

Filed on behalf of: InductEV, Inc.

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

**DECLARATION OF DR. MARK ALLEN
IN SUPPORT OF PETITIONER'S REPLY**

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I. Introduction and Qualifications

1. I have been retained as an expert witness on behalf of InductEV, Inc. (“InductEV” or “Petitioner”) in the above-captioned *inter partes* review (“IPR”) relating to U.S. Patent No. 10,027,184 (“the ’184 patent”) (Ex. 1001).

2. I previously provided a declaration in this matter, dated October 23, 2023, in which I provided opinions relating to the level of skill of ordinary persons in the art, the history of resonators and the relevant technology, claim construction, and the teachings of the prior art as they compare to the claims of the ’184 patent.

3. I understand that my original declaration was submitted as Exhibit 1003. I hereby incorporate Exhibit 1003 into this declaration by reference.

4. My experience and qualifications are set forth in Exhibit 1003 and in my curriculum vitae, which I understand was submitted as Exhibit 1004.

5. I have been asked to provide additional expert opinions regarding these matters in response to certain arguments in the Patent Owner Response and certain opinions of Patent Owner’s witness, Dr. Mark Horenstein.

II. Summary Of Materials Reviewed And Considered

6. All of the opinions contained in this Declaration are based on the documents I reviewed and my knowledge and professional judgment. In forming the opinions expressed in this Declaration, while drawing on my experience in the field of wireless energy transfer, I reviewed the following documents:

Ex.	Description
1001	U.S. Patent No. 10,027,184 B2 (“’184 patent”)
1002	File History for U.S. Patent No. 10,027,184 B2 (“’184 FH”)
1005	U.S. Patent Application Publication No. 2010/0084918 A1 (“Fells”)
1006	U.S. Patent Application Publication No. 2009/0299918A1 (“Cook”)
1007	U.S. Patent No. 6,075,433 (“Ono”)
1008	Chwei-Sen Wang, <i>Design Considerations for Inductively Coupled Power Transfer Systems</i> (2004) (Ph.D. dissertation, University of Auckland) (“Wang Thesis”)
1011	U.S. Patent No. 8,749,334 B2 (“Boys”)
1012	U.S. Patent No. 9,774,086 B2 (“Cook-086”)
1013	U.S. Patent Application Publication No. 2010/0109445 A1 (“Kurs”)
1014	U.S. Patent No. 7,656,244 B2 (“McCorquodale”)
1015	U.S. Patent No. 7,978,017 B2 (“Pernia”)
1016	U.K. Patent Application No. GB2414121 A (“Stevens”)
1018	D. Ferrazzin, et al., <i>Hall Effect Sensor-Based Linear Transducer</i> , Proceedings of the 1999 IEEE, Int’l Workshop on Robot and Human Interaction (IEEE, Sept. 1999), 219-224 (“Ferrazzin”)
1019	A.W. Green & J.T. Boys, <i>10kHz Inductively Coupled Power Transfer – Concept and Control</i> , Power Electronics and Variable-Speed Drives, Conf. Pub. No. 399 (IEE, Oct. 26-28, 1994), 694-699 (“Green”)
1020	Aiguo Patrick Hu, <i>Selected Resonant Converters for IPT Power Supplies</i> (Oct. 2001) (Ph.D. dissertation, University of Auckland) (“Hu”)
1021	Byung-Song Lee & Kyung-Hee Han, <i>Modeling and Analysis of IPT System Used for PRT</i> , Proceedings of the Eighth International Conference on Electrical Machines and Systems – ICEMS 2005, vol. 1 (ICEMS, Sept. 27-29, 2005), 839-842 (“Lee”)

Ex.	Description
1022	James E. Lenz, <i>A Review of Magnetic Sensors</i> , Proceedings of the IEEE, vol. 78, no. 6 (June 1990), 973-989 (“Lenz”)
1023	Excerpts from <i>McGraw-Hill Dictionary of Scientific and Technical Terms</i> (6th ed. 2003)
1024	Excerpts from James W. Nilsson & Susan A. Riedel, <i>Electrical Circuits</i> (8th ed. 2008) (“Nilsson”)
1025	Chwei-Sen Wang, et al., Investigating an LCL Load Resonant Inverter for Inductive Power Transfer Applications, IEEE Transactions on Power Electronics, vol. 19, no. 4 (IEEE, July 2004), 995-1002 (“Wang-IEEE”)
1026	Excerpts from <i>Wiley Electrical and Electronics Engineering Dictionary</i> (2004)
1027	William H. Wilkinson, Integrated Hall Effect Sensor, Journal of the Microelectric Engineering Conference, vol. 3, iss. 1, art. 37 (1989), 215-220 (“Wilkinson”)
1028	Larry Dickerman & Jessica Harrison, A New Car, A New Grid, IEEE Power & Energy Mag. (Mar./Apr. 2010), 55-61 (“Dickerman”)
1029	U.S. Patent Application Publication No. 2010/0277121 A1 (“Hall”)
1031	SAE International, <i>SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler</i> , J1772 (rev. Jan. 2010) (“SAE Standards”)
1032	Excerpt from Frederick Emmons Terman, <i>Electronic and Radio Engineering</i> (4th ed. 1955) (“Terman”)
1033	Claire Weiller, <i>Plug-in Hybrid Electric Vehicle Impacts on Hourly Electricity Demand in the United States</i> , Energy Policy 39 (2011), 3766-3778 (“Weiller”)
1038	Transcript of the deposition of Mark N. Horenstein, Ph.D., <i>InductEV, Inc. v. WiTricity Corp.</i> , No. IPR2024-00105 (Jan. 21, 2025) (“Horenstein Dep.”)
2001	U.S. Patent No. 9,442,172

Ex.	Description
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.”)
2007	Excerpts from Carstens, ELECTRICAL SENSORS AND TRANSDUCERS (1993) (“Carstens”)
2008	Excerpts from Staugaard, 8-BIT MICROPROCESSOR INTERFACING AND APPLICATIONS (“Staugaard”)
2009	Excerpts from Petruzella, PROGRAMMABLE LOGIC CONTROLLERS (4 th 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 (10 th ed. 2000) (“Merriam-Webster Dictionary”)
2015	Zoom Deposition of Mark Allen, Ph.D. (“Allen Depo.”)

