

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BMW OF NORTH AMERICA, LLC,

Petitioner,

v.

SCRAMOGE TECHNOLOGY LTD.,

Patent Owner.

Case No. IPR2023-00913
U.S. Patent No. 10,243,400

DECLARATION OF AL-THADDEUS AVESTRUZ, PhD

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 - e. [18d] “and a control circuit board for controlling wireless power transfer through the first to third transmission coils,” 63
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I. INTRODUCTION

1. I have been retained by BMW of North America, LLC (“Petitioner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office.

2. I am over 21 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of any proceeding.

4. I understand that this proceeding involves U.S. Patent No. 10,243,400 (“the ’400 patent,” Ex. 1001). The application for the ’400 patent was filed December 2, 2016, as U.S. Patent Application No. 15,367,945 (“the ’945 application”). The ’400 patent claims priority under 35 U.S.C. § 119 to Korean Patent Application No. 10-2015-0171274, filed in Korea on December 3, 2015.

5. I have been asked by Petitioner to provide my opinion on whether the claims of the ’400 patent would have been obvious to a person of ordinary skill in the art at the time of the earliest claimed priority date of the ’400 patent. In performing my analysis, I have been asked to assume that the priority date is December 3, 2015. My opinions are set forth below.

6. Throughout this declaration, I refer to specific pages, figures, and/or line numbers of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the propositions for which they are cited.

II. SUMMARY OF OPINIONS

7. This declaration considers claims 1-19 of the '400 patent. Below, I set forth the opinions I have formed, the conclusions I have reached, and the bases for these opinions and conclusions. I believe the statements contained in this declaration to be true and correct to the best of my knowledge.

8. Based on my experience and knowledge of the art at the time of the applicable priority date, it is my opinion that claims 1-19 of the '400 patent would have been obvious based on the asserted grounds discussed below.

9. I am being compensated for my time at my normal hourly rate. My compensation is in no way contingent upon the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding.

III. QUALIFICATIONS AND BACKGROUND

10. I believe that I am well qualified to serve as a technical expert in this matter based upon my qualifications, discussed in detail below. A copy of my curriculum vitae is included as Exhibit 1004.

11. I am competent to write this declaration.

12. In formulating my opinions, I have relied upon my training, knowledge, and experience in the relevant art. A copy of my current curriculum vitae is provided as Exhibit 1004, and it provides a comprehensive description of my academic and employment history.

13. I have been a faculty member at the University of Michigan in the Electrical Engineering and Computer Science Department since 2016, performing research in wireless power transfer, power electronics, and circuits for consumer, medical, and automotive applications. I also teach undergraduate and graduate courses in power electronics, and an undergraduate class in circuits. In power electronics courses, I teach the design, building, and testing of printed circuit boards.

14. I received my PhD in 2016 from the Massachusetts Institute of Technology where I performed research on wireless power transfer. The title of my PhD thesis: Energy Management in Biomedical Applications: Wireless Power and Biosensing. This included the design, construction, and testing of wireless power transfer systems. At the Massachusetts Institute of Technology (“MIT”), I supervised seven masters students in research projects that included the design, building, and testing of power electronics, circuits, and printed circuit boards.

15. Prior to graduate school, I worked in industry for nine years designing and building power electronics, circuits, power electronics systems, and printed

circuit boards. I have taken products from initial conception, requirements definition, design, building, and testing, all the way through manufacturing, regulatory agency approvals, and documentation.

16. At the University of Michigan, I supervised and graduated five PhD students in research projects that included the design, building, and testing of power electronics, circuits, and printed circuit boards. Three of these PhD students performed research in wireless power transfer; one of these students is currently a postdoctoral researcher at MIT and will be a faculty member at the University of Maryland.

17. I have twelve issued U.S. patents. Three of these patents are directly related to wireless power transfer and one is used in wireless power transfer. Additionally, I have seven U.S. and one PCT patents pending. Four of these patents pending are directly related to wireless power transfer.

18. I am an author of twenty-eight journal papers and fifty-three conference papers. Eight of the journal papers are directly related to wireless power transfer. Nineteen of the conference papers are directly related to wireless power transfer.

19. I was a technical program co-chair of the 2021 IEEE Wireless Power Week responsible for the technical organization of the conference and selection of the papers.

