Filed on behalf of: InductEV, Inc.

Entered: August 30, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INDUCTEV, INC.,
Petitioner,

v.

WITRICITY CORPORATION,
Patent Owner.

IPR2023-01182
Patent 8,461,719

DECLARATION OF MARK ALLEN IN SUPPORT OF PETITIONER'S REPLY

InductEV, Inc.
Exhibit 1036
InductEV v. WiTricity
IPR2023-01182

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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") concerning the validity of claims 16-17 of U.S. Patent No. 8,461,719 ("the '719 patent") (Ex. 1001).

2. I previously provided a declaration dated July 17, 2023, with my opinions related to the level of skill of ordinary artisans, the state of the art described in the '719 patent at the time of the effective filing date, and the disclosure of the prior art relative to the claims of the '719 patent. I understand that my original declaration was submitted as Exhibit 1003. I hereby incorporate Exhibit 1003 into this declaration by reference.

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

4. 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

5. 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 power transfer, I reviewed the following documents:

Ex. No.	Description
Paper 9	Institution Decision
Paper 22	Patent Owner's Response to Petition
1001	U.S. Patent No. 8,461,719 B2 ("'719 patent")
1002	File History for U.S. Patent No. 8,461,719 B2 ("'719 FH")
1005	U.S. Patent No. 8,855,554 B2 ("Cook-554")
1006	File History for U.S. Patent No. 8,855,554 B2 ("Cook Provisional" or "CProv")
1007	U.S. Patent No. 8,378,523 B2 ("Cook-523")
1008	U.S. Patent Application Publication No. US 2007/0145830 A1 ("Lee")
1009	International Patent Publication No. WO 2007/101902 A1 ("Pohjonen")
1010	Estill I. Green, *The Story of Q*, *in* 43 Am. Scientist 584 (W.J. Cunningham et al ed., (1955)) ("Story of Q")
1011	U.S. Patent No. 8,143,844 B2 ("Tamura")
1012	Frederick Emmons Terman, *Electronic and Radio Engineering* (4th ed. 1955) ("Terman")
1013	U.S. Patent No. 7,773,041 B2 ("Wang-041")
1014	U.S. Patent No. 7,623,078 B2 ("Wang-078")
1015	U.S. Patent No. 8,138,977 B2 ("Zhang")
1016	U.S. Patent No. 9,223,345 B2 ("Dabov")
1017	U.S. Patent Application Publication No. 2002/0153531 ("Levine")

Ex. No.	Description
1018	C. Yeh et al., *Dielectric Ribbon Waveguide--An Optimum Configuration for Ultralow-Loss Millimeter/Submillimeter Dielectric Waveguide*, prepared for Space Systems Division Airforce Command, by The Aerospace Corporation (Apr. 14, 1991) ("Yeh")
1019	U.S. Patent No. 9,774,086 B2 ("Cook-086")
1020	U.S. Patent No. 7,741,734 B2 ("Joannopoulos")
1021	U.S. Patent Application Publication No. 2009/0299918 A1 ("Cook-918")
1023	Kathleen O'Brien, *Inductively Coupled Radio Frequency Power Transmission System for Wireless Systems and Devices* (2007) (Ph.D. dissertation, Technische Universität Dresden ("O'Brien")
1024	File History for Patent Application No. 12/649,635 ("12/649,635 FH")
1025	File History for Patent Application No. 12/639,963 ("12/639,963 FH")
1027	U.S. Patent No. 7,599,743 B2 ("Hassler")
1028	U.S. Patent No. 8,446,045 B2 ("Smith")
1029	*Flat*, The American Heritage Dictionary of the English Language (4th ed. 2000)
1030	*Flat*, Concise Oxford American Dictionary (2006)
1035	Transcript of deposition of Mark Horenstein
2011	Declaration of Mark Horenstein
2012	Curriculum Vitae of Mark Horenstein
2013	Frederick Emmons Terman, *Radio Engineers' Handbook*
2014	Transcript of deposition of Mark Allen

Ex. No.	Description
2015	*Wiley Electrical and Electronics Engineering Dictionary*, IEEE Press

6. 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 '719 patent at the time of the alleged invention, which I have been asked to assume is September 27, 2008.

III. Legal Understanding

7. 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

8. Dr. Horenstein asserts that the term "network of capacitors" in claim 17 means "a circuit topology of passive components including one or more capacitors that provides two or more degrees of freedom." Horenstein Decl., ¶ 37. I disagree.

9. The plain meaning of "network of capacitors" uses the plain meaning of "network" and the plain meaning of "capacitors." The plain meaning of network includes an electrical circuit "connected together in some manner." Ex. 2013 at 197; *see also* Horenstein Decl., ¶ 37 (agreeing about the meaning of "network"). No special connection arrangement (i.e., topology) is needed for a

network. In other words, a network includes any circuit topology. Further, the term "capacitor" does not appear to be in dispute and does not need further construction—a POSA knows what a capacitor is. Hence, the plain meaning of "network of capacitors" is "any circuit topology including one or more capacitors."

10. The '719 patent expressly defines "network of capacitors" consistent with its plain meaning:

> It will be appreciated that ***a network of capacitors, as used herein***, may in general refer to ***any circuit topology including one or more capacitors***, including without limitation any of the circuits specifically disclosed herein using capacitors, or any other equivalent or different circuit structure(s), unless another meaning is explicitly provided or otherwise clear from the context.

'719 patent, 52:32-38 (emphasis added). Dr. Horenstein agrees that this passage is the intended definition of "network of capacitors" (Horenstein Tr. 100:2-11). This passage explicitly declines to limit the term "network of capacitors" to any specific circuit disclosed, instead allowing it to encompass "different circuit structure(s)" from those disclosed in the specification.

11. Nevertheless, Dr. Horenstein asserts that the definition of the claimed "network of capacitors" must be understood in terms of "the purpose and function that such a network plays in the various embodiments in Figs 30 (a)-(f)"

in the '719 patent—i.e., "to match the impedance of the power generator." Horenstein Decl., ¶ 40. I disagree. No specific function for the network of capacitors is recited in the claim. There is also no reason to focus on the purpose of the capacitors specifically in Figures 30(a)-(f) as the claims are not limited to these embodiments. Nor does the specification anywhere limit a network of capacitors to circuits that accomplish this function. In fact, the '719 patent explicitly states that Figures 30(a)-(f) are "*examples* . . . of impedance matching circuits" (52:16-17) and never describes them as definitional for the term network of capacitors. *See* '719 patent 51:45-57:33.

12. Although the specification describes examples where capacitor circuits are used to match impedance, it never defines a network of capacitors as requiring this function, or requiring two degrees of freedom. None of Dr. Horenstein or Patent Owner's citations show otherwise. For example, Patent Owner cites to four passages of the '719 patent for the assertion that "[t]he capacitance realized by the network may control the complex impedance, which requires that the network includes two or more degrees of freedom to control or regulate both the real and imaginary components of the complex impedance." POR 12 (citing '719 patent 44:3-6, 44:42-46, 45:58-61, 69:56-60). I discuss these passages below—none of them support limiting network of capacitors to two degrees of freedom.

13. At 44:3-6, the '719 patent recites "The element is inductive because its impedance, including both the impedance of the loop and the so-called 'reflected' impedances of any potentially coupled systems, has positive reactance, X, and resistance, R." This passage merely explains that the inductive coil is inductive, with complex impedance, and says nothing about a network of capacitors.

14. At 44:42-46, the '719 patent discloses "Furthermore, an inductive element by itself may not be a resonant network. An impedance-matching network connected to an inductive element may typically create a resonant network, whose impedance may be regulated." This passage uses the term "impedance-matching network" to describe a network that matches impedance, which further confirms that the more generic term "network of capacitors" is not limited to the function of impedance matching. This passage does not define "network of capacitors" or limit it to two degrees of freedom.

15. At 45:58-61, the '719 patent discloses "Since there may typically be two tuning objectives, matching or controlling both the real and imaginary part of the impedance level, Z_0, at the desired frequency, f, there may be two variable elements in the matching circuit." This passage refers to a "matching circuit" but not a "network of capacitors." Even then, the passage refers to what is "typical[]"

but does not limit the structure of *any* circuit to providing two degrees of freedom.

16. Finally, at 69:56-60, the '719 patent discloses, in relation to Figures 43 and 47, "The required adjustments to C1 and/or C2 and/or C3 in each resonator may be determined by measuring and processing the values of the real and imaginary parts of the input impedance from either and/or both 'port(s)' shown in FIG. 43." This passage relates to the specific architectures of Figures 43 and 47, and not to any network of capacitors in general. Even there, the passage uses permissive language ("*may* be determined") and does not define the function of any circuit as requiring two degrees of freedom.