7. My opinions are additionally guided by my appreciation of how a person of ordinary skill in the art would have understood the claims of the ’184

patent at the time of the alleged invention, which I have been asked to assume is September 9, 2011.

III. Understanding of Legal Principles

8. I am not an attorney. However, I have been informed by counsel of certain legal standards and have applied those standards, described in Exhibit 1003, in formulating my opinions.

IV. Claim Construction

9. Claim 1 of the '184 patent recites “at least one magnetic field sensor.” '184 Patent Cl. 1. In my first declaration, I applied the plain meaning of this term, as the words would be understood to a Person of Ordinary Skill (POSA) in the art in the context of the '184 patent.

10. I understand from counsel that WiTricity has suggested the term “at least one magnetic field sensor” requires the use of “*external* magnetic fields” to sense the presence of objects. I disagree with this interpretation. A POSA would understand from the component words of the term that the plain meaning of “magnetic field sensor” is a device that senses magnetic fields or changes therein. There is no requirement that the sensed field be *external* – the term encompasses a sensor that produces its own magnetic field, and then senses objects by detecting parameter changes within that produced magnetic field.

11. ***First***, nothing in the '184 patent would convey to a POSA that a “magnetic field sensor” is required to sense external magnetic fields. The examples of sensors in the '184 patent are described as “exemplary and non-limiting,” and therefore would not define or limit a POSA’s understanding of the term “magnetic field sensor.” '184 Patent at 5:45-28, 7:60-8:4. Even the non-limiting examples that are provided do not state that the system must sense external magnetic fields, but only that “sensors” can “measur[e] small changes in the magnetic field in the proximity of the FOD objects.” '184 Patent at 5:25-28; 2:20-26 (“measur[ing] perturbations in the magnetic field around the resonators of a wireless energy transfer system using magnetic field sensors and/or gradiometers”); 5:34-38 (“local disturbances in the magnetic field caused by the presence of FOD may be detected by measuring magnetic field changes ... in the vicinity of the FOD”). A POSA would understand that the type of sensor that generates its own magnetic field, and then senses changes in that field to detect the proximity of foreign objects, falls within these examples.

12. I further note that the specification of the '184 patent uses the technical term “gradiometer” to describe a specific type of sensor that detects variations in externally-generated magnetic fields. '184 patent at 2:42-53, 5:64-6:5. The fact that the claims of the '184 patent use the broader term “magnetic field sensor,” as opposed to the more specific technical term “gradiometer,” further

confirms to a POSA that the term “magnetic field sensor” is broad enough to encompass any device that utilizes a magnetic field for sensing, and not just those devices that work in the same manner as a gradiometer.

13. ***Second***, the textbooks that Dr. Horenstein relies on further confirm that there is no “external” requirement to the term “magnetic field sensor.” For example, Chapter 4 of Electrical Sensors and Transducers by James Carstens (Ex. 2007) is dedicated to “understand[ing] the theory and operation” of “magnetic field-sensing devices,” which it describes as “those sensors that ***either use or interact with a magnetic field*** to cause the sensor to operate,” with no requirement that the magnetic field be external. Ex. 2007 at 119. A POSA would understand the term “magnetic-field sensing devices” to be equivalent to the claimed “magnetic field sensors,” and thus would understand that this term encompasses any sensors that “either use or interact with a magnetic field to cause the sensor to operate.” Ex. 2007 at 119.

14. ***Third***, I understand from counsel that Patent Owner suggested that, in my deposition, I stated that an eddy-current sensor or inductive proximity sensor that generates its own magnetic field would not be considered a “magnetic field sensor.” That is not the case. As shown below, I explained that although some may not consider an eddy current sensor to “directly sens[e] a magnetic field,” it nonetheless “generates a magnetic field in the presence of a conductor that is then

sensed,” making it a “magnetic field sensor” even if it only provides an “indirect measure” of the magnetic field.

Q. And with regard to inductive proximity sensors, are there any inductive proximity sensors, in your opinion, that do not constitute a magnetic field sensor?

A. So an Eddy-current sensor, I suppose, could be something loosely like that. Although instead of directly sensing a magnetic field, it *generates a magnetic field in the presence of a conductor that is then sensed*. So it's sort of an indirect measure.

Ex. 2015 33:13-21.

I have maintained throughout my declarations and my deposition that an inductive proximity sensor, including the type that detects eddy currents, is a magnetic field sensor. Ex. 1003 ¶ 121.

15. The Lenz article that I relied on in my last declaration, titled “A Review of Magnetic Sensors,” further confirms this. Lenz, which is a list of “the most common technologies used for magnetic field sensing,” discusses a “search-coil magnetometer” that, when constructed in “active mode,” operates under the principle that “conductive materials near the active coil will have eddy currents induced, which will produce a mutual inductance change in the circuit.” Ex. 1022 at 973-975. This confirms a POSA’s understanding that this arrangement is considered a “magnetic field sensing” device and a “magnetometer,” despite

relying on eddy currents induced from an active coil, rather than external magnetic field.

16. Accordingly a POSA would understand that the plain and ordinary meaning of the term “magnetic field sensor” is *not* limited to devices that detect externally-generated magnetic fields, but covers any sensor that uses or interacts with a magnetic field to operate. *See* Carstens (Ex. 2007) at 119.

17. Regardless, as I explain further below, Fells discloses a “magnetic field sensor” under both the plain and ordinary meaning, and Patent Owner’s incorrect construction.

V. Ground 1: Claims 1, 8, and 11 are Obvious Over Fells

A. Fells Teaches a “Magnetic Field Sensor”

18. As discussed in my first declaration, Fells teaches a “magnetic field sensor” in the form of a “proximity detector.” Fells [0288]; Ex. 1003 ¶117. The proximity detector can be constructed using either a “Hall Effect sensor” or “an inductive proximity sensor.” Fells [0288]-[0289]; Ex. 1003 ¶¶117-121.

19. I understand Dr. Horenstein agrees that a Hall Effect sensor is a “magnetic field sensor.” Horenstein Dep. (Ex. 1038) 34:15-21.

20. Dr. Horenstein argues that an “inductive proximity sensor” as described in Fells is not a “magnetic field sensor.” I disagree with this interpretation, for three reasons.