20. I am a senior member of the IEEE Power Electronics Society. I am the immediate past elected chair of IEEE TC1: Technical Committee for the Control and Modeling of Power Electronics. I am the General Chair of the IEEE Twenty-Fourth IEEE Workshop on Control and Modeling for Power Electronics to held at the University of Michigan.

21. I am an associate editor of the IEEE Open Journal of Power Electronics and have been a guest associate editor for the IEEE Journal of Emerging and Selected Topics in Power Electronics.

IV. MATERIALS CONSIDERED

22. In forming my opinions, I have reviewed the following documents, and any other document cited in this declaration.

Exhibit	Description
Ex. 1001	U.S. Patent No. 10,243,400 (“the ’400 patent”)
Ex. 1002	File History of U.S. Patent No. 10,243,400
Ex. 1005	U.S. Patent Application Publication No. 2011/0140653 to Jung et al. (“Jung”)
Ex. 1006	U.S. Patent Application Publication No. 2016/0126001 to Chien et al. (“Chien”)
Ex. 1007	U.S. Patent Application Publication No. 2013/0015719 to Jung et al. (“Jung 719”)
Ex. 1008	U.S. Patent Application Publication No. 2013/0175984 to Yamazaki et al. (“Yamazaki”)

Exhibit	Description
Ex. 1009	U.S. Patent Application Publication No. 2015/0054457 to Kim (“Kim”)
Ex. 1014	U.S. Patent Application Publication No. 2011/0140538 to Jung et al. (“Jung 538”)
Ex. 1015	U.S. Patent Application Publication No. 2014/0347154 to Schmelzer et al. (“Schmelzer”)
Ex. 1016	U.S. Patent No. 6,065,679 to Levie et al. (“Levie”)
Ex. 1017	U.S. Patent Application Publication No. 2014/0036503 to Olsen (“Olsen”)
Ex. 1018	U.S. Patent No. 5,648,892 to Wieloch et al. (“Wieloch”)
Ex. 1019	Fotofab, “Photochemical Machining,” September 8, 2015 (available at https://web.archive.org/web/20150908080833/http://www.fotofab.com/designguide.php). (“NPL1”)
Ex. 1020	Fotofab, “Material Selection,” September 8, 2015 (available at https://web.archive.org/web/20150908075459/http://www.fotofab.com/dg_material.php). (“NPL2”)
Ex. 1021	Declaration supporting public availability of NPL1 and NPL2

23. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of any applicable legal principles described in this declaration.

24. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a person of ordinary skill in the

art would have understood the claims of the '400 patent at the time of the earliest claimed priority date.

25. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

V. LEGAL STANDARDS

26. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

27. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a claim “obvious” to a person of ordinary skill in the art. I understand that a claim is patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent.

28. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

29. I have been asked to provide my opinions as to whether the cited prior art discloses or renders obvious claims 1-19 of the '400 patent from the perspective of a person of ordinary skill in the art at the '400 patent's earliest claimed priority date in 2015, as described in more detail below.

30. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means "more likely than not."

31. For the purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Level of Ordinary Skill

32. I have been informed that a person of ordinary skill in the art is determined by considering several factors, including the (i) type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations are made; (iv) sophistication of the technology; and (v) educational level of active workers in the field.

33. I have been instructed to assume that a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

B. Prior Art

34. I have been advised and understand that the information used to evaluate whether an invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes patents and printed publications that existed before the earliest claimed priority date or the earliest filing date of the patent (which I have been informed is also called the “effective filing date”). I have been informed and understand that a patent or published patent application is prior art if it was filed before the earliest filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the earliest filing date.

C. Anticipation

35. I have been informed that under 35 U.S.C. § 102, a patent claim is unpatentable for anticipation if the claimed subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been informed that this is referred to as unpatentability by anticipation. I have been informed that a patent claim is anticipated under § 102 if a single prior art reference discloses all the limitations of the claimed invention.

D. Obviousness

36. I have been informed that for obviousness under 35 U.S.C. § 103, a patent claim is unpatentable if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which said subject matter pertains at the time the invention was made. I have been informed that this is referred to as unpatentability by obviousness.

37. I have been informed that an obviousness analysis includes the following considerations:

- a. Determining the scope and content of the prior art;
- b. Ascertaining the differences between the prior art and the claims at issue;
- c. Resolving the level of ordinary skill in the pertinent art; and
- d. Considering evidence of secondary indicia of nonobviousness (if available).

38. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For my obviousness analysis, counsel for Petitioner instructed me to assume that the date of invention for the challenged claims is December 3, 2015. My opinions would not change if I assumed another, e.g., later, date of invention.

39. I have been informed that a reference may be modified or combined with other references or with a person of ordinary skill in the art's own knowledge if the person would have found the modification or combination obvious. I have also been informed that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

40. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been informed that, while there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

41. In determining whether a prior art reference could have been combined with another prior art reference or other information known to a person

having ordinary skill in the art, I have been informed that the following principles may be considered:

- a. A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- b. The substitution of one known element for another is likely to be obvious if it yields predictable results;
- c. The use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results;
- d. The application of a known technique to a prior art reference that is ready for improvement to yield predictable results;
- e. Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- f. A person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle; and
- g. The proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a “reasonable expectation of success”—but not “absolute predictability” of success—in achieving the claimed invention by combining prior art references.

42. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have been informed that if a person of ordinary skill in the art could have implemented a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that, in many fields, there may be little discussion of obvious combinations, and in these fields, market demand—not scientific literature—may drive design trends. I have been informed that, when there was a design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art would have had a good reason to pursue those known options.

43. I have been informed that the law permits the application of “common sense” in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been informed that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art, and that a party asserting obviousness must still provide a specific motivation to combine or modify the

references as recited in the claims and explain why one skilled in the art would have reasonably expected to succeed in doing so.

44. I have been informed that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also understand that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

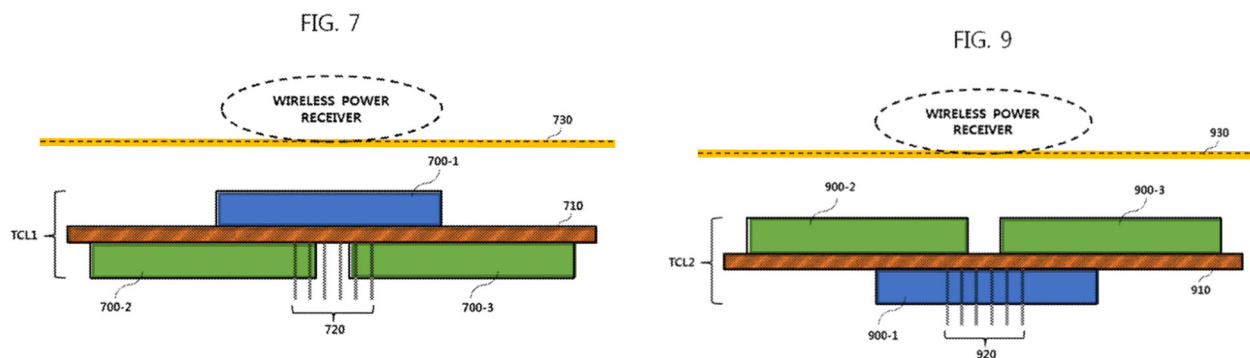
45. I am not aware of any evidence of secondary considerations that would support a determination of nonobviousness of the claimed subject matter in the '400 patent.

46. I have been informed that, in an obviousness analysis, prior art must be analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

VI. THE '400 PATENT

47. The '400 patent relates to a wireless power transmitter for charging a wireless power reception unit (also called a receiver)—e.g., “a mobile phone, a smart phone, a laptop computer ...,” etc.—disposed on a charging interface of the transmitter. Ex. 1001, 2:42-44, 4:61-5:4.

48. The wireless transmitter includes a printed circuit board (PCB) and three overlapping transmission coils arranged on opposite surfaces of the PCB. Ex. 1001, 2:53-59, 4:52-55, FIGS. 7-10. A first transmitting coil is located on either a first surface of the PCB facing an interface surface on which the power receiving device is placed—as shown in Figure 7—or on a second surface of the PCB facing opposite the interface surface—as shown in Figure 9. The first coil overlaps the second and third coils, and the coils are etched onto a copper plate attached to the PCB. Ex. 1001, 3:1-3, 3:7-18, 9:20-27.



Ex. 1001, FIGS. 7, 9 (annotated).