17. Further, the '719 patent describes Figure 36—which does not satisfy Dr. Horenstein's construction of providing two degrees of freedom—as using "networks of one variable capacitor and the rest fixed capacitors." '719 patent, 57:34-36. This usage of network of capacitors is consistent with the plain meaning of that term, which I described above. But Dr. Horenstein agrees that Figure 36 is excluded from the claims by his definition. Horenstein Tr. 92:18-93:5.

18. For all of the above reasons, the term "network of capacitors" in claim 17 should be given its plain meaning, which is "any circuit topology including one or more capacitors."

V. Ground 1: Claim 16 is obvious over Cook-554 alone or in combination with Pohjonen.

19. In my first declaration, I showed that Cook-554 alone or in combination with Pohjonen renders claim 16 obvious. Ex. 1003, ¶¶ 110-156. As part of that analysis, I discussed that the Cook Provisional provides support for claim 17 of Cook-554. I understand that analysis relates to whether Cook-554 is entitled to the priority date of the Cook Provisional in terms of it being prior art against the '719 patent. Ex. 1003, ¶¶ 74, 84-91. I also discussed that Cook-554 alone or in combination with Pohjonen discloses or renders obvious every limitation of claim 16, and that a POSA would have been motivated to combine Cook-554 and Pohjonen.

20. Below, I address different aspects of these issues raised by Dr. Horenstein and/or Patent Owner.

A. The Cook Provisional provides support for claim 17 of Cook-554.

21. In my first declaration, I showed that the Cook Provisional ("CProv") supports claim 17 of Cook-554. Ex. 1003, ¶¶ 84-90. Claim 17 of Cook-554 is reproduced below.

> 17. A method comprising:
>
> receiving power via a resonant circuit from a non-modulated wireless magnetic field at an operating frequency and at a receive power level;

> converting the received power, so as to charge a battery, with a power converting circuit having an impedance value that is variable; and
>
> varying the impedance value of the power converting circuit to tune the resonant frequency of the resonant circuit based on the received power level.

22. Dr. Horenstein asserts that "After a detailed and careful reading of Cook Provisional, [he] find[s] nothing therein that describes varying the impedance value *based on received power level*" as recited in claim 17 of Cook-554. Horenstein Decl., ¶ 96. Specifically, Dr. Horenstein does not dispute that the Cook Provisional discloses "varying the impedance value of the power converting circuit to tune the resonant frequency of the resonant circuit," but only that such varying of the impedance is "based on the received power level." *Id.* I disagree.

23. In my first declaration, I cited page 044 of the Cook Provisional and quoted it as disclosing "The tuning and matching network is generally needed to ensure that the receive antenna is operated at resonance . . . . This is particularly true for all applications requiring maximum transmission range and efficiency." Ex. 1003, ¶ 90. That disclosure relates to the "Tuning & matching network" illustrated in Fig. 4-12, which I also cited, and which is reproduced below.

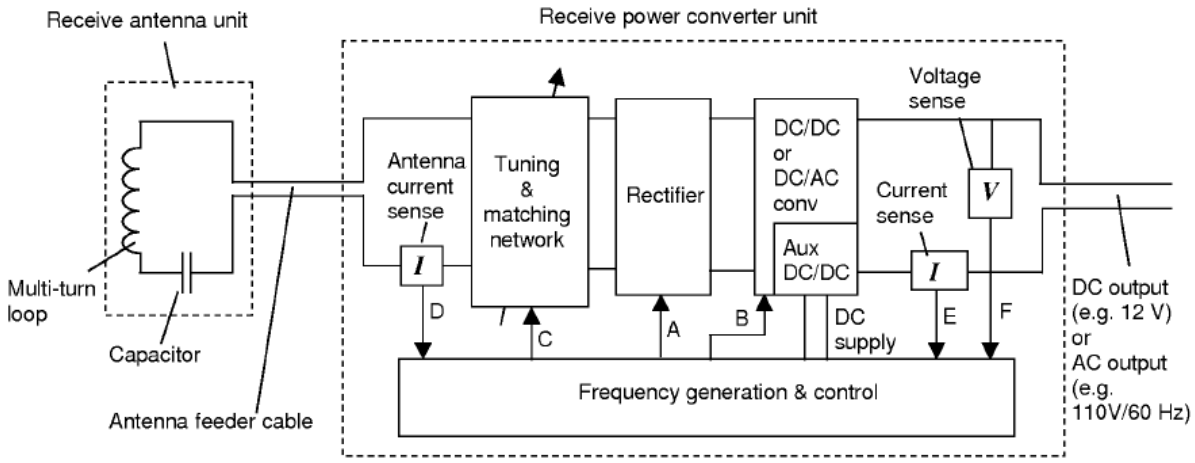


Figure 4-12: Receive subsystem

24. As disclosed on page 044 of the Cook Provisional, "The tuning & matching network is controlled and perhaps also reconfigured by the frequency generation and control subunit via the control interface C." CProv at 044. The same page also discloses that the frequency generation and control subunit "automatically controls all relevant functions and parameters of the receive subsystem to satisfy voltage and current requirements of the external load and to maximise energy transfer efficiency." CProv at 044. "Additionally, it measures the antenna current by means of the antenna current sense, the DC or AC output voltage and current by means of the voltage and current sense, respectively," and that "*[b]ased on these measurements*, it computes and adjusts relevant operational parameters and configurations of the receive power converter unit in order to satisfy power demand by the receiver (within specified limits) and to maximise energy transfer efficiency." CProv at 044-045 (emphasis added).

25. Thus, as shown in Figure 4-12 (reproduced above), the Tuning & matching network that performs the claimed impedance varying is controlled by the Frequency generation & control subunit. By adjusting the parameters of the Tuning & matching network to "satisfy power demand" and "maximise energy transfer efficiency," the Tuning & matching network varies impedance based on the received power level. CProv at 044-045. The current and voltage measurements, e.g., in Figure 4-12, enable this operation. Specifically, the Frequency generation & control subunit inputs measurements of current and voltage, and computes and adjusts parameters—including resonant frequency—based on these measurements. Ex. 1003 ¶ 90; CProv at 055. Because it is well-known that the measured voltage & current are based on received power level the Frequency generation & control subunit adjusts its parameters (and thus varies impedance) based on received power level. This is explicitly confirmed, e.g., by the Cook Provisional, which states that parameters are determined based on "antenna current and voltage, input power, etc." CProv 031 ("The receivers control system may determine the model parameters using specific measurements (e.g. antenna current and voltage, input power, etc.) and calibration routines. Based on this local model the receivers parameters may be optimized to maximise transfer efficiency and to satisfy the power demand of the receiver.").

Dr. Horenstein does not address Figure 4-12 or the description thereof on page 044 of the Cook Provisional. Horenstein Decl., ¶¶ 94-97.

26. Patent Owner notes that "the Cook Provisional discloses tuning and matching to compensate for 'possible detuning effects caused by the transmit subsystem and/or extraneous objects in proximity of the receive antenna, and by the rectifiers load impedance," and observes that the Cook Provisional describes various other reasons why an antenna needs to be tuned. POR at 34. Patent Owner states, however, that "[n]one of the above factors from the Cook Provisional are 'based on the received power level at which power is received at the antenna.'" POR 34. That misses the point. These factors relate to why an antenna needs to be tuned—Figure 4-12 and related description show that the tuning is *based on* the received power level.

B. Cook-554 renders obvious the "enclosed" limitation alone or in combination with Pohjonen.

27. Claim 16 of the '719 patent recites, among other things, "wherein at least one of the resonators is enclosed in a low loss tangent material." In my first declaration, I explained that a POSA would have found this element obvious in view of Cook-554 alone or in combination with a POSA's knowledge and/or Pohjonen. Ex. 1003 ¶¶ 148-155.