21. ***First***, Dr. Horenstein's analysis focuses on one particular way of constructing an inductive proximity sensor: "a sensing coil that is part of an LC resonant circuit," which "produces a magnetic field and responds to changes in its inductance values caused by metallic objects." Horenstein Decl. (Ex. 2005) ¶ 35. While this is one way to construct an inductive proximity sensor, a POSA would have understood that the "inductive proximity sensor" taught in Fells could be constructed in many different ways, and is not limited to this specific type of construction. Fells does not say that it uses a sensing coil as part of an LC resonant circuit – it says only that "an inductive proximity sensor could be formed using another coil in the wireless power supply that is independent of the coil used to transfer power," and that "[t]here are a number of different ways of implementing the proximity detector," including using "any sensor capable of detecting presence of an object within proximity of the primary unit." Fells [0289]-[0290].

22. One type of "inductive proximity sensor," which a POSA would have been familiar with and understood to be encompassed by Fells' reference to an "an inductive proximity sensor," is called an inductive pickup coil. Carstens explains, as a POSA would have known, that such an inductive coil was "used primarily as a proximity sensor," and that "it is relatively easy to use this type of device for a proximity sensor." Carsten (Ex. 2007) at 130. "[A] typical installation as a proximity switch" of this type of device "would be virtually identical to that of the

Hall effect detector” – the other type of proximity detector expressly called out by Fells. Carsten (Ex. 2007) at 132; Fells [0289]. Accordingly, a POSA would have understood that this device was connected to the remaining circuitry of Fells in the same manner as the inductive proximity sensor and Hall Effect sensor I previously described. Ex. 1003 ¶¶119-135.

23. A POSA would have understood that if Fells’ inductive proximity sensor was constructed as an inductive pickup coil, it would be a magnetic field sensor under both the plain and ordinary meaning and Patent Owner’s incorrect definition. Carstens explains that an “inductive pickup coil” is a “magnetic field-sensing device[]” that “generates a current proportional to the change in flux of a magnetic field.” Carstens (Ex. 2007) at 130. Rather than generate its own magnetic field, this type of sensor “is used to sense the presence of a magnetic field” (which a POSA would understand to mean an external field) and “when used by itself, is used primarily as a proximity sensor.” Carstens (Ex. 2007) at 129-133. I understand that Dr. Horenstein agrees that an inductive pickup coil is a magnetic field sensor, even under his definition. Horenstein Dep. (Ex. 1038) 34:22-35:4.

24. A POSA would have understood not only that Fells’ disclosure of an “inductive proximity sensor” taught the well-known inductive pickup coil proximity sensor, but that this type of inductive proximity sensor was particularly well suited to Fells’ design, given its ease of use and similarity to Hall Effect sensor

circuits. Carsten (Ex. 2007) at 130-132. By contrast, the “LC resonant circuit” version of an inductive proximity sensor that Dr. Horenstein discusses—while also encompassed by Fells’ teachings—is the type of sensor that would be used “for the detection of minerals in the earth” in a metal detector, and so is not the type that would first spring to mind for a POSA reading Fells. Carstens (Ex. 2007) at 250.

25. ***Second***, even if Dr. Horenstein were correct that Fells’ disclosure of an “inductive proximity detector” is limited to the specific construction of “a sensing coil that is part of an LC resonant circuit” which “produces a magnetic field and responds to changes in its inductance values caused by metallic objects,” that would still constitute a magnetic field sensor under the plain and ordinary meaning of the term. As Dr. Horenstein agrees, this type of proximity sensor “rel[ies] on magnetic principles” and detects objects by “produc[ing] a magnetic field and respond[ing] to changes in its inductance value caused by metallic objects.” Horenstein Decl. (Ex. 2005) ¶ 83. In other words, the mechanism of action of this type of sensor is to create a magnetic field, and then respond to the changes in that magnetic field that are indicative of the presence of a foreign metallic object. That makes it, as a POSA would understand, a magnetic field sensor.

26. The textbooks cited by Dr. Horenstein further confirm that the specific type of inductive proximity detector he addresses operates by responding to changes in magnetic fields. The mechanism of operation is that:

Th[e sensor] generates an alternating magnetic field ... [W]hen a metallic object enters the proximity of the magnetic field, eddy currents are created within the object through electromagnetic induction (Faraday's law). The eddy currents in the object create a magnetic field that opposes the original magnetic field produced by a coil (Lenz's law). As a result, voltages are induced back in the coil that oppose the original oscillating voltage.

Staugaard (Ex. 2008) at 8-25. Thus, as a POSA would understand, this is a magnetic field sensor because it detects when an object “enters the proximity of the magnetic field” and does so by detecting “a magnetic field” created by “eddy currents in the object.” Staugaard (Ex. 2008) at 8-25; Petruzella (Ex. 2009) at 102 (sensor operates by “generat[ing] a high frequency electromagnetic field” and detecting “when a metal object enters the field”); Rabiee (Ex. 2010) at 75 (sensor “detect[s] the presence of currents *induced by magnetic fields* to detect nearby metallic objects”); Carr (Ex. 2011) at 2011 (“sensors depend on changing a magnetic field surrounding a sensor element... when a metallic target is in the field of the coil, the magnetic field of the coil will induce eddy currents”)

27. **Third**, even if Dr. Horenstein were correct that Fells' disclosure was limited to the specific construction of a sensing coil that he relies on, that type of

sensor would constitute a magnetic field sensor even under Dr. Horenstein's "external" definition. This type of sensor generates a magnetic field, but when a foreign object enters the field, "eddy currents in the object *create a magnetic field that opposes the original field produced by the coil* (Lenz's law)." Staugaard (Ex. 2008) at 8-25. Thus, even in this case, the sensor is detecting an external field—the field generated by eddy currents within the foreign object—and not merely detecting the original magnetic field produced by the sensor coil. Staugaard (Ex. 2008) at 8-25; Rabiee (Ex. 2010) at 75 ("current flow in the object will in turn generate *another magnetic field that opposes the original magnetic field* ... this results in a change of inductance value of the coil in the sensor"); Carr (Ex. 2011) at 191 ("eddy currents *create a magnetic field around the target*, and this field will change the resistance component of the impedance of the sensor coil").