49. The transmitter also includes a “control circuit board for controlling wireless power transfer through the” coils to select “the best-aligned transmission coil based on the signal strength indicator” to charge the wireless power reception unit. Ex. 1001, 2:53-59, 5:37-45, FIG. 4. The coils are “connected to the control circuit board via a connector [720, 920] inserted into the PCB.” Ex. 1001, 3:4-6, 10:37-44, 11:60-67.

50. Both the “electromagnetic induction type wireless charging technology” and “electromagnetic-induction-type wireless charging technology” are “defined by the Wireless Power Consortium (WPC) and the Power Matters Alliance (PMA), which are wireless charging technology standardization organizations.” Ex. 1001, 4:46-60.

VII. Claim Construction

51. I have been instructed that the “intrinsic record” includes the ’400 patent itself, including the claims, description, and figures (Ex. 1001), and the ’400 patent’s prosecution history—which I understand is the record of proceedings at the U.S. Patent and Trademark Office (“Patent Office”) concerning the patent (Ex. 1002). I understand that, like the claims and written description, the prosecution history provides evidence to a person of ordinary skill in the art of how the inventor intended their patent to be understood, and how the Patent Office understood the patent. I understand that the inventor is permitted to apply a special

definition to the terms or to limit the scope of claim terms in their patent claims, which may differ from the term's plain and ordinary meaning. That special definition or limitation on scope may be provided in the patent's written description, the patent's prosecution history, or both.

52. I understand that claim interpretation may also be informed by "extrinsic evidence" (that is, evidence outside of the patent record itself). I have been informed that extrinsic evidence may include dictionaries, technical treatises, and other materials evidencing the meaning of a claim term and the understanding held by a person of ordinary skill in the art in the relevant time period.

53. I have been asked for the purposes of this declaration to apply the plain and ordinary meaning of the claim terms as they would have been understood by a person of ordinary skill in the art at the earliest claimed priority date of the '400 patent.

54. I understand that no claim term's construction is in dispute at this time. Based on my review of these materials and my personal knowledge and experience, I have considered each term of the '400 patent as it would have been understood by a person of ordinary skill in the art at the earliest claimed priority date of December 3, 2015.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

55. In rendering the opinions set forth in this declaration, I have been asked to consider the '400 patent's claims and the prior art through the eyes of a person of ordinary skill in the art (which I may also refer to as "one skilled in the art," "skilled artisan," "POSITA," or similar variations). I have considered factors such as the educational level and years of experience of those working in the pertinent art, the types of problems encountered in the art, the teachings of the prior art, patents and publications of other persons or companies, and the sophistication of the technology.

56. Taking the factors described in the Legal Standards – Level of Ordinary Skill section into consideration, it is my opinion that a POSITA would have had at least a bachelor's degree in electrical engineering or a related engineering discipline, and at least two years of experience in wireless power transfer and circuit design. Relevant work experience can substitute for formal education, and additional education could substitute for work experience.

57. I met the criteria for a POSITA at the earliest priority date of the '400 patent.

IX. THE PRIOR ART

58. In forming my opinions, I found the following prior art relevant when considering whether the claims of the '400 patent would have been obvious to a person of ordinary skill in the art.

Exhibit	Description
Ex. 1005	U.S. Patent Application Publication No. 2011/0140653 to Jung et al. (“Jung”)
Ex. 1006	U.S. Patent Application Publication No. 2016/0126001 to Chien et al. (“Chien”)
Ex. 1007	U.S. Patent Application Publication No. 2013/0015719 to Jung et al. (“Jung 719”)
Ex. 1008	U.S. Patent Application Publication No. 2013/0175984 to Yamazaki et al. (“Yamazaki”)
Ex. 1009	U.S. Patent Application Publication No. 2015/0054457 to Kim (“Kim”)
Ex. 1014	U.S. Patent Application Publication No. 2011/0140538 to Jung et al. (“Jung 538”)
Ex. 1015	U.S. Patent Application Publication No. 2014/0347154 to Schmelzer et al. (“Schmelzer”)
Ex. 1016	U.S. Patent No. 6,065,679 to Levie et al. (“Levie”)
Ex. 1017	U.S. Patent Application Publication No. 2014/0036503 to Olsen (“Olsen”)
Ex. 1018	U.S. Patent No. 5,648,892 to Wieloch et al. (“Wieloch”)
Ex. 1019	Fotofab, “Photochemical Machining,” September 8, 2015 (available at https://web.archive.org/web/20150908080833/http://www.fotofab.com/designguide.php). (“NPL1”)

Exhibit	Description
Ex. 1020	Fotofab, “Material Selection,” September 8, 2015 (available at https://web.archive.org/web/20150908075459/http://www.fotofab.com/dg_material.php). (“NPL2”)

59. As explained below, in my opinion, claims 1-19 of the '400 patent would have been obvious based on Jung, Chien, Jung 719, Yamazaki, and NPL1, in the combinations discussed below.