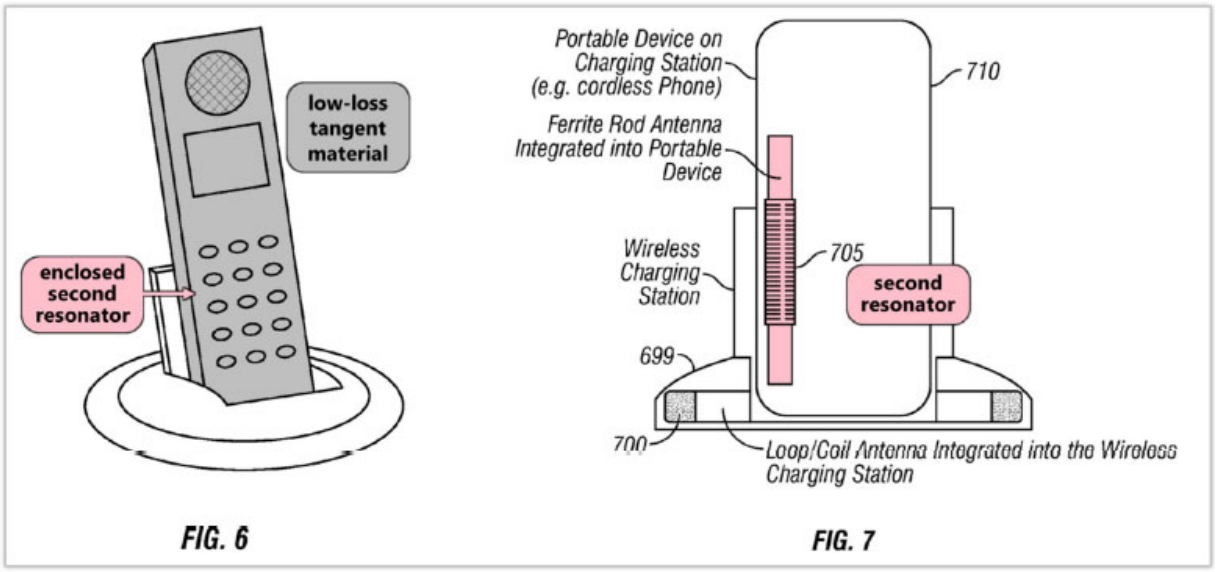
28. Dr. Horenstein raises seven disputes about the "enclosed" limitation with respect to Cook-554 and Pohjonen. Horenstein Decl., ¶¶ 98-104. I disagree as discussed below.

1. Cook-554 discloses a resonator enclosed within a portable phone.

29. Dr. Horenstein first asserts that "Cook-554 teaches resonator 'integrated' with a portable electronic device," but "Cook-554 does not teach a resonator 'inside' a portable electronic device." Horenstein Decl., ¶ 98. I disagree.

30. Dr. Horenstein focuses on the language "integrated into" and asserts that it is not equivalent to "inside" or "enclosed." Horenstein Decl., ¶ 98 (citing Wiley (Ex. 2015) at 379); *see also* Horenstein Decl., ¶ 113 ("[T]he integration of an antenna into a device is not the same as *enclosing* a resonant antenna, as claim 16 requires."). I note that Exhibit 2015 does not include the definition that Dr. Horenstein reproduces in his declaration. Nevertheless, Dr. Horenstein's focus on a dictionary definition of "integrated" ignores how a POSA would have understood Cook-554's use of the term in the context of that reference. For example, Dr. Horenstein's declaration does not address Cook-554's disclosure that the resonant antenna is "internal" to the portable device. Horenstein Decl., ¶ 98; *see* Ex. 1003 ¶ 149 (quoting Cook-554 at 9:20-28 as disclosing "*internal* antenna 705 in the portable device 710"). Further, as I discussed in my first

declaration, the figures of Cook-554 provide additional context in showing the POSA that the antenna is enclosed within the portable device. Ex. 1003 ¶ 149. For example, in Figures 6 and 7 (annotated below), a portable device is shown with and without an outside enclosure, respectively. In fact, as I mentioned above, the antenna 705 in Figure 7 is explicitly disclosed as "internal" in Cook-554. Cook-554 9:20-28.



Ex. 1003 ¶ 149 (annotating Cook-554)

31. Dr. Horenstein's declaration also ignores other parts of Cook-554 that he admits show the antenna inside the portable device. For example, Figures 21A and 21B (reproduced below) illustrate a ferrite antenna inside a mobile device. Dr. Horenstein agrees. Horenstein Tr. 70:23-71:3.

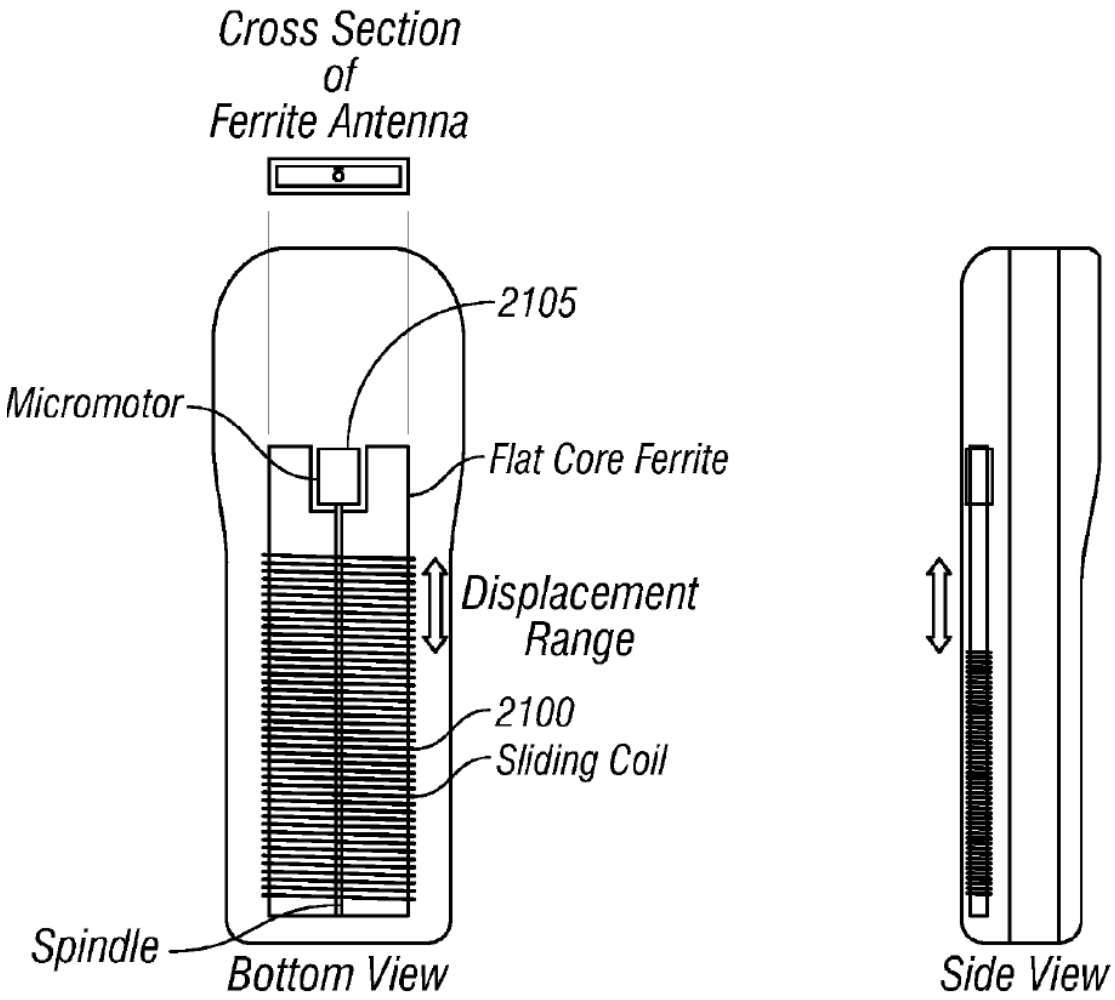


FIG. 21A FIG. 21B

32. Dr. Horenstein does not cite to anything in Cook-554 that would suggest having the antenna *not* enclosed. Patent Owner, however, cites to Cook-523 (note: ***not*** Cook-554) as evidence of how a POSA would understand the term "integrated." POR 38-39; *see* Horenstein Decl., ¶ 125. However, Cook-523 does not show that "integrated into" means that an antenna would be outside of the outer enclosure of a mobile device. Specifically, Figures 12-13 show an internal housing for antennas, not an outer enclosure for a phone. Figure 13B, annotated

below by Dr. Horenstein, is exemplary. Horenstein Decl., ¶ 127. This figure includes a coil around a ferrite rod inside of a metallic case. Dr. Horenstein argues that the metallic case "does not *enclose* the antenna coil 1350 . . . because the case shown has open ends and an open gap on the top." Horenstein Decl., ¶ 127. Of course, all that does not matter because, when integrated into a mobile device, a POSA would have understood there would be an additional outer enclosure that a POSA would have been motivated to make out of low-loss tangent material, as I explained in my first declaration. *See, e.g.*, Ex. 1003 ¶ 193. This and other figures don't depict any part of the outer enclosure of a phone, such as a screen or keyboard keys, but instead contain large openings that would obviously not be part of a phone's outer enclosure.