28. Dr. Horenstein suggests that because the above devices are sensitive to impedance change, they are not measuring magnetic fields. I disagree. As I explained in my original declaration, inductors respond to changes in magnetic fields. Nilsson (Ex. 1024) at 174. Thus, as a POSA would understand, measuring changes in inductance is a method of measuring changes in magnetic fields. *See* Lenz (Ex. 1022) at 975 (describing "inductively coupled proximity sensor" as a "magnetometer" within list of "common technologies used for magnetic field sensing").

29. For all of the above reasons, as well as those described in my original declaration, a POSA would understand that Fells “inductive proximity sensor” teaches the claimed “magnetic field sensor.”

B. Fells Teaches The Magnetic Field Sensor “Positioned Within The Magnetic Field of the Wireless Energy Transfer System”

30. As discussed in my first declaration, regardless of whether Fells’ proximity detector is constructed as a Hall Effect sensor or an inductive proximity sensor, a POSA would understand that the detector is positioned within the magnetic field of the wireless energy transfer system. Ex. 1003 ¶¶130-133.

31. I understand that Dr. Horenstein contends that Fells’ proximity detector would be positioned “outside of (but in proximity to) the magnetic field.” Horenstein Decl. ¶ 101. I disagree.

32. **First**, Dr. Horenstein’s opinion is contrary to Fells’ disclosure. As Dr. Horenstein admits, in his interpretation of Fells, because the proximity detector is not “positioned *within* the magnetic field of the wireless power supply,” it cannot detect foreign objects that are placed “on or over” the wireless power supply, within the magnetic field. Horenstein Decl. (Ex. 2005) ¶ 98. Thus, in Dr. Horenstein’s interpretation, the proximity detector essentially has a blind spot in the entire area of the magnetic field of the wireless power supply.

33. Fells, however, teaches that its proximity detector can detect not just if “a device or foreign object has been placed in the vicinity of the wireless power

supply,” but also “if a device or foreign object *is removed from the wireless power supply*.” Fells [0288]. As a POSA would understand, this teaches that the detected area includes the area of the wireless power supply itself, and not merely the surrounding area. Other portions of Fells repeatedly make clear that the sense circuit (of which the proximity detector is one example) can sense the presence of objects not merely when they are near the wireless power supply, but also when they are placed specifically on or removed specifically from the wireless power supply (i.e., providing detection within the magnetic field). Fells [0194]-[0195] (if “the foreign object has been *placed on* the wireless power supply 200, an inductance change will be detected”), [0248] (checking whether “a foreign object 1818 *is placed on* the wireless power supply”), [0250] (“the Sense Circuit 206 periodically looks for a change 1912 indicating a device or object may have been *placed on* or *removed from* the charger”), [0259] (“inductance would change if a portable device ... was *placed on* the wireless power supply”), [0267]-[0268] (“device or metal object is *placed on* the wireless power supply”).

34. Moreover, a POSA would have understood that even where Fells uses the phrase “in the vicinity of the wireless power supply,” this means the area within the magnetic field itself. Fells incorporated by reference the Stevens patent as an example of how to perform foreign object detection. Fells [0192]. Stevens explains that “[i]n the operating mode, the primary coil 12 generates an

electromagnetic field in the vicinity of the primary unit.” Stevens (Ex. 1016) at 24:26-28. Thus, “the vicinity of the primary unit” would be understood to mean the area in which the coil “generates an electromagnetic field.” *Id.* Other passages of Stevens confirm the same. 1:10-18, 2:8-10 (items in “proximity with the primary coil” will “coupl[e] to the coil”), 4:1-12 (the area “in proximity to the primary unit” is where “power can be received inductively by the secondary device”), 17:12-26 (“induced electromagnetic field in the proximity of the primary coil ... electromagnetic field generated by the primary unit ... in proximity to the primary unit”); Fells [0192] (incorporating Stevens by reference).

35. These passages confirm that Fells does not have the blind spot Dr. Horenstein describes. As a POSA would understand, and Dr. Horenstein does not dispute, the only way for the proximity detector to provide detection on or over the area of the wireless power supply is for the detector to be placed within the magnetic field of the wireless power supply. Thus, the only interpretation that is consistent with Fells’ repeated disclosures is that the proximity detector is placed within the field of the wireless power supply.

36. Dr. Horenstein’s interpretation of Fells is also contrary to Fells’ stated purpose, which is to “detect the presence of foreign objects which could adversely affect operation,” particularly in those areas in which “foreign objects ... would get hot or hinder power transfer” or “otherwise interfere with the system.” Fells at

[0002], [0189]. As a POSA would have understood, the area that is the biggest concern for the presence of foreign objects is the area on or over the wireless power supply. That is where the strongest magnetic field exists during wireless power transfer, and therefore is the area where a foreign object presents the biggest concern of “get[ting] hot or hinder[ing] power transfer.” Fells [0002]; Stevens 15:8-20 (“foreign objects” that are “placed in proximity with the primary coil” will “have eddy currents induced therein ... which will cause heating of the object”). The area on or over the wireless power supply (i.e. within its magnetic field) is also the area where the proximity of any object – even non-foreign objects – is most relevant, because it is where the device to be charged will arrive. The presence (or lack thereof) of a device at this location must be sensed in order to know whether a device is present that requires charging.