A. Jung (U.S. Patent Application Publication No. 2011/0140653)

60. Jung published as U.S. Patent Application No. 2011/0140653 on June 16, 2011, and was filed April 17, 2009. I understand and have been asked to assume that Jung is prior art to the '400 patent.

61. Jung discloses “a non-contact charging station with a planar-spiral power transmission core, a non-contact power-receiving apparatus, and a method for controlling the same.” Jung, [0015]. The charging station, a wireless power transmitter, includes a “power transmission PCB core” “realized by forming one or more layers of planar-spiral cores made of copper on a PCB [not shown].” Jung, [0075]. The planar spiral cores (transmission coils) include partially overlapping “upper and lower cores,” e.g., **base core 331**, **first upper core 332**, and **second upper core 333**, and each coil is separately and selectively operable such that the coil having the “best sensitivity,” transmits power to the “non-contact power-

receiving apparatus” (load) 50 by generating “an induced magnetic field.” Jung, [0028], [0088], [0099], FIG. 5.

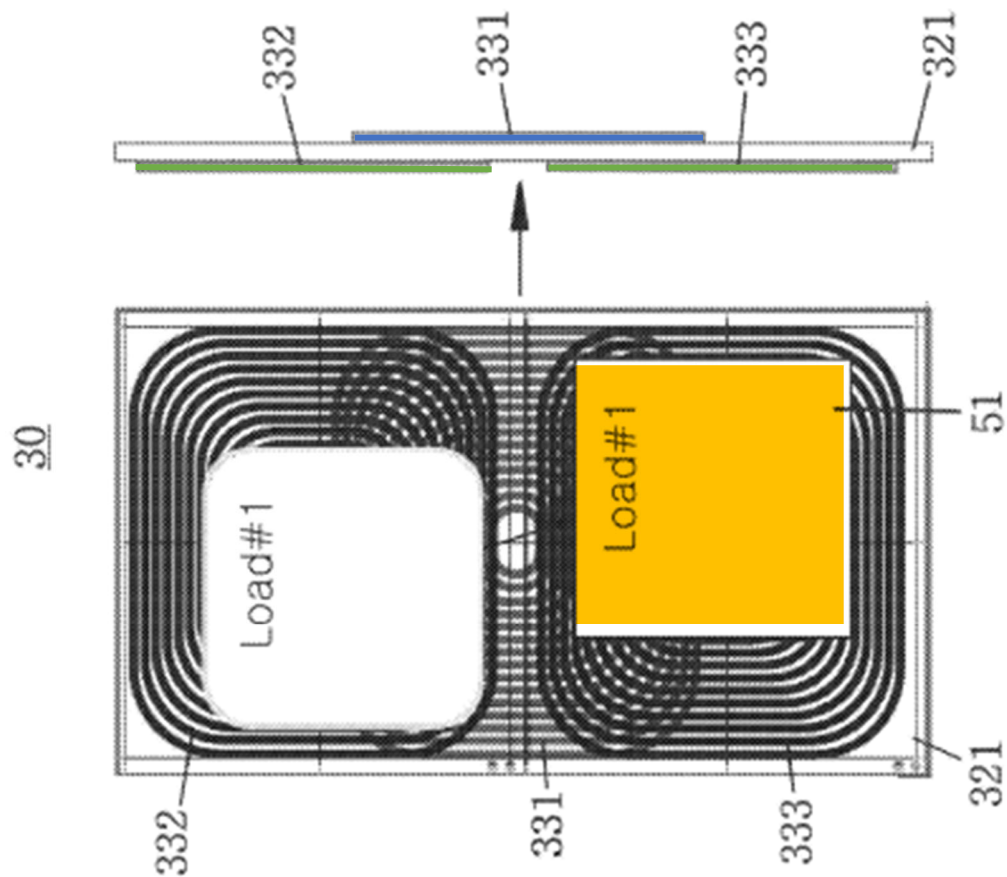


Fig.5

Jung, FIG. 5 (annotated).