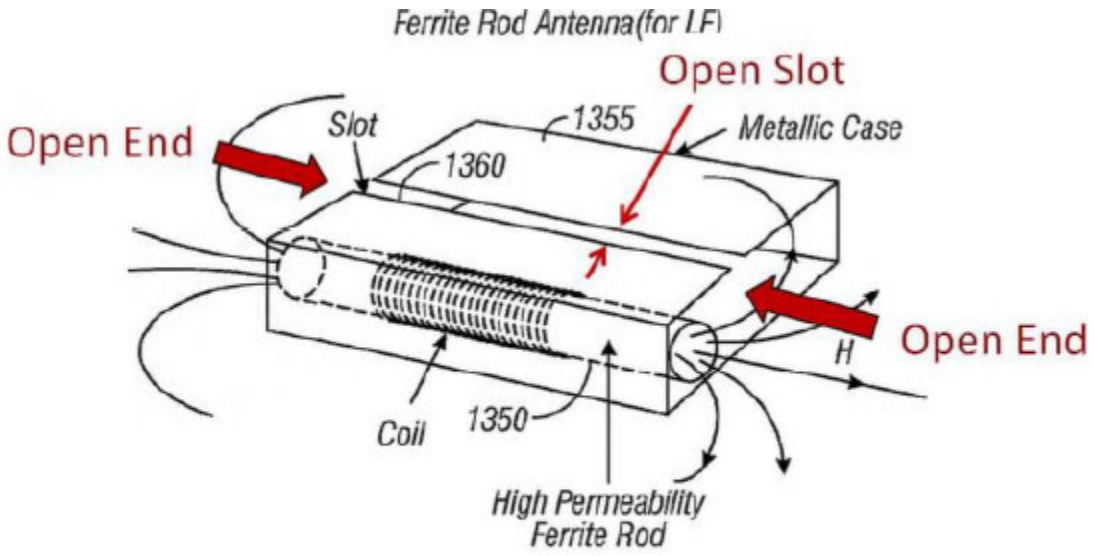
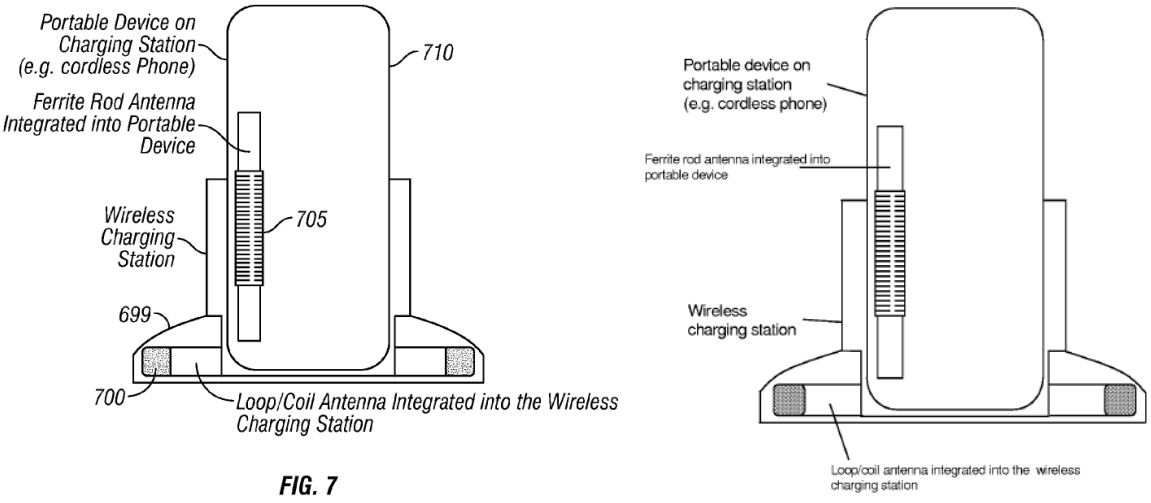


FIG. 13B

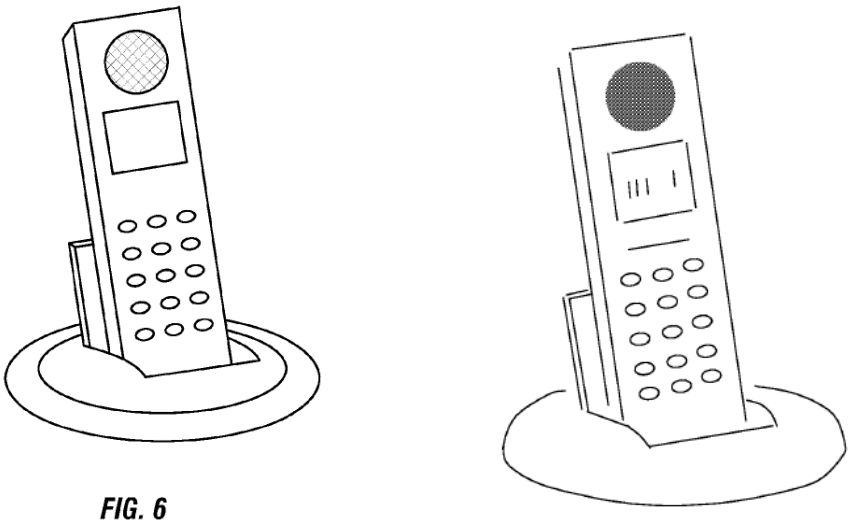
Horenstein Decl., ¶ 127 (annotating Cook-523 Figure 13B)

33. Dr. Horenstein agrees that the metallic case is not the outer enclosure of a phone, and that a phone would have an outer enclosure with "other components that are not shown in Figure 13B" that would cover the slots and openings with "some non-conducting material." Horenstein Tr. 85:10-23. In other words, the phone's outer enclosure would not have the gaps Dr. Horenstein criticizes in Figure 13B of Cook-523, and the antenna would be enclosed by a non-conducting (e.g., low loss tangent) material.

34. Returning to Cook-554, although Dr. Horenstein does not address the disclosure that the antenna is "internal," Patent Owner addresses this disclosure by arguing that it does not appear in the Cook Provisional and is not fairly prior art. POR 36. I disagree. I noted in my first declaration that Figures 4-3 and 4-4 of the Cook Provisional are identical to Figures 6 and 7 of Cook-554, which I discussed above as disclosing an internal antenna. Ex. 1003 ¶ 149. Figures 6-7 of Cook-554 and Figures 4-3 and 4-4 of the Cook Provisional are reproduced below for comparison.



Cook-554 Figure 7 (left), CProv Figure 4-4 (right)



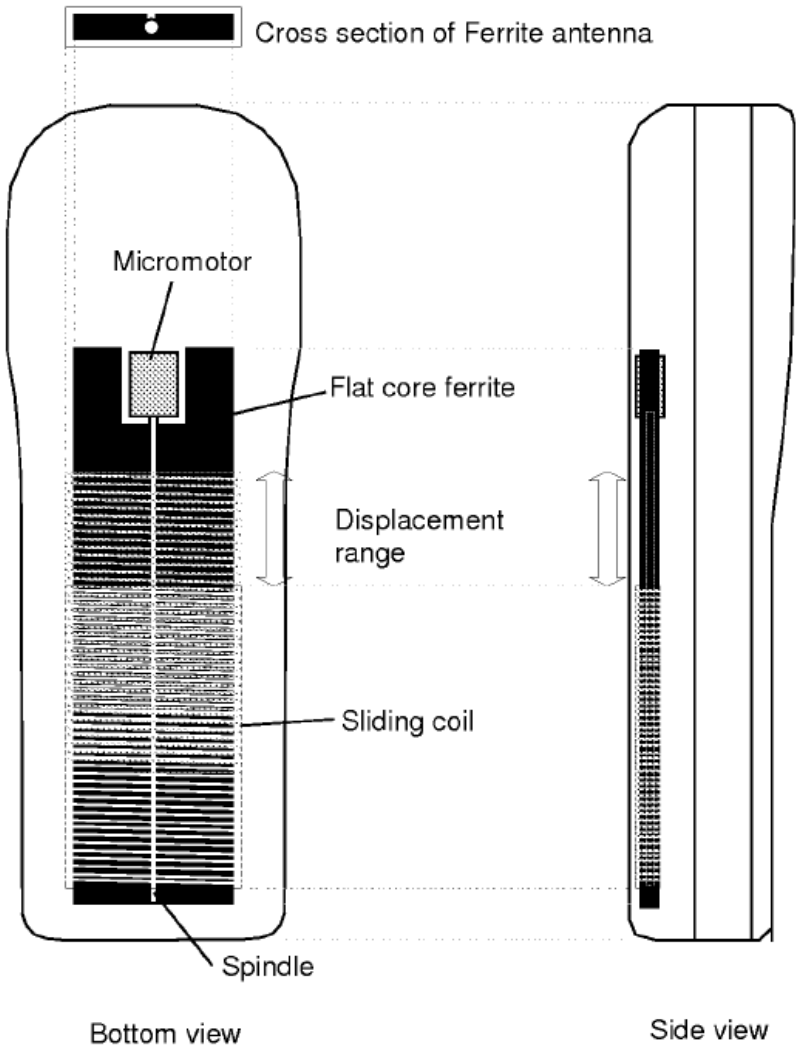
Cook-554 Figure 6 (left) and CProv Figure 4-3 (right)

35. Thus, the exact figure that shows an "internal" antenna in Cook-554 is also in the Cook Provisional. The fact that the Cook Provisional does not use the word "internal" does not mean a POSA would have viewed the figure any differently. To the contrary, a POSA would have understood the figures, along

with their description of an antenna "integrated into" the devices, as disclosing an antenna that is inside the outer enclosure of the device.