37. The Stevens patent, which is incorporated by reference into Fells, depicts this plainly:

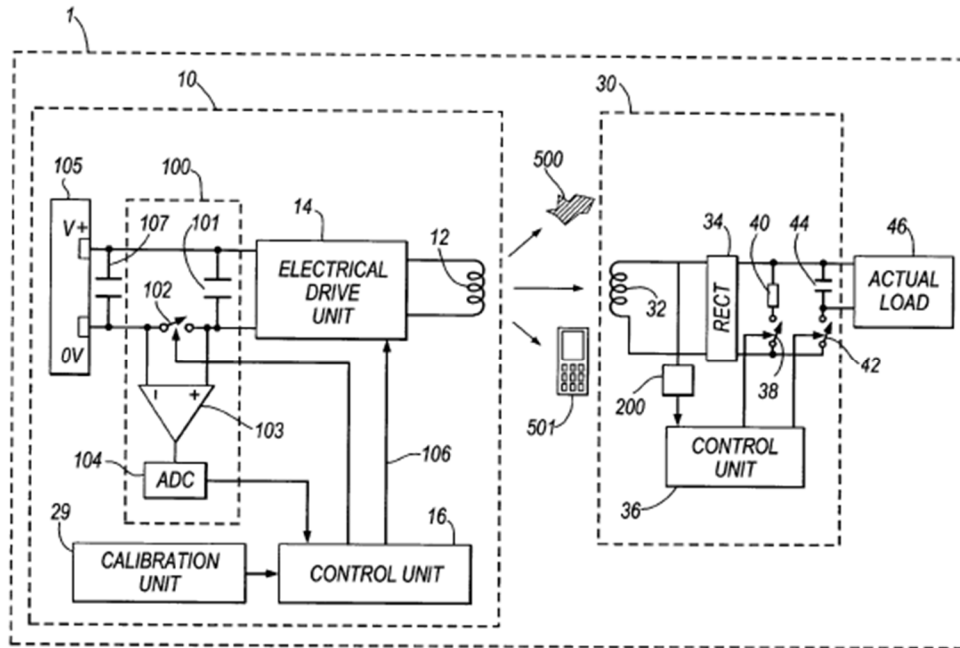


Fig.4

Stevens (Ex. 1016) at Fig. 4. In this figure, foreign object 500 is a “foreign object placed in the vicinity of the primary unit,” which presents a “parasitic load 500 on the primary unit” – confirming that during operation, the foreign object is within the magnetic field of the primary coil. Stevens 21:13-20. A POSA would not interpret Fells in a manner that *does not detect foreign objects in the area shown*, as Dr. Horenstein does, because that would contradict Fells’ teaching that “foreign objects may be detected using a method disclosed in [Stevens] which is incorporated herein by reference”). Fells at [0192].

38. **Second**, a POSA would not agree with Dr. Horenstein’s interpretation of Fells because the result would be a system that generates numerous false positives and false negatives. As Dr. Horenstein concedes, by placing the

proximity detector outside of the magnetic field of Fells' power supply, "the proximity detector may falsely trigger on an object" that was not going to encroach on Fells' magnetic field. Horenstein Decl. (Ex. 2005) ¶ 101. As a POSA would recognize, this would cause Fells' system to wake up from low power mode unnecessarily, closing the switch and providing mains power to the Control element, the Energy Storage element, and other components. Fells [0191]. Although it is true that Fells will not operate its primary resonator in response to this false positive (because there is a further check for "whether there is a valid device present"), this false positive nonetheless wastes power by unnecessarily powering on the mains and the control element, contrary to Fells' stated goal of "reducing power consumption."

39. Even more concerningly than the false positives, a POSA would not agree with Dr. Horenstein's interpretation of Fells because it would generate significant false negatives. If Dr. Horenstein were correct that the proximity detector is placed outside of the magnetic field of the primary coil, and therefore does not detect the area of the primary coil, then an approaching device could reach Fells' wireless power supply without ever being detected by the proximity detector. For example, if the proximity detector were placed "off to the side" of the primary coil's magnetic field, as Dr. Horenstein claims, then an object that approached

Fells' primary coil from the opposite side as the detector would not be detected.

Dr. Horenstein admitted this would be a problem:

Q. Sure. But isn't it possible that the foreign object is approaching from the opposite side, where the proximity detector is not located, and, therefore, it will enter the field of the primary coil before being detected by the proximity detector?

A. That is possible.

Q. Wouldn't that be a problem for Fells?

A. If a foreign object came in from a place where there isn't a detector, that would be a problem.

Horenstein Dep. 81:8-82:11. If the proximity detector/sense circuit does not detect an approaching object, then the system will remain in Ultra Low Power mode, will not connect to main power, and will not activate the Control element or the resonator to provide power. Fells [0191]. The entire charging system would become non-functional, unaware that there was a device sitting on the primary coil waiting to be charged. Fells [0191]. A POSA would not interpret Fells' disclosure in a manner that leaves this gaping hole in its functionality.

40. **Third**, Dr. Horenstein argues that when Fells describes its Hall Effect sensor as producing "a change in voltage in response to a change in magnetic field," this "magnetic field" is not the magnetic field produced by Fells' wireless power supply, but a magnetic field produced by the ferrite core of an approaching portable device to be charged. Horenstein Decl. (Ex. 2005) ¶ 96. I disagree. For

one, even if Dr. Horenstein were correct about this particular sentence, a POSA would still understand that Fells discloses its proximity sensor to be within the magnetic field of the wireless power supply in order to perform functional and accurate detection, as I describe above. But Dr. Horenstein is not correct. Fells does not describe an approaching portable device as generating or producing a magnetic field, but only describes it as “altering” an already-existing magnetic field. Fells [0289]. The only discussion in Fells of generating a magnetic field describes “the field generated” by the primary coil for “power transfer,” which a POSA would understand to be referring to the magnetic field generated by Fells’ wireless power supply. Fells [0295]. Thus, a POSA would understand Fells to be describing that the Hall Effect sensor is within the magnetic field generated by the wireless power supply – which can be altered by an approaching portable device – not that the sensor is within the field only of the approaching portable device.

41. ***Fourth***, I understand that at his deposition, Dr. Horenstein testified that his view of where the magnetic field of Fells’ wireless power supply exists assumes that “the magnetic field between L_p and the secondary coil ... would be principally on the axes of those two coils,” and therefore limited in range. Horenstein Dep. (Ex. 1038) 64:14-65:7. A POSA would not agree with this. Fells expressly states that “the field generated may be perpendicular or parallel or any other orientation with respect to the power transfer surface” and “the coil axes may

be parallel or perpendicular to the power transfer service.” Fells [0295]. Thus, Fells discloses all possible orientations of coil axes and magnetic fields, including those orientations in which the magnetic field expands outward and encompasses the proximity detector. Fells [0295].

42. ***Fifth***, Dr. Horenstein claims that “a POSA would not have positioned Fells’ proximity detector within the magnetic field of the wireless power supply, because the proximity detector would become a foreign object that Fells seeks to detect and avoid.” Horenstein Decl. (Ex. 2005) ¶ 99-100. I disagree. A POSA would not have considered Fells’ proximity detector—a key component of Fells’ power transfer system—to be a “foreign object.” A POSA would have been familiar with wireless power transfer systems that have components within the field of the wireless power supply, without cause for alarm or error, and would have interpreted Fells in that same manner.

