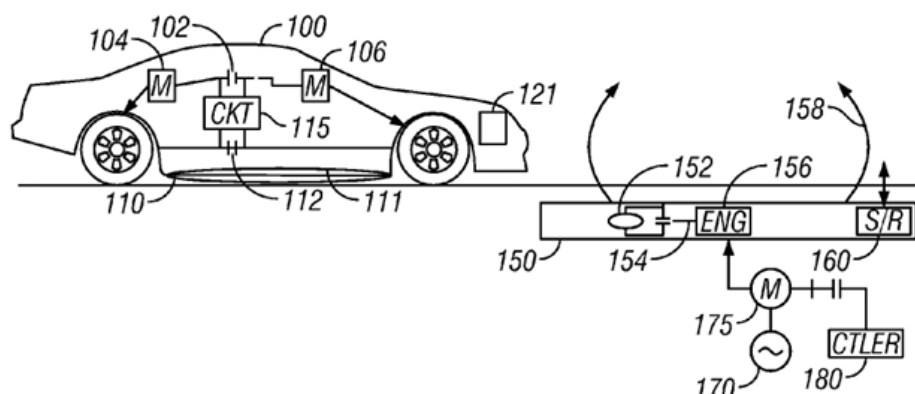
The proximity detector may be an inductive proximity detector, a capacitive proximity detector, a Hall Effect sensor, an optical detector, ultrasonic proximity detector, contact-based detector (e.g., pressure switch), reed switch, or motion sensor. *Id.* ¶¶ 289-290. In the case of a Hall Effect sensor, Fells discloses that the Hall Effect sensor produces a change in voltage in response to a change in magnetic field, which may be caused by the presence of a ferrite core or other material with similar properties within a portable device. *Id.* ¶ 289.

2. U.S. Pat. Pub. No. 2009/0299918 (“Cook”)

Cook is a U.S. pre-grant publication that published on December 3, 2009.

Cook relates to “wireless delivery of power to a mobile powered device such as an automobile.” Cook ¶ 2; Horenstein Decl. ¶ 65. In particular, Cook relates to a power delivery system for an automobile (a vehicle) that includes a unique identifier, which may be used to detect an account for a metered amount of power delivered to the automobile. Cook Abstract, ¶ 15.

As shown in FIG. 1 (reproduced below), Cook describes a charger 150 that includes a coil 152, capacitor 154 and charging circuit 156 to produce a magnetic field 158. *Id.* ¶ 13. When an electrically powered vehicle is within range of the magnetic field, the vehicle may receive power from the magnetic field to charge a battery 102 that powers the vehicle. *Id.* ¶¶ 9, 13. The vehicle includes a magnetic resonant antenna 110 to receive a magnetic signal from the magnetic field, and a receiving circuit 115 to convert the magnetic signal into a current for charging the battery (or for powering electric motors 104, 106 of the vehicle. *Id.* ¶¶ 11, 12.



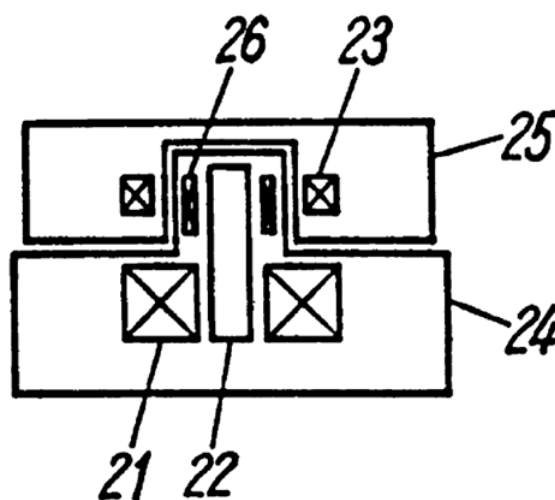
As also disclosed, the charger includes a send and receive device 160, and the vehicle includes an RFID device that uniquely identifies the vehicle. *Id.* ¶ 14. The send and receive device may detect a unique identifier of the vehicle from the RFID device. *Id.* When the vehicle’s identification is detected by the charger, the system checks if the vehicle is associated with an account. If verified, the charging process is enabled, and power is delivered through a meter that tracks the energy supplied to the vehicle for billing purposes through the account. Cook ¶ 15; Horenstein Decl. ¶ 66.

3. U.S. Pat. No. 6,075,433 (“Ono”)

Ono is a U.S. patent that issued on June 13, 2000. Ono describes “a non-contact type power supply unit for use in small portable equipment.” Ono 1:4-5; Horenstein Decl. ¶ 68. As disclosed, the non-contact type power supply unit addresses problems with typical non-contact power supply units that include primary and secondary coils inside separate enclosures, as well as mechanical and

magnetic switches used to identify the secondary coil or some other foreign object and reduce a supply of power to the foreign object. Ono 1:10 – 2:38; Horenstein Decl. ¶¶ 68-69.

As illustrated in FIG. 2 (reproduced below), in one embodiment, a transformer is provided that includes a primary coil 21 in which a ferrite core 22 is inserted. Ono FIG. 2, 2:58-60, 3:38-43 (describing a similar structure shown in FIG. 1), 4:3-14; Horenstein Decl. ¶ 70. The ferrite core extends toward a secondary coil 23 that is wound around the ferrite core. Ono FIG. 2, 2:58-60, 3:38-43 (describing a similar structure shown in FIG. 1), 4:3-14. The primary coil and ferrite core are mounted inside a primary enclosure 24, and the secondary coil is mounted inside a secondary enclosure 25. *Id.* 3:38-43, 4:24-25.



As also shown, the transformer includes a detector coil 26 that is within the primary enclosure, on the ferrite core at a position that is closer to the secondary coil than the primary coil. Ono FIG. 2, 4:6-8; Horenstein Decl. ¶¶ 70-71. The detector coil induces a voltage that reflects a condition on a secondary side of the transformer, which may be used to determine whether what is connected is the secondary coil or some foreign object. Ono 4:11-19.

4. Chwei-Sen Wang, *Design Considerations for Inductively Coupled Power Transfer Systems* (2004) (Ph.D. thesis, University of Auckland) (“Wang Thesis”)

Wang Thesis is a doctoral thesis that Petitioner purports was published in 2004 and made available no later than October 2005. Wang Thesis relates to the design of an inductively coupled power transfer (ICPT) system for a high power application. Wang Thesis i; Horenstein Decl. ¶¶ 73-74.