B. Chien (U.S. Patent Application Publication No. 2016/0126001)

62. Chien published as U.S. Patent Application Publication No. 2016/0126001 on May 5, 2016, and was filed January 26, 2015. I understand and have been asked to assume that Chien is prior art to the '400 patent.

63. Chien discloses a wireless power transmitter comprising a PCB (30) and first, second, and third transmitting coils disposed on opposite surfaces of the PCB. Chien, Abstract, FIGS. 8-10. In some embodiments, “there are two coils 88 and 89 arranged on top layer of the PCB 30 and a coil 90 arranged on bottom layer of the PCB 30,” and in other embodiments, the “first coil 31 is arranged on a first layer (first face) of the PCB 30, and the other two coils 82, 83 are arranged on a second layer (second face) of the PCB 30.” Chien, [0032], [0034], FIG. 8.

C. Yamazaki (U.S. Patent Application Publication No. 2013/0175984)

64. Yamazaki published July 11, 2013, as U.S. Patent Application Publication No. 2013/0175984, and was filed on December 14, 2012. I understand and have been asked to assume that Yamazaki is prior art to the '400 patent.

65. Yamazaki also discloses a wireless power transmitter for transmitting power to a mobile terminal power receiver. Yamazaki, [0043], FIGS. 2 and 4. The wireless transmitter includes a flexible circuit board 11 having top and bottom surfaces on which “copper foils are etched by a metal corrosive agent” to form symmetrical coils. Yamazaki, [0072], FIGS. 2 and 4.

66. Yamazaki further discloses that the coils are thicker than the flexible circuit board such that a circuit board thickness is “within the range of 12 μm to 75 μm , preferably 12 μm to 25 μm ” and the etched coils 12 “protrude from the respective surfaces of the flexible circuit board 11 for about 60 μm .” Yamazaki, [0051], FIG. 2. The copper foil from which the coils are etched is also thicker than the PCB. Yamazaki, [0051] (“On each of the top and bottom surfaces of the flexible circuit board 11, a copper foil which is 60 μm thick (is 18 μm to 75 μm thick, preferably 35 μm to 50 μm thick) is attached.”). Etching, the thickness of the PCB, plate, and coils contribute to the desirable low profile of the power transmitter. Yamazaki, [0029]-[0030].

D. NPL1

67. NPL1 published September 8, 2015. NPL1, 1; Ex. 1021, 1-3, 6-8. I understand and have been asked to assume that NPL1 is prior art to the '400 patent.

68. NPL1 teaches a photochemical machining process “for manufacturing high-precision flat metal parts by chemically etching away the unwanted materials, using a photographically prepared mask (a Fototool) to protect the metal that is to remain after the etching process.” NPL1, 1; Ex. 1021, 6-8. In practice, images of the desired product design are transferred “to a sheet of clean flat metal which has been coated on both sides with a photosensitive, etchant-resistant polymer called

photoresist” and “metal not covered by the photoresist is dissolved, leaving precisely the” design of the desired product. NPL1, 1, FIG. 1 (illustrating a metal product formed by symmetrically etching both surfaces of the metal); Ex. 1021, 6-8.

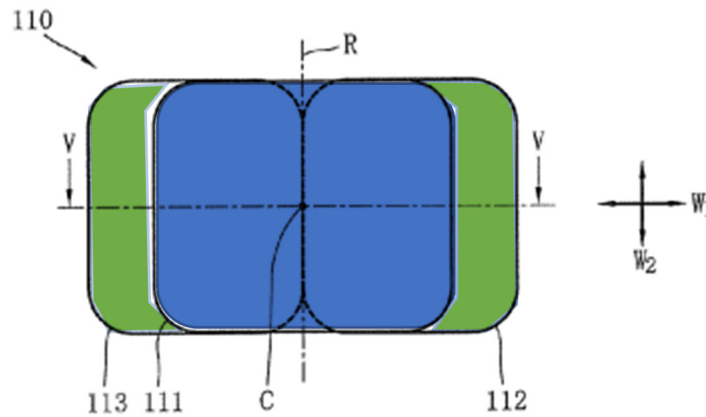
E. Jung 719 (U.S. Patent Application Publication No. 2013/0015719)

69. Jung 719 published on January 17, 2013, as U.S. Patent Application Publication No. 2013/0015719, and was filed July 16, 2012. I understand and have been asked to assume that Jung 719 is prior art to the '400 patent.