43. By definition, Fells’ proximity detector would not be a “foreign object” because it is not foreign – it is a known and accounted-for component of Fells’ detection system. Fells [0288], Fig. 40. Fells repeatedly distinguishes between “the wireless power supply 200” and its components on the one hand, and “a foreign object” on the other hand. Fells at [0194], [0196] (differentiating between “the system,” “a foreign object,” and “a valid device”), [0248] (same),

[0251] (same), [0253] (same). A POSA would therefore understand that components of “the system” are not foreign objects.

44. To the extent Dr. Horenstein suggests that having the proximity sensor within the magnetic field of Fells’ wireless power supply would cause operational problems for Fells’ system, that is not correct. Fells already describes that other sensors or coils can be located in the magnetic field of the primary coil, without causing issue or being detected as foreign objects. For example, one embodiment has “a few turns of a sense coil” wound “around each primary coil” – but the presence of the sense coil in the magnetic field of the primary coil is not detected as a foreign object and does not interfere with Fells’ system. Fells [0283].

45. As another example, Fells teaches to use the foreign object method detection taught in Stevens. Fells [0192]. Stevens, in turn, explains that the system can effectively provide wireless charging even if there is a “friendly parasitic load” or “host object” – i.e. a non-foreign component that is desired to be present, but is nonetheless within the magnetic field of the wireless power supply and must be accounted for. Stevens 21:13-20; Fig. 4 (showing friendly parasitic load as an “electronic device” that is desired to be present).

46. Stevens explains, as a POSA would have known, that “friendly parasitic load[s]” such as “electronic device[s]” can be distinguished from “parasitic load[s] ... caused for example by a foreign object.” Stevens at 21:13-

20. The calculation made to determine whether foreign objects are present accounts for “any parasitic load 501” (i.e., “friendly” parasitic load) that comes from, among other things, “the primary unit itself.” Stevens 25:25-31; *see also* Stevens 27:13-25 (“the detection of parasitic loads 500 from foreign objects is not influenced by the number of [other] devices present”); 27:35-28:8 (further accounting for “friendly parasitics”); 32:12-30 (“The primary unit can deduce the total ‘friendly parasitic load’” and account for this in charging).

47. As a POSA would understand, this calculation accounts for any components of the wireless power transfer system that may be within the magnetic field, even if they result in parasitic losses, and does not treat them as “foreign objects” or allow them to interfere with the system. A POSA would have implemented this approach in Fells, as Fells instructs via its incorporation of Stevens. Fells [0192]. Therefore the presence of a proximity detector within the magnetic field of Fells’ power supply would not be treated as a “foreign object” and would not impede the functionality of Fells.

48. Moreover, as a general rule, a POSA would understand that a sensor configured to detect an anomalous condition is not going to detect itself. That would render nearly all such sensors useless for their intended purpose. So Dr. Horenstein’s suggestion that Fells’ system would detect its own proximity detector as a foreign object is misguided. Dr. Horenstein appears to suggest that some other

component of Fells performs foreign object during wireless charging, and that this other component could detect the proximity sensor, but that is not necessarily the case. Fells teaches that “the control element 208 in the wireless power supply determines ... whether there is a foreign object present.” Fells [0191]. But the control element does not, itself, contain any separate sensor or coil. Fells [0191]. Thus, even when the control element is making the foreign object check, a POSA would understand that this is performed, at least in some embodiments of Fells, using the sensors or coils of the proximity detector (or other sense circuit), along with additional logic. Fells [0192]-[0196] (explaining that the sense circuit is used to conduct foreign object checks). Contrary to Dr. Horenstein’s interpretation of Fells, the proximity detector is not going to detect itself as a foreign object.

49. For all of the above reasons, as well as those described in my original declaration, a POSA would understand that Fells’ proximity sensor (both in the case of an “inductive proximity sensor” and a “Hall Effect sensor”) is positioned within the magnetic field of Fells’ wireless power supply.

C. Fells Renders Obvious The Magnetic Field Sensor “Positioned Within The Magnetic Field of the Wireless Energy Transfer System”

50. As discussed in my first declaration, to the extent Fells does not teach that its proximity detector (whether a Hall Effect sensor or an inductive proximity

sensor) is positioned within the magnetic field of the wireless power supply, it would have been obvious to place it there. Ex. 1003 ¶¶ 134-135.

51. This would have been obvious for all of the reasons that I described in the prior section of this declaration, which I re-incorporate here.

52. In sum, placing the proximity detector within the magnetic field of the wireless power supply would have been obvious because it is the only sensor positioning that would allow Fells' system to detect objects within that magnetic field. If the proximity detector were not within that magnetic field, Fells would be subject to false negatives: it would be unable to detect objects that are placed on or over the wireless power supply, significantly hindering operation of the charging system. Thus, an obvious way to accomplish Fells' stated goal of detecting objects that are "placed on" or "removed from" the wireless power supply is to place the proximity detector in the magnetic field of the wireless power supply, thereby providing object detection in that area. Fells [0288], [0194]-[0195].

53. By placing the detector within the magnetic field of the wireless power supply, Fells' system would monitor the most critical area of the invention: the area directly over the wireless power supply, where magnetic fields are the strongest and there is the highest likelihood that a stray foreign object "would get hot or hinder power transfer" or "otherwise interfere with the system." Fells [0002]. The area within the magnetic field of the wireless power supply is also the

most critical place for detection of non-foreign objects, because it is the location where portable devices reside for charging. Fells [0191]. If Fells' system cannot monitor the area of the wireless power supply, then it cannot tell whether or not a device is present there, which creates a significant concern of false negatives: a device needing charging could be sitting on the power supply, but Fells' system has not detected it and is not operational. Placing the proximity detector within the field of the wireless power supply allows for detection at the point of the wireless power supply, removing this possibility of false negative detections.