B. Claims 1, 8 and 11 are Patentable Over Fells (Ground 1)

1. Fells Does Not Disclose “Wherein the At Least One Magnetic Field Sensor Is Positioned Within the Magnetic Field of the Wireless Energy Transfer System”

Petitioner asserts that claim 1 is unpatentable as being obvious over Fells. As explained below, however, Fells does not disclose “wherein the at least one magnetic field sensor is positioned within the magnetic field of the wireless energy transfer system,” as required by claim 1. Petitioner asserts that Fells’ proximity

detector must be within the magnetic field of the wireless energy transfer system in order to provide a change in voltage [or inductance] in response to a change in magnetic field. Pet. 20; Allen Decl. ¶ 131. But Petitioner both makes factually incorrect statements as to what constitutes a magnetic field sensor and confuses which magnetic field, if any, Fells' proximity detector is responsive to. Horenstein Decl. ¶¶ 76-102.

a) Fells' Inductive Proximity Sensor is Not a Magnetic Field Sensor

Petitioner alleges that Fells discloses its proximity detector may be a “Hall Effect sensor” or “an inductive proximity sensor,” and that each constitutes “at least one magnetic field sensor” as in claim 1. Pet. 15-17; Allen Decl. ¶¶ 119-121. Regarding the inductive proximity sensor in particular, Petitioner's sole basis for concluding that an inductive proximity sensor is a magnetic field sensor appears to be that “inductors respond to changes in magnetic fields.” Pet. 16; Allen Decl. ¶ 121. But a person of ordinary skill in the art (POSA) would clearly understand that this does not make an inductive proximity sensor a magnetic field sensor. Horenstein Decl. ¶¶ 80-82.

As a POSA would understand, magnetic field sensors are sensors, such as the loop(s) of wire disclosed in the '184 patent, that are designed to sense and respond to *external* magnetic fields. '184 Patent 2:20-31, 5:29-34, 39-49;

Horenstein Decl. ¶¶ 90-92; *see also* Carstens 119, 130-131; Staugaard 8-26 . In contrast to a magnetic field sensor, an inductive proximity sensor as referenced in Fells is a sensor designed to detect the presence of a metallic object by generating and monitoring changes in an electromagnetic field produced by the inductive proximity sensor itself. Horenstein Decl. ¶¶ 83-89; *see also* Carstens 250; Staugaard 8-25; Petruzella 102; Rabiee 75; Carr 191.

An inductive proximity sensor includes a sensing coil through which a current is passed to cause the sensing coil of the inductive proximity sensor to produce an oscillating electromagnetic field at a frequency of oscillation. Horenstein Decl. ¶ 84; Carstens 250; Petruzella 102. When a metallic object approaches the inductive proximity sensor, the oscillating electromagnetic field induces small circulating electric currents in the object that cause a change in the inductance of the coil of the inductive proximity sensor for the current that is passed through it. Horenstein Decl. ¶¶ 83, 85-88; Petruzella 102; Rabiee 75; *see also* Allen Decl. ¶ 121. These currents are known as “eddy currents,” and for this reason, the inductive proximity sensor is also at times referred to as an eddy current (proximity sensor) or probe. Petruzella 102; Staugaard 8-25; Carr 191; *see also* McGraw-Hill Dictionary-2 (Ex. 2012) 679 (defining “eddy-current sensor” as “[a] proximity sensor which uses an alternating magnetic field to create eddy currents in

nearby objects, and then the currents are used to detect the presence of the objects”).

Both an inductive proximity sensor and a magnetic field sensor rely on magnetic principles, but a POSA would not consider an inductive proximity sensor to be a magnetic field sensor. Horenstein Decl. ¶ 82. A magnetic field sensor detects the presence or strength of *external* magnetic fields which may be from permanent magnets or electromagnet, while an inductive proximity sensor creates its own magnetic field and then detects the presence of metallic objects regardless of whether those objects are magnetic. Horenstein Decl. ¶¶ 89-92; Carstens 119, 120; Staugaard 8-25, 8-26; Petruzella 102; Rabiee 75; Carr 191; McGraw-Hill Dictionary-2 679. Petitioner’s declarant, Dr. Allen, in fact admits that “an Eddy-current sensor, I suppose, could be something loosely like [an inductive proximity sensor that does not constitute a magnetic field sensor].” Allen Depo. (Ex. 2015) 33:13-18; *see also id.* 34:9 – 35:6. As Dr. Allen explains, “instead of directly sensing a magnetic field, [an inductive proximity sensor that does not constitute a magnetic field sensor] generates a magnetic field in the presence of a conductor that is then sensed.” *Id.* 33:18-21. In this regard, the magnetic field created by an inductive proximity sensor is sensitive to metallic objects but does not directly respond to external magnetic fields. Horenstein Decl. ¶¶ 89-90.

Petitioner's declarant, Dr. Allen, explains that Fells' inductive proximity sensor includes a coil, and that "when a 'device or foreign object has been placed' in [vicinity of the wireless power supply], the magnetic field will change, resulting in a change to the coil's own inductance." Allen Decl. ¶ 121. As further explained, "[t]hat inductance can be measured, thereby indicating 'that a device or foreign object has been placed' or 'removed from the wireless power supply.'" *Id.* This is consistent with how an inductive proximity sensor (an eddy-current sensor) works, noting that the magnetic field that is changing is generated by the inductive proximity sensor's own coil. Horenstein Decl. ¶¶ 83-88. But then Dr. Allen continues.

According to Dr. Allen, "[t]he '184 patent describes this same type of coil-based magnetic field sensor, describing that sensors for magnetic fields 'may comprise loops of wire ... that generate an electrical signal *proportional to the amount of magnetic flux* crossing its surface.'" *Id.* (emphasis in original). Dr. Allen is correct in that the '184 patent describes a sensor that generates an electrical signal proportional to the amount of magnetic flux crossing its surface. '184 Patent 2:26-31, 5:45-47. But this is not "the same type of" sensor as Fells' inductive proximity sensor, as described by Dr. Allen. That is, the magnetic field sensor of the '184 patent is responsive to an *external* magnetic field, and does not operate by

creating its own magnetic field and then measuring a change in the inductance of its coil, which is how an inductive proximity sensor works. Horenstein Decl. ¶¶ 89-92.

b) Fells' Proximity Detector is not Positioned Within the Magnetic Field of Its Wireless Power Supply

Even assuming, *arguendo*, Fells' inductive proximity sensor or Hall Effect sensor constitutes a magnetic field sensor, Petitioner fails to establish that Fells discloses the inductive proximity sensor / Hall Effect sensor "is positioned within the magnetic field of the wireless energy transfer system," as required by claim 1. Fells in fact does not disclose that its proximity detector (inductive proximity sensor, Hall Effect sensor) is positioned as required by the claim.