36. As I noted in my first declaration, the Cook Provisional also supports enclosing the antenna through its teaching that one should "avoid a metallic housing" (CProv at 051) and integrate the antenna in a part "providing better penetration of magnetic fields" (CProv at 058). Ex. 1003 ¶ 151.

37. Lest there were any doubt, Dr. Horenstein admitted that Figures 21A and 21B, which I discussed above, illustrate an antenna inside of the mobile device. Horenstein Tr. 70:23-71:3. He also admitted that these figures are in the Cook Provisional as Figure 5-6 (reproduced below) that also illustrates the antennas inside the mobile device. Horenstein Tr. 72:19-73:3. I agree with Dr. Horenstein about these figures.



CProv at 056 (Fig. 5-6)

2. POSAs would have been motivated to enclose Cook-554's resonant antenna in a low loss tangent material.

38. The remainder of Dr. Horenstein's seven enumerated arguments relate to a POSA's motivation to enclose Cook-554's resonant antenna in a low loss tangent material. Horenstein Decl., ¶¶ 99-104. As I showed in my first declaration, a POSA would have been motivated to enclose Cook-554's resonant antenna in a low loss tangent material because, among many other reasons, such

materials were typical for use in outer enclosures of mobile phones at the time of the '719 patent. Ex. 1003 ¶ 154. Dr. Horenstein does not dispute that fact. Instead, Dr. Horenstein makes other arguments that I either disagree with or that do not change my underlying opinion of obviousness. I address these matters below.

39. Dr. Horenstein's second through fifth disputes revolve around the POSA's motivation to enclose the antenna for protection. Horenstein Decl., ¶¶ 99-102. Dr. Horenstein does not appear to assert that a POSA would *not* want to protect an antenna, but focuses on an alleged failure to explain various details. *Id.* I disagree that such details were not explained. *See* Ex. 1003 ¶¶ 113-116.

40. Further, Dr. Horenstein asserts that other materials are stronger and more durable than low loss tangent materials cited in the Petition, but that misses the point. *Id.* ¶ 102. A POSA would have been motivated to protect the antenna within an outer enclosure of a mobile device, and such enclosures were well known to be made of low loss tangent materials. The existence of other materials does not detract from the obviousness of the claimed enclosure.

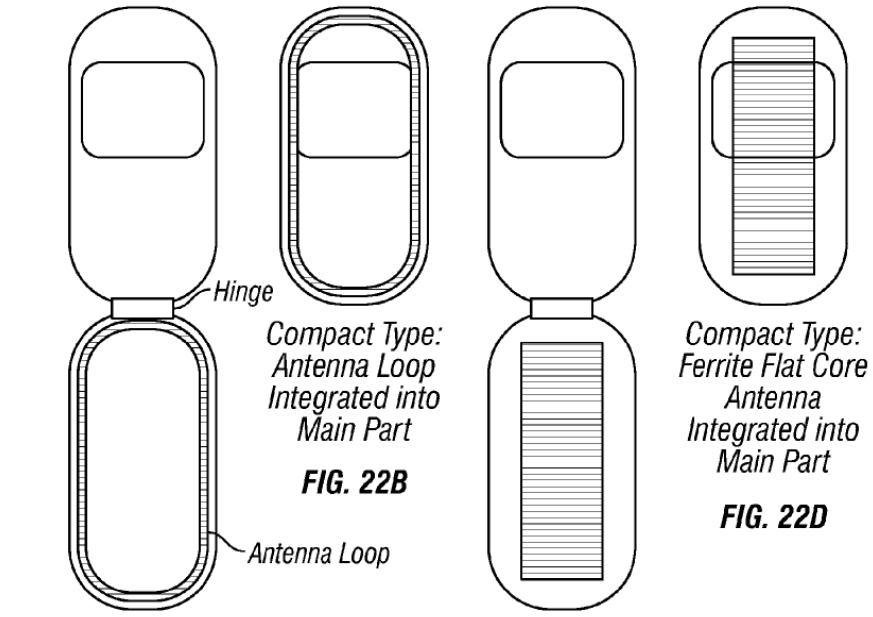
41. Dr. Horenstein's sixth dispute is that the "complex tradeoffs" of outer cover design "could in many cases lead a POSA away from enclosing" resonators in a low loss tangent material. Horenstein Decl., ¶ 103. According to Dr. Horenstein, they might lead a POSA to using metal. *Id.* But again Dr.

Horenstein does not appear to dispute that low loss tangent materials were well-known materials for enclosing a mobile device. Further, Cook-554 teaches that "[m]any reasons exists to avoid metallic housing for this system" (Cook-554 17:1-2), and Pohjonen expressly teaches toward using low loss tangent materials. Ex. 1003 ¶ 114.

42. Lastly, Dr. Horenstein asserts that, at best, a low loss tangent material would be "localized to the region of the covering where electromagnetic fields are emitted and electromagnetic waves pass." Horenstein Decl., ¶ 104. Dr. Horenstein cites to Dabov and Zhang in support of this statement. Horenstein Decl., ¶¶ 104-106. I disagree that these references would have led a POSA away from enclosing an antenna in a low loss tangent material. To the contrary, Dabov teaches an antenna chassis 922 and antenna cap 930 "formed from any material suitable for allowing electromagnetic waves (e.g., from the antenna) to pass." Dabov 10:27-29. The antenna chassis 922 "may be formed from a porous material that has low density, low dielectric, and low loss tangent, while still providing sufficient stiffness." Dabov 10:29-32. The "antenna may be molded into an antenna chassis 922 manufactured from foam (e.g., place antenna *inside* foam chassis mold), which may protect the antenna from mechanical damage (e.g., during manufacturing of the electronic device) and from rusting (e.g., insert molding technique)." Dabov 10:45-50; *see* Ex. 1003 ¶ 114 (citing Dabov 10:27-

50). Dr. Horenstein does not address these passages. Dr. Horenstein seems to criticize Zhang for having only plastic caps and "metal sidewalls" but omits that the reference expressly discloses that its "plastic caps" are used to "enclose an antenna." Zhang 10:47-52; *see* Horenstein Decl., ¶ 106.

43. Returning to Cook-554, Dr. Horenstein criticizes Figure 22B and the disclosure that the loop antenna depicted therein is "integrated into a main part" of the mobile device. Horenstein Decl., ¶ 112. Of course, as noted above, Figures 21A-21B indisputably depict an antenna inside the outer enclosure of a mobile device; Figures 6-7 do as well, with the specification teaching an "internal" antenna. The passage Dr. Horenstein quotes relates only to Figure 22B. Nevertheless, Dr. Horenstein admitted in his deposition that the antennas shown in Figures 22A-22D could be inside the device. Horenstein Tr. 82:22-83:21.



Cook-554 Figs. 22A-22D.

44. Dr. Horenstein also disputes that Cook-554's teaching against a metallic housing would lead a POSA to low loss tangent enclosure. Horenstein Decl., ¶¶ 108-110. Dr. Horenstein asserts that the disclosure "refers solely to eddy-current losses, not dielectric losses." *Id.* ¶ 110. I disagree. Cook-554 discloses "*Many reasons* exist to avoid metallic housing for this system." Cook-554 17:1-2; CProv 051, 058. Cook-554 expressly refers to dielectric losses to be avoided in a housing material. *See* Cook-554 19:36-38 ("At HF, both eddy currents and dielectric losses may degrade the Q-factor."); CProv 058. I agree

with Dr. Horenstein that low loss tangent materials mitigate this degradation of the Q-factor. Horenstein Tr. 71:4-72:5.

3. A POSA would have been motivated to combine Cook-554 and Pohjonen.

45. As explained in my first declaration, a POSA would have been motivated to combine Cook-554 with Pohjonen for a number of reasons. Ex. 1003 ¶¶ 111-120.

46. Dr. Horenstein opines that "the POSA would not have been drawn to or motivated to consider Pohjonen when contemplating the wireless power systems of Cook-554." Horenstein Decl., ¶ 114. This is because, according to Dr. Horenstein, Pohjonen relates to antennas that "radiate signals into the far field" whereas Cook-554 "does not focus on the design of devices . . . to be used for far-field communication." Horenstein Decl., ¶¶ 114-115. I disagree that any such differences would have kept a POSA from considering Pohjonen.