54. A POSA would know how to place Fells' proximity detector within the magnetic field of the wireless power supply, and would have a reasonable expectation of success in doing so, because Fells already describes how to create and utilize its proximity sensor, and this operation would not need to be changed to merely position the proximity detector within the magnetic field. Fells [0288]-[0290], Fig. 40. As previously described, a POSA would have been familiar with wireless power transfer systems that have some electronic components within the primary magnetic field, and it would have been within a POSA's skill to implement Fells' system in this manner while accounting for any electromagnetic loss as a result of the proximity detector, while still providing wireless power transfer and without the sensor being detected as a foreign object.

VI. Ground 2: Fells and Cook Render Obvious Claims 2-7, 9-10, and 16**A. Fells Teaches a “health and/or status check”**

55. As discussed in my first declaration, Fells teaches two different “health and/or status check[s]”: a “sense circuit calibration” check, and a status check of the energy storage element. Ex. 1003 ¶¶183-196, 225-227. These are checks “of the wireless energy transfer source” (as required by claims 4-6) and also checks “of a source resonator” (as required by claim 16).

1. Sense Circuit Calibration

56. I understand that Dr. Horenstein argues that the sense circuit calibration is only performed in the Figure 2 embodiment of Fells, and not in the Figure 40 embodiment. I disagree.

57. With respect to Figure 2, Fells describes that “the sense circuit 206 detects that an object has been placed on (or in proximity to) the wireless power supply.” Fells [0191]. Fells then describes the “sense circuit calibration,” also called a “calibration inductance measurement,” as being performed by the sense circuit in order to set a baseline inductance status to determine whether or not the sense circuit should activate. Fells [0196].

58. Figure 40 of Fells is described as “an embodiment of Fig. 2 using a proximity sensor.” Fells [0182]. Specifically, Fells explains that “in the embodiment illustrated in Fig. 40, a sense circuit that acts as a proximity detector 4002 is used to initially detect that a device or foreign object has been placed in

the vicinity of the wireless power supply.” Fells [0288]. This confirms to a POSA that Fig. 40 utilizes the same functionality as Figure 2, the primary difference being that the “sense circuit” is a “proximity detector” (i.e. it can be an “inductive proximity sensor” or a “Hall Effect sensor”). Fells [0288]-[0289]. Because the sense circuit performs the sense circuit calibration as described for Figure 2, a POSA would understand that the proximity detector (which is just a version of a sense circuit) performs that same calibration with respect to the version of Fells’ system shown in Figure 40. This is particularly true, for example, for the inductive proximity sensor described in Fells, given that the sense circuit calibration is described as a “calibration inductance measurement,” which this proximity sensor would perform.

59. I understand that Dr. Horenstein argues there are differences between Fells’ Fig. 40 and Fig. 2, including the way the sense circuit is connected to the main power or primary coil. None of these differences change my opinion that Fig. 40 performs the sense circuit calibration. The sense circuit/proximity detector remains electrically connected to, and part of the same circuit as, the rest of Fells’ components including the primary coil. And, as described above, Fells describes Fig. 40 as merely a variant of Fig. 2, with no relevant distinctions between their functionality.

60. For this reason, to the extent my prior declaration (or this declaration) uses the word “sense circuit” when describing Fells with respect to claims 4-6, I intended this to include Fells’ proximity detector (whether as Hall Effect sensor or inductive proximity sensor), which performs the same functionality in the context of the Fig. 40 version of Fells.

61. I understand that Dr. Horenstein further contends that the sense circuit calibration is not a health and/or status check “of the wireless energy source” or “of the resonator.” I disagree.

62. As I explained in my prior declaration, Fells’ “wireless power supply 200” corresponds to the claimed “wireless energy transfer source.” Ex. 1003 ¶103. The “sense circuit” is a component of the “wireless power supply,” and therefore a component of the claimed wireless energy transfer source. Fells [0191], Fig. 2, Fig. 40. Thus, a POSA would understand that checking and calibrating the sense circuit constitutes checking the health and/or status of the wireless energy transfer source, of which the sense circuit is a component.

63. The sense circuit calibration is also a check of the health and/or status “of a source resonator.” The sense circuit calibration requires “perform[ing] a calibration inductance measurement” and the check of “mak[ing] sure that the calibration measurement is a valid one and not a rogue measurement.” Fells [0196]. This calibration is what allows the sense circuit to accurately detect the

presence of incoming objects, whether foreign objects or devices to be charged. Fells [0196]. If the sense circuit is not calibrated correctly, or does not have a valid calibration measurement, then the sense circuit will not accurately detect the presence of an approaching object. Fells [0196]. In that case, the sense circuit will not close switch “SW1”, which is what “allow[s] the circuits in the wireless power supply 200 to receive power.” Fells [0191]. If the switch is not closed, then even if a device to be charged approaches Fells’ charger, the resonator will not turn on to provide charging. Fells [0191]. Thus, the calibration inductance measurement and the check of “mak[ing] sure that the calibration measurement is a valid one” is a status check “of a source resonator” because Fells’ resonator will not turn on or function if that calibration check or measurement is non-functional or returns an invalid result. A functional and calibrated sense circuit is a necessary precondition to the resonator operating.

64. The sense circuit calibration is also a status check “of a source resonator” because the resonator itself (primary coil) can be used to measure the baseline inductance to perform the check. Fells teaches “numerous .. techniques that may be employed” to “implement the sense circuit,” including that “the sense coil 206 uses the same coil for detection as used for the transfer of power, Lp 212.” Fells [0259]. The primary coil is then used for sensing and calibration: “the inductance seen across Lp 212 changes ... if a portable device ... was placed on

the wireless power supply” or “a metal object or an object containing magnetic material was placed in proximity to the primary coil.” Fells [0259]; Fells [0196] (primary coil forms resonator and measures inductance to perform sense circuit calibration.” Thus, the sense circuit calibration is a status check “of a source resonator” because the resonator itself – primary coil Lp 212 – is used to perform the check.

2. Energy Storage Element Check

65. I understand that Dr. Horenstein contends that Fells’ check of the “energy storage” element is not a health and/or status check “of the wireless energy transfer source” or “or the resonator.” I disagree.