Fells discloses that its proximity detector detects a portable device or foreign object in the vicinity of the wireless power supply. Fells ¶ 288. Fells discloses that a Hall Effect sensor produces a change in voltage in response to a change in magnetic field, but then explicitly discloses that "[t]he presence of a ferrite core or other material with similar properties within the portable device may result in altering the magnetic field." *Id.* ¶ 289.

(1) *Fells’ Proximity Detector Is Not Responsive to Wireless Power Supply Magnetic Field*

Petitioner alleges that Fells’ Hall Effect sensor must be within the magnetic field of its wireless power supply (alleged wireless energy transfer source) in order to provide “a change in voltage in response to a change in magnetic field.” Pet. 20 (citing Fells ¶ 289); Allen Decl. ¶ 131. Petitioner suggests that the magnetic field Fells’ Hall Effect sensor is responding to is the magnetic field generated by Fells’ wireless power supply. But this does not stand to reason.

Fells explicitly discloses a standby (ultra low power or “ULP”) mode in which SW1 is open so that the wireless power supply draws no power from the mains. Fells ¶ 191; Pet. 7-8; Allen Decl. ¶ 69. It is in this mode that the sense circuit / proximity detector (inductive proximity sensor, Hall Effect sensor) is powered by the energy storage element to detect an object, which in turn causes the sense circuit / proximity detector (inductive proximity sensor, Hall Effect sensor) to close SW1, which then allows the wireless power supply to draw power. Fells ¶ 191; Pet. 7-8; Allen Decl. ¶ 70. The sense circuit / proximity detector (inductive proximity sensor, Hall Effect sensor) therefore operates to detect an object when the wireless power supply is in the standby mode; and in the standby mode, the wireless power supply is not powered to generate its magnetic field. Horenstein Decl. ¶¶ 63, 95.

As explained by Petitioner's declarant, Dr. Allen, "[i]f the purpose of the standby mode is ultra low power mode, I would think that the designers would not want [the tank circuit to generate an oscillating magnetic field]." Allen Depo. 23:7-12; *see also* Allen Depo. 20:4-11 (discussing whether the tank circuit would generate an oscillating magnetic field, and explaining that "when [] in the ultra low power mode, I would imagine not in order to conserve power."). As Dr. Allen further explained, "I suppose it's possible that the onboard energy storage could supply energy to the power train to generate an oscillating magnetic field, but I think that would defeat the purpose of having the low power mode or ultra low power mode." Allen Depo. 23:12-17; *see also id.* 24:5-16.

In order for Fells' Hall Effect sensor to respond to a change in the magnetic field of the wireless power supply as asserted by Petitioner, the wireless power supply must be powered and generating a magnetic field. Horenstein Decl. ¶¶ 63, 95. But in the standby mode in which SW1 is open and the Hall Effect sensor operates to detect an object, Fells teaches that the wireless power supply is not powered and therefore cannot generate a magnetic field in the standby mode. Fells ¶ 191; Horenstein Decl. ¶¶ 63, 95. In embodiments in which Fells' sense circuit detects an object by a change in inductance of the primary coil, the sense circuit does provide power to the primary coil to check for devices. Fells ¶¶ 194-195. But

the proximity detector (inductive proximity sensor, Hall Effect sensor) does not similarly power the primary coil, as the proximity detector “is completely separate from the primary coil and therefore not connected to it.” Fells ¶ 288.

According to Fells, then, in the standby mode, the wireless power supply does not draw any power from the AC electrical mains input. Therefore, in this standby/low power mode, because the wireless power supply draws no power, it does not – and cannot – generate a magnetic field when the proximity detector (inductive proximity sensor, Hall Effect sensor) operates to detect an object. Horenstein Decl. ¶¶ 63, 95.

So in the standby mode, the magnetic field to which Fells’ Hall effect sensor responds to in order to detect an object cannot be the magnetic field of the wireless power supply because, at that time, the wireless power supply draws no power and thus is not generating a magnetic field. Horenstein Decl. ¶¶ 63, 95. A POSA would instead understand that the magnetic field being sensed by the Hall Effect sensor is from the ferrite core within the portable device (like a mobile phone) that is detected in the vicinity of the wireless power supply. Fells ¶ 289; Horenstein Decl. ¶¶ 63, 95.

In the context of Fells, a “ferrite core” is a magnetic material around which a magnetic coil is wound. Wiley Dictionary-2 (Ex. 2013) 280 (defining “ferrite

core”), 444 (defining “magnetic core”). A “magnetic coil” is one or more conductors wound in a series to introduce an inductance or produce a magnetic field in a circuit, and the ferrite core serves to concentrate the magnetic field. Wiley Dictionary-2 444 (defining “magnetic core” and “magnetic coil”); Wang Thesis 11-12 (“Magnetic cores concentrate the flux, while conductor windings conduct the electric currents.”). A POSA would therefore understand that Fells’ teaches a portable device including a ferrite core around which a magnetic coil is wound, and that Fells’ Hall Effect sensor produces its change in voltage in response to a change in the magnetic field (of the magnetic coil) guided by the ferrite core. Horenstein Decl. ¶ 96.

(2) FIG. 40 of Fells is Unavailing

Petitioner alleges that FIG. 40 of Fells supports the proximity detector positioned within the magnetic field of the wireless power supply. Pet. 21; Allen Decl. ¶ 132. Petitioner is incorrect. Although features shown in a drawing may be sufficient to establish anticipation, those features must be “shown clearly.” *In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972); *see also In re Seid*, 161 F.2d 229, 231 (CCPA 1947). FIG. 40 is a block diagram that shows various components and their interconnections within the circuitry. Horenstein Decl. ¶ 97. The figure is not intended to show how the components are physically arranged relative to one

another, much less relative to a magnetic field generated by the primary coil. *Id.* As admitted by Petitioner's declarant, Dr. Allen, the figure does not show the magnetic field that would be produced by the primary coil, and therefore does not show whether *any* component would be positioned within the primary coil's magnetic field, including not showing whether the proximity detector is positioned within that magnetic field. Allen Depo. 43:24 – 44:1.