47. Dr. Horenstein does not explain why any difference in antenna design would lead a POSA away from considering Pohjonen. Nothing in Cook-554 or Pohjonen teach away from using the same materials for enclosures of a different antenna types. To the contrary, as I discussed above, Cook-554 discloses its antenna inside a mobile device, which would presumably also have an antenna for cellular communications utilizing the far field.

48. Further, Pohjonen teaches enclosures made from "low-loss thermoplastic" that had "several functions" including being "essentially transparent … to radio waves," and provides "required mechanical strength, stiffness and support." Pohjonen 9. Cook-554's antenna, even if a different design, also transmits power at radio frequencies (e.g., spanning VLF, LF, and HF (Cook-554 21:24-26; CProv 062) and would benefit from materials having sufficient mechanical strength, stiffness and support for protection. Pohjonen also indicates that its disclosures are not limited to any particular antenna design. Pohjonen 2 (stating losses of the "antenna itself are typically not of importance"), 9 (invention "does not limit the form" of the antenna element).

49. Dr. Horenstein asserts that "a design incorporating a resonant magnetic antenna into a portable device requires complicated tradeoffs that take into account a number of design constraints" and that the "design constraints do not dictate that a magnetic resonant / non-radiative antenna must be enclosed in a low loss-tangent material." Horenstein Decl., ¶ 65. Dr. Horenstein does not specify exactly what design constraints would lead away from low loss-tangent material, but nevertheless, even accepting for the sake of argument that a magnetic resonant antenna does not *have* to be enclosed in such a material, it does not change the fact that low loss tangent material was obvious to use to

enclose the antenna for the reasons above and for the reasons I delineated in my first declaration.

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

50. In my first declaration, I showed that claim 17 would have been obvious in view of Cook-554 and the knowledge of a POSA. Ex. 1003 ¶¶ 157-187.

51. Claim 17 recites:

> 17. A system, comprising:
>
> a source resonator having a Q-factor Q1 and a characteristic size x1, and a second resonator having a Q-factor Q2 and a characteristic size x2, and located a distance D from the source resonator;
>
> wherein the source resonator and the second resonator are coupled to exchange energy wirelessly among the source resonator and the second resonator, and wherein √{square root over (Q1Q2)} is greater than 100; and
>
> ***wherein at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors***, wherein the plurality of turns are in a common plane, and wherein a characteristic thickness of the at least one of the resonators is much less than a characteristic size of the at least one of the resonators.

52. Dr. Horenstein makes two arguments distinguishing Cook-554 from the claim 17 limitation "wherein at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors.

First, Dr. Horenstein employs his construction of "network of capacitors" to

distinguish the claims from Cook-554. According to Dr. Horenstein, "the capacitor bank of Fig. 16 in Cook-554 has a structure that is different from that of the network of capacitors described in the '719 patent" because according to Dr. Horenstein, Cook-554's capacitor bank "only has one degree of freedom for setting a resonant frequency." Horenstein Decl., ¶ 120. For the reasons discussed above in Section IV, I disagree that the claimed "network of capacitors" must provide two degrees of freedom. For at least that reason, I disagree with Dr. Horenstein's distinction between Cook-554 and the "network of capacitors" of claim 17. Further, Dr. Horenstein does not dispute that the "network of capacitors" is disclosed by Cook-554 under the plain meaning of that term discussed above and applied in my first declaration—i.e., any circuit topology including one or more capacitors.

53. ***Second***, Dr. Horenstein argues that Cook's capacitor bank is not "part of the resonator" as, according to him, is required by the claim. I disagree. To begin, the plan language of the claim does not require the network of capacitors to be "part of the resonator." Rather, it merely requires the resonator to include "a coil" which is "connected to a network of capacitors." This does not require the "network of capacitors to be "part" of the resonator.

54. But even if the claims do require the network of capacitors to be part of the resonator, I disagree that Cook-554 fails to teach it. Although this claim

limitation only relates to "at least one of the resonators," I discussed in my original declaration, that both the transmit and receive resonators in Cook-554 include a coil connected to a network of capacitors. Ex. 1003, ¶¶ 175-176. Dr. Horenstein annotates Figures 13 (transmitter) and 15 (receiver) of Cook-554 (reproduced below), arguing that portions he highlighted blue constitute a resonator to the exclusion of other portions (including the tuning/matching networks in each figure).

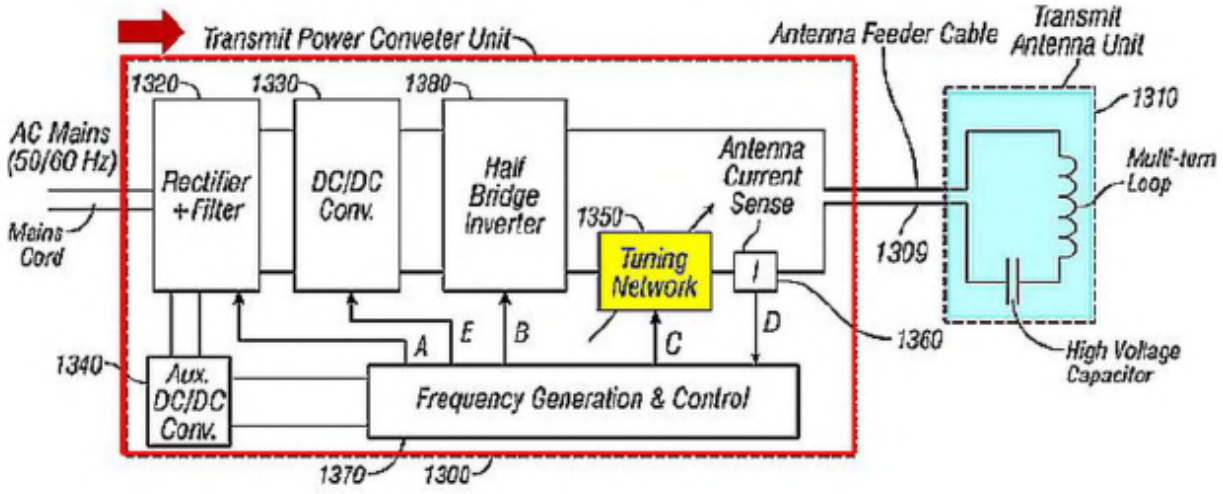


FIG. 13

Cook-554 Fig. 13, annotated

Horenstein Decl. ¶ 121.

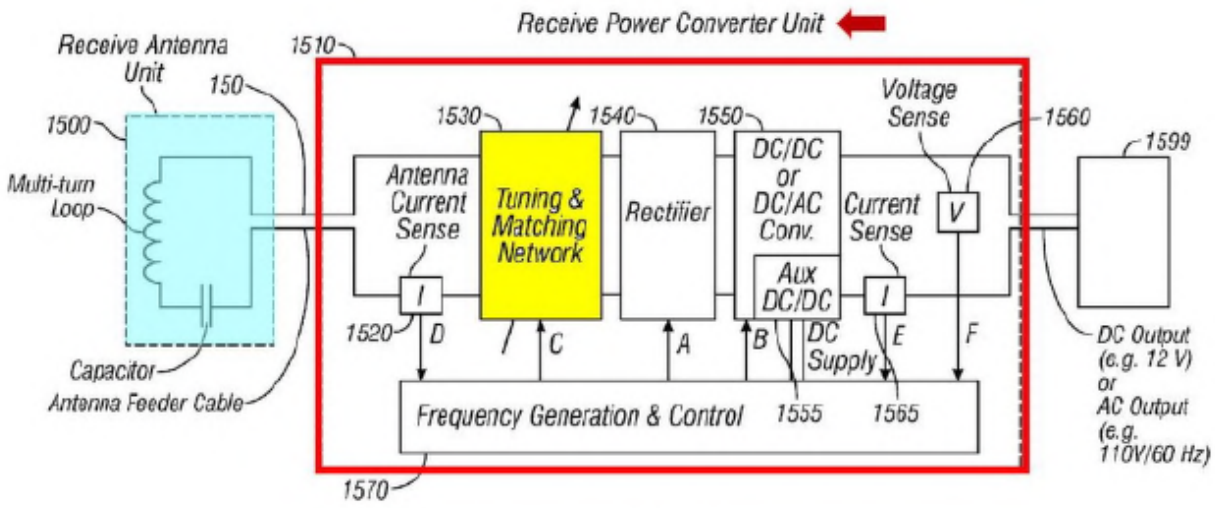


FIG. 15

Horenstein Decl. ¶ 122.