66. Fells discloses that the sense circuit “periodically monitors the energy in the energy storage element,” and that the system may provide a signal “indicative of the energy level of the energy storage element” as “an output.” Fells [0245]-[0246], Fig. 40. This monitoring of the energy level of the energy storage element is a check of the health and/or status “of the wireless energy transfer source,” because the energy storage element is part of the wireless energy transfer source. As I explained in my prior declaration, Fells’ “wireless power supply 200” corresponds to the claimed “wireless energy transfer source.” Ex. 1003 ¶103. The “energy storage element” is a component of the “wireless power supply,” and therefore a component of the claimed wireless energy transfer source. Fells [0191],

Fig. 2, Fig. 40. Thus, a POSA would understand that checking the status of the energy storage element constitutes checking the status of the wireless energy transfer source, of which the energy storage element is a component.

67. Fells' check of the energy level of the energy storage element is also a health and/or status check "of a source resonator" because Fells' resonator cannot turn on unless the energy storage element has sufficient energy. If the energy storage element has "deplete[d] fully," it will "prevent[] operation of the sense circuit." Fells [0246], [0191] ("The sense circuit 206 takes its power from the energy storage element"). If the sense circuit does not operate, it cannot close switch "SW1", which is what "allow[s] the circuits in the wireless power supply 200 to receive power." Fells [0191]. If the switch is not closed, then even if a device to be charged approaches Fells' charger, the resonator will not turn on to provide charging. Fells [0191]. Thus, the energy level of the energy storage element indicates the current health or status of the resonator: if the energy level is depleted, the resonator's status is that is it not currently capable of functioning to provide charging. In this sense, a successful energy storage element check (and a functional sense circuit, generally) are necessary preconditions to the operation of Fells' resonator. Fells [0191].

VII. Ground 3: Fells and Ono Render Obvious Claim 12

68. As discussed in my first declaration, Fells teaches “an enclosure housing at least a portion of the wireless energy transfer source, wherein the foreign object debris detection system is integrated into the enclosure.” In the alternative, this would have been obvious to a POSA in view of Fells and Ono. Ex. 1003 ¶¶245-249.

69. I understand that Dr. Horenstein argues that the dotted lines in Fells’ diagrams do not indicate integrated enclosures, based on Figure 7 of Fells. I disagree.

70. As I previously explained, a POSA would have understood that the dotted lines in Fells’ diagrams indicate an “integrated” system that a POSA would have understood to be logically implemented within a single enclosure encompassing the components within those dotted lines. Ex. 1003 ¶ 246. Nothing about Figure 7 of Fells changes my opinion. Figure 7 shows a “ULP circuit” 700 in one dotted line box, and a “main circuit” 704 in a second dotted line box. Fells Fig. 7. That is consistent with a POSA’s understanding that the components of Figure 7 can be – and are shown to be – in two separate enclosures connected by wires. The fact that the two circuits are connected by an “input port” and an “output port” confirms that they are in separate enclosures and not, for example, on the same circuit board. Fells [0206]. The fact that main circuit 704 is called a

“main circuit board” is wholly consistent with my opinion. Fells [0236]. A POSA would understand that the primary enclosure can have a main circuit board, while the separate ULP enclosure can have a separate circuit board. Fells further describes, for example, that the “main circuit board” can be connected by socket to a separate “very small” circuit “integrated into a plug,” which confirms the existence of two separate enclosures: the circuit within the wall plug, and the main circuit in a separate primary enclosure. Fells [0236].

71. I understand that Dr. Horenstein also argues that a POSA would understand this claim to require not just that the components be located within the same enclosure, but that “the foreign object debris detection system is united with the enclosure to form a functioning or unified whole.” I do not agree. A POSA would not understand what this means, let alone view it as the plain meaning of the claim term, because the phrase a “system ... united with the enclosure to form a ... unified whole” is unclear.

72. I understand that, at his deposition, Dr. Horenstein further explained his definition as requiring that “the disclosed sensing meshes are formed into the plastic housing the resonator” or “the sensors would actually have to be molded into the plastic housing of the resonator.” Horenstein Dep. (Ex. 2038) 116:14-117:17. Again, I do not agree. That is not the plain meaning of the words “integrated into the enclosure.”

73. There is no explanation of sensors formed or molded into plastic housing anywhere in the '184 patent. Rather, the '184 patent says that “a FOD Detector system (not shown) can be integrated into the system in a variety of places,” including being “integrated ... into the housings or enclosures of the source resonator and the like,” confirming that the term merely means that the various components are within the same housing or enclosure. '184 Patent 11:4-10. The specification further confirms that “integrating” refer to placing a component within a physical enclosure or space. '184 Patent 4:24-28 (“increasing a resonator size may not be practical owing to the ... desire to integrate a resonator into a system of a specified volume”). Thus, the only explanation of integration in the specification aligns with the way I have read the claims, not the way Dr. Horenstein does.

74. Dr. Horenstein relies on Merriam-Webster's dictionary, which also provides another definition of “integrate”: “to incorporate into a larger unit” or “to unite with something else.” Ex. 2014 at 4. In my opinion, this is the meaning of “integrate” that a POSA would understand the claim to be using in the context of the '184 patent. The claim language “an enclosure housing at least a portion of the wireless energy transfer source, wherein the foreign object debris detection system is integrated into the enclosure” would be understood to mean that the foreign

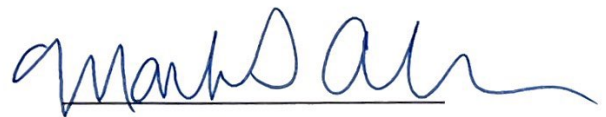
object debris system is “incorporated into,” and thereby “united with,” some portion of the wireless energy transfer source in a larger single enclosure.

75. Accordingly, a POSA would understand that the claim term “an enclosure housing at least a portion of the wireless energy transfer source, wherein the foreign object debris detection system is integrated into the enclosure” is met when the foreign object debris detection system is placed within the enclosure that houses at least a portion of the wireless energy transfer source. That is true in the combination of Fells and Ono. Ex. 1003 ¶¶ 247-249. The claim does not require any further “uniting” of the enclosure and the sensors, such as molding the sensors into the plastic of the enclosure.

VIII. Conclusion

All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true. Further, I am aware that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under penalty of perjury that the foregoing is true and correct.

Executed on Jan 27, 2025 (date), in Philadelphia, PA (city, state).

A handwritten signature in blue ink, appearing to read "Mark Allen", written over a horizontal line.

Mark Allen