(3) *Fells' Stated Goal Does Not Require Positioning within the Magnetic Field*

Petitioner further alleges that Fells' Hall Effect sensor must be positioned *within* the magnetic field of the wireless power supply in order to detect foreign objects in the "vicinity" of the wireless power supply. Pet. 22; Allen Decl. ¶¶ 131-133. Petitioner appears to equate "in the vicinity of" the wireless power supply with "on or over" the wireless power supply. But Petitioner provides no logical basis for this construction. But by its very definition, "vicinity" is not so limited. Merriam-Webster Dictionary (Ex. 2014) 1312 (defining "vicinity" as "the quality or state of being near"). And Fells could detect a foreign object that would get hot or hinder power transfer by detecting the foreign object in the vicinity of the wireless power supply, before the foreign object reaches the magnetic field of the wireless power supply. Horenstein Decl. ¶ 98.

Notably, the purpose of the detection performed by Fells' proximity detector is not in fact to detect foreign objects that would get hot or hinder power transfer while charging devices. The purpose of Fells' proximity detector is instead to enable a lower standby power in which the wireless power supply is only connected to AC electrical mains when an object is in the vicinity of the wireless power supply. Fells ¶ 191 (“[t]he Sense Circuit ... does not determine whether or not the object is a legitimate object, such as a valid secondary device”). Fells' control unit determines whether the object is a legitimate object that desires power, or a foreign object. *Id.*

2. Petitioner Fails to Establish Obviousness of “Wherein the At Least One Magnetic Field Sensor Is Positioned Within the Magnetic Field of the Wireless Energy Transfer System”

Petitioner also fails to provide sufficient motivation for a POSA to position Fells' proximity detector (inductive proximity sensor, Hall Effect sensor) within the magnetic field of the wireless power supply. Petitioner relies on the same reasons given for why Fells discloses the proximity detector within the magnetic field to reason it also would have been obvious to position the proximity detector within the magnetic field. Pet. 22-23; Allen Decl. ¶ 135.

To the contrary, a POSA would understand that in the context of Fells, a proximity detector positioned within the magnetic field would in fact itself become

a foreign object that Fells seeks to detect and avoid. Horenstein Decl. ¶¶ 99-100.

According to Petitioner, Fells' proximity detector (inductive proximity sensor, Hall effect sensor) includes "circuitry within the proximity detector" to generate an output signal ("Detect O/P"), and would be constructed with circuitry such as a comparator or microcontroller. Pet. 17-20; Allen Decl. ¶¶ 122-129. A POSA would recognize that such a proximity detector (including "circuitry within the proximity detector"), when exposed to the magnetic field of the wireless power supply, would support eddy currents created by the magnetic field of the wireless power supply. Horenstein Decl. ¶ 100; Wiley Dictionary-2 226 (defining "eddy current" as "[a] circulating current induced in a conductor that is moved through a magnetic field, or which is subjected to a varying magnetic field"). These eddy currents could in turn hinder operation of the wireless power supply, which negative impact that Fells explicitly seeks to avoid. Fells ¶¶ 2, 189; Wiley Dictionary-2 226 (explaining that "Eddy currents are generally undesired, and energy is lost usually in the form of heat").

A POSA would instead position the Fells' proximity detector outside (but in proximity) of the magnetic field, which would satisfy Fells' purpose of detecting objects in the "vicinity" of the wireless power supply, while also avoiding the negative impact of the proximity detector itself becoming a foreign object to Fells'

wireless power supply. Horenstein Decl. ¶ 101. Placing the proximity detector outside the magnetic field may trigger on an object that does not end up encroaching into the magnetic field, but Fells expresses no concern for false triggering of its sense circuit / proximity detector because its control unit confirms that a valid device is present without a foreign object before delivering power. Fells ¶¶ 193, 262, 290; Horenstein Decl. ¶ 101.

3. Dependent Claims 8 and 11

Because dependent claims 8 and 11 depend from claim 1, Patent Owner respectfully submits that the Petition has failed to establish that the challenged dependent claims are unpatentable at least by virtue of their respective dependencies.

* * *

For at least the foregoing reasons, Petitioner therefore fails to establish that claims 1, 8 and 11 are unpatentable as being obvious over Fells. Accordingly, Ground 1 fails.

C. Claims 2-7, 9, 10 and 16 Are Patentable Over Fells and Cook (Ground 2)

1. Dependent Claims 2-7, 9 and 10

a) Cook Does Not Cure the Deficiencies of Fells

Petitioner asserts that claims 2-7, 9, 10 and 16 are unpatentable as being obvious over Fells and Cook. As explained above in Section VI.B., Petitioner fails to establish that claims 1, 8 and 11 are unpatentable as being obvious over Fells. Cook does not cure the aforementioned deficiencies of Fells, including at least positioning of the at least one magnetic field sensor, as required by claim 1, and by dependency claims 2-7, 9 and 10. Horenstein Decl. ¶ 104. Petitioner does not in fact cite Cook for teaching placement of the at least one magnetic field sensor.

For at least the same reasons given above, Petitioner fails to establish that claims 2-7, 9 and 10 are unpatentable as being obvious over Fells and Cook. Ground 2 as to claims 2-7, 9 and 10 therefore fails.

b) Petitioner Fails to Establish Obviousness of “Wherein the Foreign Object Debris Detection System Is Configured to Perform a Health and/or Status Check of the Wireless Energy Transfer Source Before the Vehicle Is Positioned Over the Source Resonator”

Ground 2 as to claims 4-6 also fails for additional reasons. In this regard, dependent claim 4 (and by further dependency claims 5 and 6) requires that the foreign object debris detection system is configured to perform a health and/or

status check of the wireless energy transfer source before the vehicle is positioned over the source resonator. Petitioner alleges that Fells teaches two health and/or status checks, namely, a “sense circuit calibration” and a check of the energy level in the energy storage element. Pet. 40-42, 52-53; Allen Decl. ¶¶ 184-196, 225-227. Petitioner is incorrect. Horenstein Decl. ¶ 105.

(1) Sense Circuit Calibration

Petitioner argues that Fells performs a sense circuit calibration to “prepare[] for the arrival of a future device and or vehicle to be charged by the resonator (by checking the current induction status) and establish[] a baseline induction measurement that the sense circuit will compare future induction measurements to, in order to determine when to activate the resonator.” Pet. 40-41; Allen Decl. ¶ 188. Petitioner further argues that Fells performs validation checks as part of the sense circuit calibration, which Petitioner alleges constitute additional health and/or status checks. Pet. 41; Allen Decl. ¶ 188.