55. For the transmit unit, Dr. Horenstein argues that the tuning network "does not form an impedance-matching network for the multi-turn loop," but he does not explain why this assertion would exclude the network from being part of the resonator. Horenstein Decl., ¶ 121. Of course, he does not and cannot make that same argument for the receive unit which discloses a "tuning & matching network" 1530. Horenstein Decl., ¶ 122; Horenstein Tr. 49:6-18 (agreeing Figure 15 performs impedance matching). Nevertheless, nothing in the claims requires the network of capacitors to perform any function, let alone impedance matching. And Cook-554 taught its tuning and matching network is used for impedance-matching too. *See, e.g.,* Cook-554 14:26-39 ("The tuning and matching network is generally used to ensure that the receive antenna is operated at resonance and that the rectifier's input impedance is optimally matched to the receive

antenna."), 13:58-63 ("tuning and matching network 1530 . . . to match the rectifier to the receive antenna"); CProv 043-044; *see also, e.g.,* Cook-554 3:25-27, 4:47-60, 6:53-62, 14:26-27; CProv Fig. 3-1, 026-027, 043-044.

56. Instead, Dr. Horenstein pivots to focus on the "connection"—i.e., even if there is a network of capacitors, it is not *connected* as required by the claims. *Id.* Dr. Horenstein further clarified in deposition that he reads the claims as requiring a direct connection between the coil and the network of capacitors with no intervening elements. Horenstein Tr. 44:22-45:5. In Dr. Horenstein's opinion both the antenna current sense 1360 and antenna feeder cable 1309 prevent the tuning network 1350 from being connected to the coil in Figure 13. Horenstein Tr. 44:17-21. I disagree. For one, the plain meaning of the term "connected" does not require a direct connection with no intervening parts. For example, other claims explicitly recite "direct electrical connections" connections when that is what the inventor intended. *See* '719 patent, claims 1, 2, 3, 9. Additionally, the '719 patent uses "connected to" broadly to not be limited to direct connections. *See* '719 patent, 48:48-49 ("The power supplies and the power consumers may be **connected to** magnetic resonators **directly or indirectly or inductively**."). Under the plain meaning of "connected to," the tuning network of Figure 13 is connected to the coil, and Dr. Horenstein does not dispute that. Ex. 1003 ¶¶ 175-176.

57. But even under Dr. Horenstein's interpretation, the receiver resonator includes a network of capacitors that is connected to the coil. For one, the coil in both Figures 13 and 15 is directly connected to a capacitor even in the blue portion demarcated by Dr. Horenstein as the resonator. *See* Ex. 1003 ¶¶ 175-176.

58. Dr. Horenstein's arbitrary boxes around Figure 15 do not tell the whole story. For example, Figure 16 of Cook-554 shows the tuning capacitors directly connected to the coil in a manner that also illustrates they are part of the resonator. *Cf.* '719 patent, Fig. 30(h) (showing tunable reactance and capacitance).

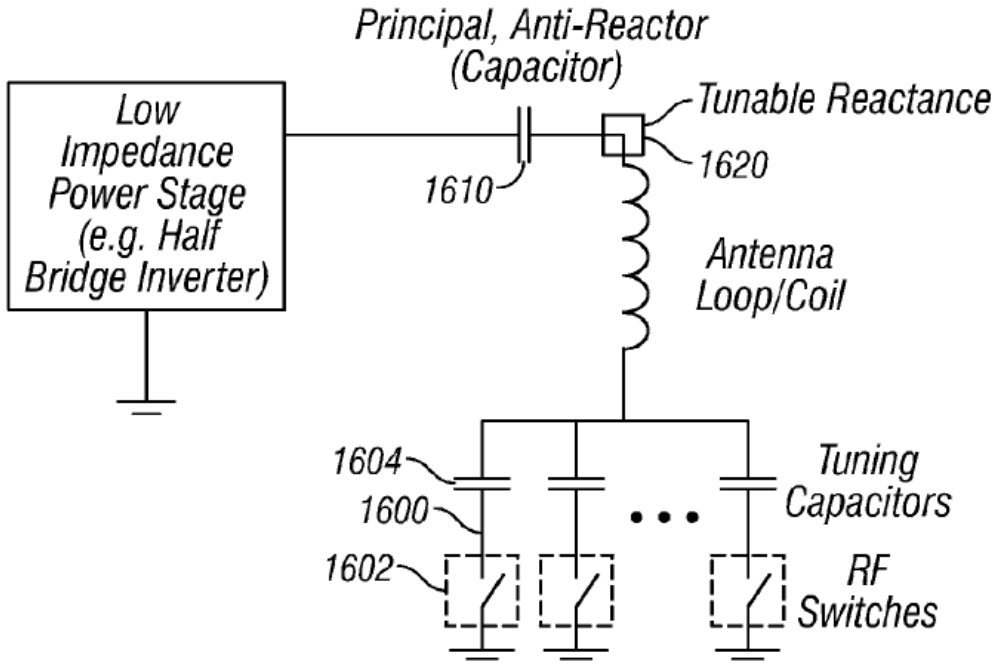


FIG. 16

Cook-554 Fig. 16, 17:41-51; *see also* Ex. 1003 ¶ 175. This figure also shows that the tuning circuit includes "Tunable reactance 1620" and therefore also provides two degrees of freedom. *See* Horenstein Tr. 95:15-96:14 (agreeing that a circuit with one variable capacitor and one variable inductor provides two degrees of freedom). I note that Dr. Horenstein's definition of "network of capacitors" does not require that both degrees of freedom be provided by the capacitors. Horenstein Tr. 96:2-15. Further, as I discussed above, Cook-554 discloses the same impedance-matching function that Dr. Horenstein asserts *requires* two degrees of freedom, and therefore the limitation is disclosed even under his construction. Horenstein Decl., ¶¶ 41-42; Horenstein Tr. 49:19-24. In his deposition, Dr. Horenstein hedged from that requirement, saying that impedance matching could be done with only one degree of freedom. Horenstein Tr. 50:7-17; 52:22-53:6; 57:13-58:17. To the extent that is true, it only further proves that his construction requiring two degrees of freedom is incorrect.

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

59. As discussed in my first declaration, claim 16 is obvious over the combination of Cook-523 and Pohjonen. Ex. 1003 ¶¶ 188-220.

60. Dr. Horenstein argues that a POSA would not have combined Cook-523 and Pohjonen for two reasons. ***First***, Dr. Horenstein asserts that a POSA would not have looked to Pohjonen because it "relates to wireless

communications via far-field radiation." Horenstein Decl., ¶ 124. I disagree for the reasons I discussed above for Ground 1. *See* Section V.B.3.

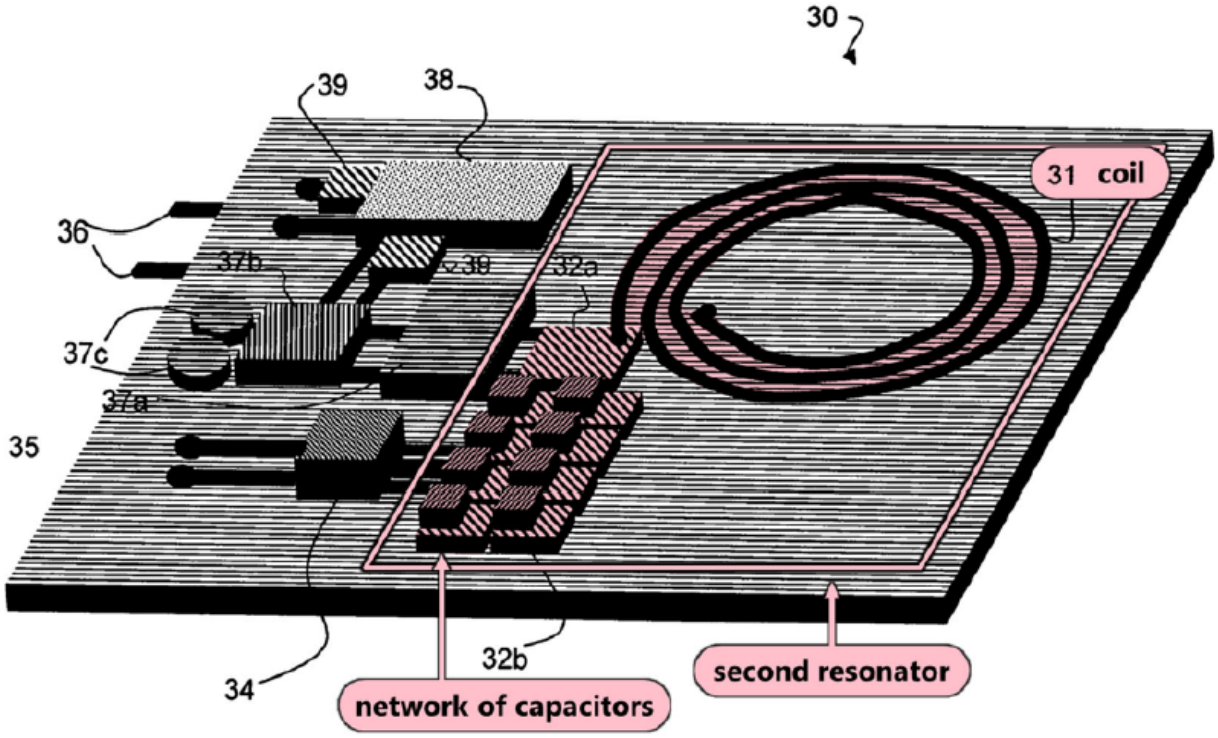
61. ***Second***, Dr. Horenstein repeats many of his Ground 1 arguments that a POSA would not have been motivated to enclose Cook-523's resonant antenna in a low-loss tangent material. Horenstein Decl., ¶¶ 128-129. I disagree for the reasons discussed above for Ground 1. *See* Section V.B.2. For example, Dr. Horenstein argues that the phrase "integrated into"—which appears in Cook-523 in a similar context as Cook-554 from Ground 1—does not teach or suggest enclosing the antenna in a low-loss tangent material. Horenstein Decl., ¶ 125. Dr. Horenstein does not appear to address the disclosure of Cook-523 that antennas are "preferably of a small size to allow it to fit into a mobile, handheld device." Cook-523 1:31-45; *see also* Ex. 1003 ¶¶ 100, 194.