Importantly, the system of claim 3 requires (by its dependency on claim 1) at least one magnetic field sensor, which Petitioner alleges is disclosed by Fells’ proximity detector shown and described with respect to FIG. 40. Pet. 14-17; Allen Decl. ¶¶ 117-121. In Fells, however, the sense circuit calibration is specific to the embodiment shown and described with respect to FIG. 2. Horenstein Decl. ¶¶ 108-

109. Petitioner alleges that FIGS. 2 and 40 are the same circuit. Pet. 14-15; Allen Decl. ¶ 118. Petitioner is incorrect. Horenstein Decl. ¶¶ 76-79.

In the embodiment shown in FIG. 2, the sense circuit is connected to the primary coil, and detects an object by a change in inductance across the primary coil. Fells FIGS. 2, 3(a)-3(c), 18-21, ¶¶ 193-196, 248-253; Horenstein Decl. ¶ 76-77. During the sense circuit calibration, a calibration inductance measurement of the primary coil is performed to determine measurement threshold limits, which are then used by the sense circuit to check for an object. *Id.* ¶¶ 193, 196, 207, 211, 223, 225, 232, 237, 238; Horenstein Decl. ¶ 108.

In contrast to the embodiment shown and described with respect to FIG. 2, the embodiment of Fells shown and described with respect to FIG. 40 includes a proximity detector (alleged to be the at least one magnetic field sensor), but the proximity detector is not connected to the primary coil. Fells ¶ 288; Horenstein Decl. ¶¶ 78-79, 109. Fells does not disclose that its proximity detector carries out the sense circuit calibration, or that the proximity detector has any use for a calibration inductance measurement of the primary coil. Horenstein Decl. ¶ 109. In the case of a Hall Effect sensor in particular, Fells discloses that a portable device may be detected by a change in voltage in response to a change in magnetic field,

not based on a change in inductance of the primary coil. Fells ¶ 289; Horenstein Decl. ¶ 109.

Petitioner has not specifically alleged that the proximity detector carries out the sense circuit calibration. Likewise, Petitioner fails to explain why a POSA would have been motivated to carry out the sense circuit calibration in the embodiment including the proximity detector. *See In re Stepan Co.*, 868 F.3d 1342, 1346 (Fed. Cir. 2017) (“Whether a rejection is based on combining disclosures from multiple references, combining multiple embodiments from a single reference, or selecting from large lists of elements in a single reference, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful, otherwise a skilled artisan would not arrive at the claimed combination.”).

(2) *Check of the Energy Level in the Energy Storage Element*

Petitioner points to Fells disclosing a check of the energy level in its energy storage element, and alleges that the check of the energy level constitutes a health and/or status check of the wireless energy transfer source, as required by claim 4 (and by further dependency claims 5 and 6). Pet. 41-42; Allen Decl. ¶¶ 192-196. Petitioner is incorrect. Horenstein Decl. ¶ 110.

According to Petitioner, Fells' resonant tank circuit consisting of capacitor 214 and primary coil 212 corresponds to the source resonator. Pet. 40. Fells also discloses an energy storage element 204, which is separate and distinct from the resonator. Fells FIG. 2, ¶ 191. The energy storage element powers the sense circuit that controls the AC electrical mains input to the wireless power supply when an object is detected. *Id.* The resonator, on the other hand, is responsible for delivering power to a portable device when the wireless power supply is powered. *Id.*

Fells discloses that the sense circuit periodically monitors energy in the energy storage element, and closes SW1 to charge the energy storage element when the energy falls below a certain threshold. *Id.* ¶ 246. This check ensures that the sense circuit can properly function, but it does not directly relate to the health and/or status of the resonator itself. Horenstein Decl. ¶¶ 111-112. In contrast, the resonator's ability to deliver power depends on the sense circuit being functional to detect an object and close SW1. The check of the energy storage element's energy level only ensures that the sense circuit can potentially be triggered. *Id.*

Petitioner argues that “[c]hecking that the energy storage element is not fully depleted provides the health and/or status of the resonator, as the resonator is incapable of being turned on by the sense circuit if the energy storage element is depleted.” Pet. 42 (citing Fells ¶¶ 191, 255); Allen Decl. ¶¶ 195-196. To the

contrary, however, the sense circuit does not “turn on” or “activate” the resonator. Horenstein Decl. ¶ 113. Instead, the sense circuit closes SW1 to allow the wireless power supply to draw power from AC electrical mains input. Fells ¶ 191; Horenstein Decl. ¶ 113. If the control unit determines that object detected by the sense circuit is a valid device that desires power, the control unit (not the sense circuit) turns on the resonator (activates the inverter to supply current to the tank circuit). Fells ¶ 191; Horenstein Decl. ¶ 113.

Petitioner suggests that Fells checks for a fully-depleted energy storage element which impacts the health and/or status of the resonator. Pet. 42. But Fells expressly does not allow its energy storage element to fully deplete, instead recharging the energy storage element when its energy level falls below a threshold. Fells ¶¶ 203, 246 (explaining that “the Energy Storage element 1604 is monitored so that it does not deplete fully”); Horenstein Decl. ¶ 114. According to Fells, if the energy level of the energy storage element decreases to below a threshold, SW1 is closed to allow the energy storage element to be recharged from the main circuit. Fells ¶¶ 246, 248.

Insofar as the resonator’s ability to be turned on by the sense circuit, the health and/or status of the resonator is in fact the same, regardless of the outcome of the check of the energy storage element. Horenstein Decl. ¶ 115. More

specifically, the resonator is capable of being turned on by the control unit either way. *Id.* If the energy storage element's energy level is above the threshold, the sense circuit may be triggered by detection of an object to close SW1, as described above in Section VI.A.1. Fells ¶ 191, 248; Horenstein Decl. ¶ 115. But as also described above, if the energy level is below the threshold, the sense circuit is triggered to close SW1 to recharge the energy storage element. Fells ¶¶ 246, 248; Horenstein Decl. ¶ 115. Either way, SW1 is closed to allow the wireless power supply to draw mains power, which enables the control circuit to detect a valid device that desires power, and turn on the resonator. Horenstein Decl. ¶ 115. The check of the energy level of the energy storage element therefore does not provide any check of the health and/or status of the resonator, as per claim 12.

For at least this additional reason, Petitioner fails to establish that claim 4, and by further dependency claims 5 and 6, are unpatentable as being obvious over Fells and Cook.

2. Independent Claim 16

Independent claim 16 requires performing a health and/or status check of a source resonator of the wireless energy transfer system. As explained above in Section VI.C.1.b) with respect to claims 4-6 (Ground 2), Petitioner alleges that Fells teaches two health and/or status checks, namely, a “sense circuit calibration”

and a check of the energy level in the energy storage element. Pet. 40-42, 52-53; Allen Decl. ¶¶ 184-196, 225-227. Again, Petitioner is incorrect.

a) Sense Circuit Calibration

Again, Petitioner argues that Fells’ sense circuit calibration constitutes a status check of the source resonator “because it prepares for the arrival of a future device or vehicle to be charged by the resonator (by checking the current induction status) and establishes a baseline induction measurement that the sense circuit will compare future induction measurements to, in order to determine when to activate the resonator.” Pet. 40-41; Allen Decl. ¶ 188. Petitioner fails to explain, however, how preparing for the arrival of a device makes the sense circuit calibration a status check of the source resonator. Likewise, Petitioner fails to explain how establishing a baseline induction measurement makes the sense circuit calibration a status check of the source resonator.

As understood by a POSA, a status check of a source resonator is a test to verify the functioning status of that source resonator. Horenstein Decl. ¶ 106; Wiley Dictionary-2 108 (defining “check” as “[t]he verifying or testing of the accuracy, function, indications, or results of a component, device, instrument, system, or process”); *see also* ’184 Patent 11:42-45 (explaining that “diagnostic tests can be performed ... to check the health and status of the charging station”);

Wiley Dictionary-2 183 (defining “diagnostic tests” as “[t]ests utilized to verify that a component, device, piece of equipment, or system is functioning properly”). Even if performed to prepare for the arrival of a device, Fells’ sense circuit calibration does not verify the functioning status of the source resonator. Horenstein Decl. ¶ 107. Likewise, establishing a baseline induction measurement also does not verify the functioning status of the source resonator. *Id.*

To the extent Petitioner believes that the sense circuit calibration is a status check because the baseline induction measurement enables the sense circuit to determine when to activate the resonator, Petitioner is also incorrect. As explained above in Section VI.C.1.b)(2), Fells’ sense circuit does not “turn on” or “activate” the resonator. Instead, the sense circuit closes SW1 to allow the wireless power supply to draw power from AC electrical mains input. Fells ¶ 191. If the control unit determines that object detected by the sense circuit is a valid device that desires power, the control unit (not the sense circuit) turns on the resonator (activates the inverter to supply current to the tank circuit). *Id.*

Petitioner further alleges that “Fells performs additional health and/or status checks, such as validation checks, as part of the calibration inductance measurement,” citing paragraph 196 of Fells as support. Pet. 41; Allen Decl. ¶ 187-188. In the cited paragraph, Fells explicitly states that the calibration inductance

measurement “may take longer than a normal measurement as it is important to make sure that the calibration measurement is a valid one and not a rogue measurement.” Fells ¶ 196. But taking more time for the calibration inductance measurement is not “a validation check,” and Fells does not teach or suggest that a validation check is performed during the increased time. Horenstein Decl. ¶ 118. Fells instead discloses measuring inductance in various manners in which a longer measurement acquisition time may make sure the calibration measurement is valid and not rogue. Fells ¶¶ 197, 222, 266, 268; Horenstein Decl. ¶ 118.

For example, Fells discloses that its sense circuit may use a variable frequency oscillator and “make[] a relative measurement of the inductance by measuring the frequency of the [oscillator’s output] signal,” which is achieved by counting a number of pulses of the signal that occur within a defined time interval. Fells ¶ 197; Horenstein Decl. ¶ 119. As would be understood by a POSA, increasing the defined time interval over which the number of pulses are counted allows for the accumulation of more pulses, which improves statistical accuracy and reduces the impact of random fluctuations or noise. Horenstein Decl. ¶ 119. As also disclosed, for example, the sense circuit “first allows the oscillator signal to settle,” which would increase the time of a calibration inductance measurement, but also allow for any initial fluctuations, overshoots or noise to dissipate before

the measurement is taken. Fells ¶ 268; Horenstein Decl. ¶ 119. In at least these examples, the acquisition time for an inductance measurement is increased in a manner that may make sure the measurement is valid and not rogue, without the sense circuit performing any “validation check.”

b) Check of the Energy Level in the Energy Storage Element

Petitioner points to Fells disclosing a check of the energy level in its energy storage element, and alleges that the check of the energy level constitutes a health and/or status check of the source resonator, as required by claim 16. Pet. 41-42; Allen Decl. ¶¶ 192-196. As explained above in Section VI.C.1.b)(2) with respect to claims 4-6, however, checking the energy level in the energy storage element that powers the sense circuit is not a health and/or status check of the source resonator.

As explained, the check of the energy level in the energy storage element ensures that the sense circuit can properly function, but it does not directly relate to the health and/or status of the resonator itself. The resonator’s ability to deliver power depends on the sense circuit being functional to detect an object and close SW1, but a check of the energy storage element’s energy level only ensures that the sense circuit can potentially be triggered. In fact, insofar as the resonator’s ability to be turned on by the sense circuit, the health and/or status of the resonator

is in fact the same, regardless of the outcome of the check of the energy storage element.

* * *

For at least the foregoing reasons, Petitioner therefore fails to establish that claims 2-7, 9, 10 and 16 are unpatentable as being obvious over Fells and Cook. Accordingly, Ground 2 fails.

D. Claim 12 Is Patentable Over Fells and Ono (Ground 3)

1. Ono Does Not Cure the Deficiencies of Fells

Petitioner asserts that claim 12 is unpatentable as being obvious over Fells and Ono. As explained above in Section VI.B., Petitioner fails to establish that claims 1, 8 and 11 are unpatentable as being obvious over Fells. Ono does not cure the aforementioned deficiencies of Fells, including at least positioning of the at least one magnetic field sensor, as required by claim 1, and by dependency claim 12. Horenstein Decl. ¶ 121. Petitioner does not in fact rely on Ono for teaching placement of the at least one magnetic field sensor.

For at least the same reasons given above, Petitioner fails to establish that claims 12 is unpatentable as being obvious over Fells and Ono. Ground 3 therefore fails.