62. Instead, Dr. Horenstein focuses on Figures 12 and 13. Horenstein Decl., ¶¶ 125 (Fig. 12A), 126 (Fig. 12B), 127 (Fig. 13B). But as discussed above for Ground 1, these figures, and particularly Figure 13B, illustrate an *inner* housing for an antenna, not an outer enclosure for a mobile device. *See* Section V.B.1; *see also* Ex. 1003 ¶¶ 100, 193-198. This is shown at least by the fact that the metallic housing has sizeable openings and gaps that would otherwise act to expose the inner electronics in a manner that a POSA would have wanted to prevent. Dr. Horenstein appears to agree with me on this point. Horenstein Tr.

85:10-23. Dr. Horenstein, in light of his deposition testimony, does not appear to dispute that mobile device would have an additional enclosure outside of what is shown in Figure 13B, and that typical materials for such enclosures had low loss tangents as disclosed in Pohjonen. Pohjonen at 003; *see* Ex. 1003 ¶¶ 193, 195.

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

63. As discussed in my first declaration, the combination of Lee and Cook-523 renders claim 17 obvious. Ex. 1003 ¶¶ 221-264. Specifically, the combination discloses "wherein at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors." Ex. 1003 ¶¶ 260-262. For example, Lee's second resonator includes a coil 31 connected to a network of capacitors 32a and 32b, as annotated below in Lee's Figure 12.



Ex. 1003 ¶ 261 (annotating Lee Fig. 12)

64. Lee teaches an LC resonant circuit with a coil "in parallel ***connection with***" the "main capacitor 32a" and the "bank of switched capacitors 32b which are also in parallel." Lee [0075].

65. Dr. Horenstein argues that the combination does not disclose "wherein at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors." Horenstein Decl., ¶¶ 133-135. As discussed above for Ground 2, Dr. Horenstein interprets this limitation to require (1) that the network of capacitors be a component of the resonator; (2) that the network of capacitors be directly connected to the coil; and

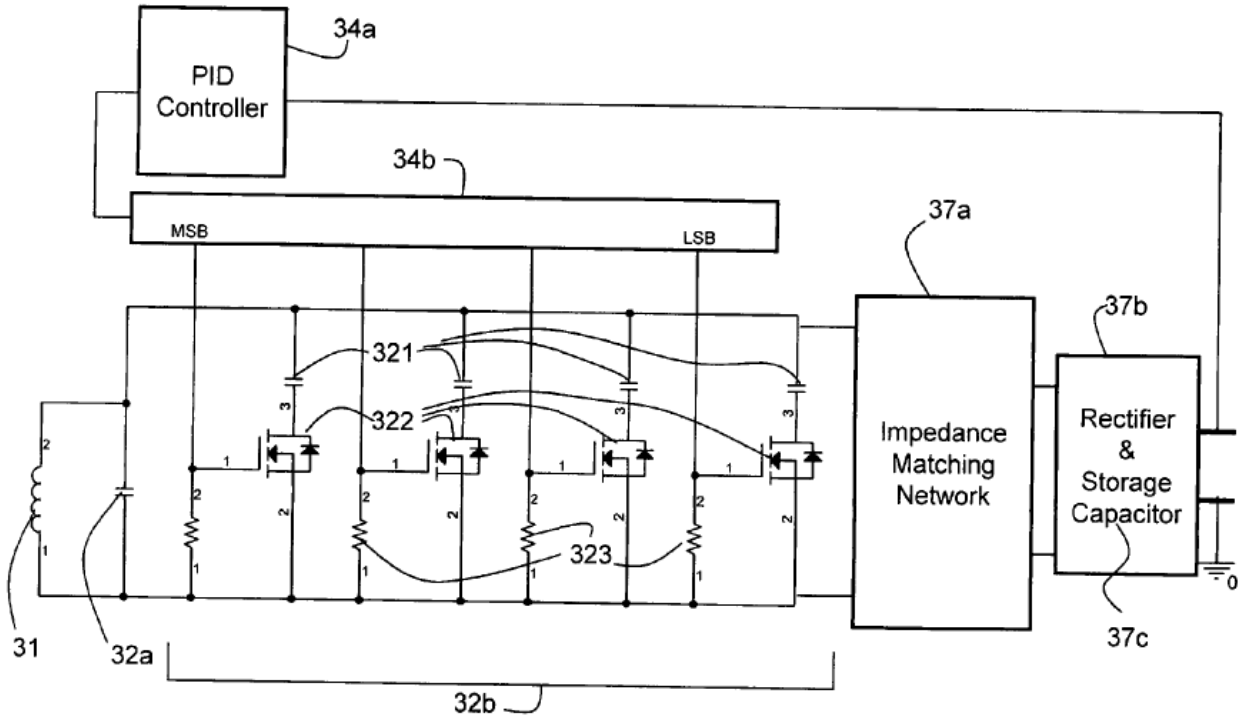
(3) the network of capacitors provide at least two degrees of freedom. I disagree with Dr. Horenstein's interpretations for the reasons already discussed above. *See* Sections IV and VI.

66. However, the combination of Lee and Cook-523 disclose the limitation even under Dr. Horenstein's interpretations.

67. First, Dr. Horenstein asserts that "the resonator in Fig. 12 of Lee does not include the capacitor bank." Horenstein Decl., ¶ 133. I disagree. The capacitor bank in particular is used to adjust the resonant frequency of the resonator "so that it can stay matched with the RF driving frequency." Lee [0078]. It is therefore part of the "LC network that has a resonant frequency." Dr. Horenstein stated in his declaration, and confirmed in deposition, that capacitors in parallel form a single effective capacitor with a single effective capacitance. Horenstein Decl., ¶ 52; Horenstein Tr. 13:6-14:16. He also stated that placing capacitors in parallel with a main resonator capacitor changes the capacitance and therefore the resonant frequency of the resonator. Horenstein Tr. 15:10-16:21; Horenstein Decl., ¶¶ 19-20. Because these network of capacitors modifies the "C" (capacitance) in the "LC" resonator, it is part of the resonator.

68. Dr. Horenstein does not seem to dispute that the capacitor bank 32b is directly connected to the coil 31. This is explicitly shown, for example, in

Figure 13, reproduced below, where the coil 31 is directly connected not only to capacitor 32a, but also to the capacitor bank 32b.



Lee Fig. 13, [0075].

69. Lastly, Dr. Horenstein repeats his Ground 2 argument that a capacitor bank is not a network of capacitors because, according to him, it does not provide two degrees of freedom. Horenstein Decl., ¶¶ 134-135. Dr. Horenstein does not appear to dispute disclosure of "network of capacitors" under the plain meaning of that term that I applied in my first declaration, i.e., "any circuit topology including one or more capacitors."

70. Nevertheless, Lee's circuit includes an "impedance matching network" 37a. Lee Fig. 13, [0075], which performs the impedance-matching

function that Dr. Horenstein asserts requires two degrees of freedom. *See* Section VI, above. Thus, claim 17 is obvious even under Dr. Horenstein's interpretation of "network of capacitors."

IX. 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 Aug 30, 2024 (date), in Philadelphia, PA (city, state).

Mark Allen