2. Fells and Ono Do Not Disclose “The Foreign Object Debris Detection System Is Integrated into the Enclosure”

Ground 3 also fails because the combination of Fells and Ono does not disclose “the foreign object debris detection system is integrated into the enclosure,” as required by claim 12. Petitioner alleges that Fells discloses the foreign object debris detection system integrated into the enclosure. Alternatively, Petitioner alleges that Ono teaches the feature, and that it would have been obvious to a POSA to combine Fells and Ono to teach the claim. Pet. 61-63; Allen Decl. ¶¶ 245-249. Petitioner is once again incorrect. Horenstein Decl. ¶ 122.

a) Fells Does Not Disclose “The Foreign Object Debris Detection System Is Integrated into the Enclosure”

Petitioner argues that Fells discloses the foreign object debris detection system is integrated into the enclosure, relying predominately on dotted lines shown in FIG. 40 of Fells. Pet. 61-62; Allen Decl. ¶ 246. According to Petitioner, “[a] POSA would have understood that the dotted lines in Fells’ diagrams indicate an ‘integrated’ enclosure encompassing all components within the dotted lines.” Pet. 62; Allen Decl. ¶ 246. Again, Petitioner is incorrect. Horenstein Decl. ¶¶ 123-125.

Again, features shown in a drawing may be sufficient to establish anticipation, those features must be “shown clearly.” *In re Mraz*, 455 F.2d at 1072.

As shown below, FIG. 40 is a block diagram that shows various components and their interconnections within the wireless power supply. Horenstein Decl. ¶ 123.

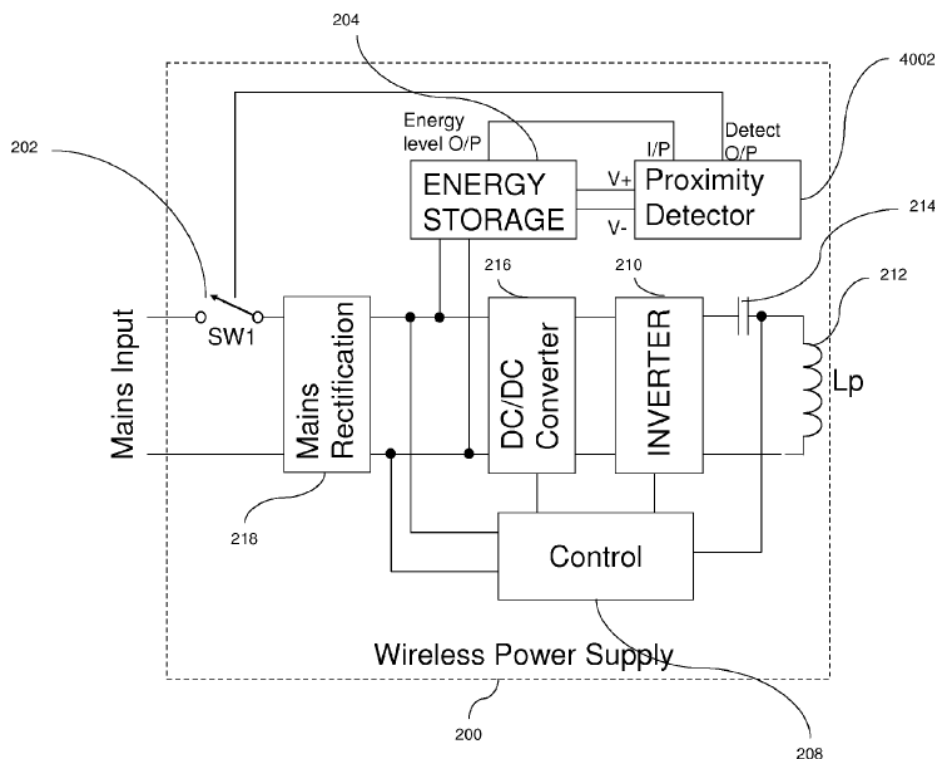
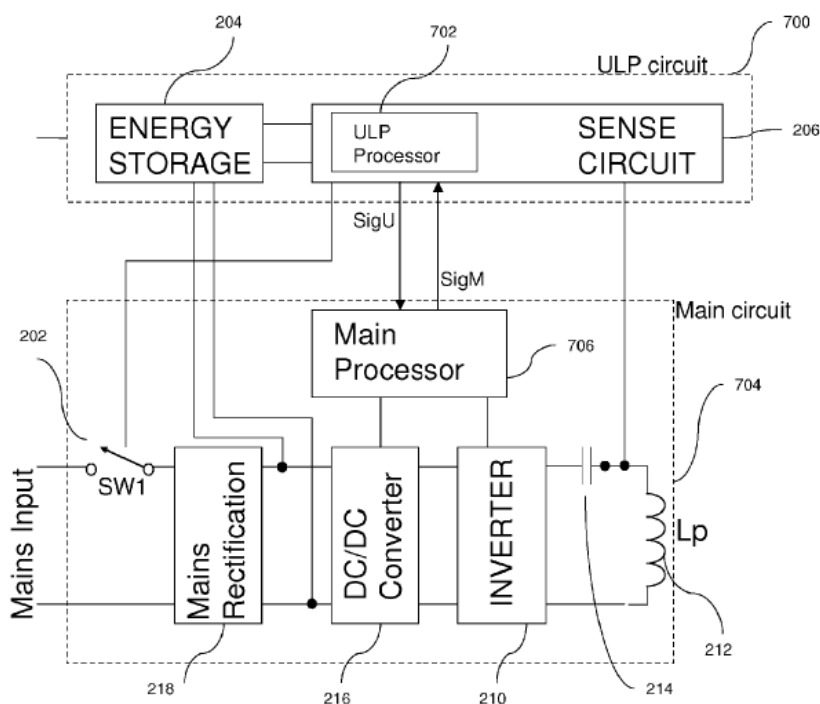


FIG. 40 includes reference numerals identified in the corresponding description of Fells. The dotted line boundary is identified by reference number 200, which Fells refers to as a wireless power supply, primary unit or wireless power unit. Fells ¶¶ 191, 203. But nowhere does Fells describe the wireless power supply, primary unit or wireless power unit as an enclosure, or as including an enclosure. Horenstein Decl. ¶ 123. Petitioner instead simply relies on its declarant, Dr. Allen, and strained inferences to figures and passages in Fells referring to

“integration” of the wireless power supply with another piece of electronic equipment.

As noted by Petitioner, Fells includes several diagrams with dotted line boundaries. During his deposition, Dr. Allen reiterated his opinion that a POSA would interpret the dotted lines in FIG. 40 to represent an enclosure. Allen Depo. 45:16-21. Dr. Allen similarly opined that a POSA would interpret the dotted lines in FIGS. 1 and 23 to represent enclosures. *Id.* 46:13-17, 46:20 – 47:5. In Fells, FIGS. 4-7 and 12 also include dotted lines, but Dr. Allen could not give the same opinion. Dr. Allen could not explain the differences in the dotted lines in the figures, or say whether a POSA would interpret the dotted lines in those figures as an enclosure. *Id.* 47:7 – 50:11.

Moreover, Petitioner’s proposition that “the dotted lines in Fells’ diagrams indicate an ‘integrated’ enclosure encompassing all components within the dotted lines,” is contrary to the explicit teachings of Fells. Horenstein Decl. ¶¶ 124-125. In FIG. 7 (reproduced below), for example, Fells illustrates the wireless power supply organized into a ULP circuit 700 and a main circuit 704, each of which is shown by a boundary of dotted lines. Fells ¶ 206; Horenstein Decl. ¶ 124.



Similar to FIG. 40, FIG. 7 includes a dotted line boundary, or more specifically two dotted line boundaries identified by reference numbers 700 and 704. Fells ¶ 206; Horenstein Decl. ¶ 125. In the corresponding description, Fells refers to reference number 700 as the ULP circuit, and Fells refers to reference number 704 as the main circuit. Fells ¶ 206. Fells also refers to reference number 704 (for one of the dotted line boundaries) as “the main *circuit board* 704.” *Id.* ¶ 236 (emphasis added). The “the dotted lines in Fells’ diagrams” therefore do not clearly “indicate an ‘integrated’ enclosure encompassing all components within the

dotted lines,” as argued by Petitioner. Horenstein Decl. ¶ 125; Allen Depo. 47:7 – 50:11.

b) Fells and Ono Do Not Disclose “The Foreign Object Debris Detection System Is Integrated into the Enclosure”

In the alternative, Petitioner argues that “a POSA implementing Fells would have considered it obvious to place Fells’ wireless power supply, including the proximity detector, control unit, and tank circuit, within a primary enclosure as taught by Ono. Pet. 63; Allen Decl. ¶ 247. According to Petitioner, “a housing would protect the coil of Fells’ wireless power supply from environmental contaminants ..., while also shielding the coil and related circuitry from damage that could cause electrical shorts” Pet. 63; Allen Decl. ¶ 249. Even assuming, *arguendo*, a POSA would have considered it obvious to place Fells’ wireless power supply within a primary enclosure as taught by Ono, Petitioner still fails to establish that Fells and Ono discloses that the foreign object debris detection system is *integrated* into the enclosure, as required by claim 12. Horenstein Decl. ¶¶ 126-128.

In particular, Petitioner appears to believe that claim 12 merely requires an enclosure housing the wireless energy transfer source and the foreign object debris detection system. Once again, Petitioner is incorrect. The claim does require “an

enclosure *housing* at least a portion of the wireless energy transfer source.” But the claim also requires that the foreign object debris detection system is *integrated into* the enclosure,” which is different from the enclosure merely housing the foreign object debris detection system. Horenstein Decl. ¶ 126; *see CAE Screenplates, Inc. v. Heinrich Fiedler GmbH & Co.*, 224 F.3d 1308, 1317 (Fed. Cir. 2000) (“In the absence of any evidence to the contrary, we must presume that the use of different terms in the claims connotes different meanings.”).

In the context of claim 12, a POSA would understand that the foreign object debris detection system integrated into the enclosure means that the foreign object debris detection system is united with the enclosure to form a functioning or unified whole. Horenstein Decl. ¶ 127; Merriam-Webster Dictionary 606 (defining “integrate” as “to form, coordinate, or blend into a functioning or unified whole”). This is more than simply housing the foreign object debris detection system in the enclosure, which a POSA would understand to mean that the foreign object debris detection system is simply enclosed in the enclosure. Horenstein Decl. ¶ 127; Merriam-Webster Dictionary 561 (defining “house” to as “to encase, enclose, or shelter as if by putting in a house”).

Petitioner fails to establish that Ono, or Fells and Ono in combination, discloses that the foreign object debris detection system is *integrated into* the

enclosure. Horenstein Decl. ¶ 128. Ono in particular discloses a transformer including a primary coil mounted inside a primary enclosure, and a detector coil that is also within the primary enclosure. Ono FIG. 2, 3:38-43, 4:6-8. Ono at best discloses that the primary enclosure houses or encloses the primary coil and the detector coil, but Ono does not disclose that the detector coil is integrated into the primary enclosure. Horenstein Decl. ¶ 128.

* * *

For at least the foregoing reasons, Petitioner therefore fails to establish that claim 12 is unpatentable as being obvious over Fells alone or with Cook.

Accordingly, Ground 3 fails.

E. Claim 13 Is Patentable Over Fells and Cook and/or Wang Thesis (Ground 4)

Petitioner asserts that claim 13 is unpatentable as being obvious over Fells and Cook and/or Wang Thesis. As explained above in Section VI.B., Petitioner fails to establish that claims 1, 8 and 11 are unpatentable as being obvious over Fells. Cook and/or Wang Thesis does not cure the aforementioned deficiencies of Fells, including at least positioning of the at least one magnetic field sensor, as required by claim 1, and by dependency claim 13. Horenstein Decl. ¶ 129.

Petitioner does not in fact cite Cook and/or Wang for teaching placement of the at least one magnetic field sensor.

For at least the same reasons given above, Petitioner fails to establish that claims 13 is unpatentable as being obvious over Fells and Cook and/or Wang Thesis. Ground 4 therefore fails.

* * *

For at least the foregoing reasons, Petitioner therefore fails to establish that claim 13 is unpatentable as being obvious over Fells and Cook and/or Wang Thesis. Accordingly, Ground 4 fails.

VII. CONCLUSION

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

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Respectfully submitted,

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

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the foregoing paper complies with the type-volume limits of C.F.R. § 42.24(b)(2). The foregoing paper contains 11,939 words, as calculated by Microsoft Word, excluding the parts of the paper exempted by 37 C.F.R. § 42.24(a)(1).

Dated: September 19, 2024

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CERTIFICATE OF SERVICE

It is certified that a copy of the *Patent Owner's Response* has been served on
Petitioner as provided in 37 C.F.R. § 42.6(e) via electronic mail transmission
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