70. Jung 719 discloses a wireless power transmitter 100 including a first (main) coil 111 and second and third (sub) coils 112, 113 disposed in a partially overlapping arrangement. Jung 719, FIGS. 2-3.

71. In one embodiment, the coils are dimensioned such that the widths of the coils in the W_2 direction are the same, and the width of the main coil 111 in the direction W_1 is “60-80% of the sum of the widths of the first sub coil 112 and the second sub coil 113.” Jung 719, [0070], FIG. 4.

FIG. 4



Jung 719, FIG. 4 (annotated).

72. In another embodiment, the coils are dimensioned such that the width of the first coil 111 is “100% of the sum of the widths of the first sub coil 112 and the second sub coil 113” so “any one portion of the first sub coil 112 and the second sub coil 113 in the direction W_1 is not exposed to the outside.” Jung 719, [0070].

73. The overlapping configurations “minimize[] deterioration of a power transmitting efficiency by ... increasing a freedom degree of a correct position in which the wireless power receiving device for receiving power from the wireless power transmitting device is to be disposed.” Jung 719, [0008].

F. Jung, Chien, Yamazaki, NPL1, and Jung 719 are analogous art to the '400 Patent

74. Taking into consideration the test for “analogous art” discussed above, it is my opinion that Jung, Chien, Yamazaki, and Jung 719 are analogous art to the '400 patent because each reference, like the '400 patent, is directed to the same technical field: “a wireless power transfer technology, and more particularly, to a wireless power transmitter.” *Compare* Ex. 1001, 1:13-16, *with* Jung, [0001]; Chien, [0010]-[0013]; Yamazaki, [0007]-[0009]; Jung 719, [0012]-[0017]. NPL1 is analogous art because it is reasonably pertinent to the problem of forming a design from a metallic material. *Compare* Ex. 1001, 9:20-27, *with* NPL1, 1; Ex. 1021, 6-8. More specifically, a POSITA would have looked to NPL1 when considering economical methods for etching designs, including transmission coil designs, into a copper sheet. NPL2 (explaining that NPL1’s “photochemical machining process is capable of producing” parts from metal sheets of copper.); Ex. 1021, 5-8.

X. GROUNDS OF UNPATENTABILITY

75. Based on my review of the materials set forth above, including my application of the knowledge of a person of ordinary skill in the art, it is my opinion that claims 1-19 of the '400 patent would have been obvious to one of ordinary skill in the art.

76. In particular, it is my opinion that claims 1-19 of the '400 patent would have been obvious to a person of ordinary skill in the art based on the combinations shown below:

Ground	Claim(s) Challenged	35 USC §	References
1	1-3, 5, 8-11, 13, 14, 17, and 18	103	Jung
2	2 and 13	103	Jung and Chien
3	4, 12, and 19	103	Jung, Yamazaki, and NPL1
4	6, 7, 15, and 16	103	Jung and Jung 719

XI. THE CHALLENGED CLAIMS ARE UNPATENTABLE BASED ON THE PRIOR ART

77. In my opinion, claims 1-19 would have been obvious to one skilled in the art at the earliest priority date of the '400 patent.

A. Ground 1: Claims 1-3, 5, 8-11, 13, 14, 17, and 18 are Obvious over Jung

1. Independent Claim 1

B. Jung discloses or renders obvious claim 1.

a. [1Preamble] “A wireless power transmitter comprising:”

C. To the extent the preamble is limiting, Jung discloses a “wireless power transmitter”: “a non-contact charging station for generating an induced

magnetic field” and “controlling power transmission” to a non-contact power-receiving apparatus “for power charge.” Jung, [0027], [0059].

b. [1a] “a Printed Circuit Board (PCB);”

80. Jung discloses that its charging station includes a PCB. Jung’s charging station includes a PCB core (also called a “primary core” or “inductance pattern core”) “realized by forming one or more layers of planar-spiral cores made of copper on a PCB.” Jung, [0001], [0029], [0033], [0075] (emphasis added).

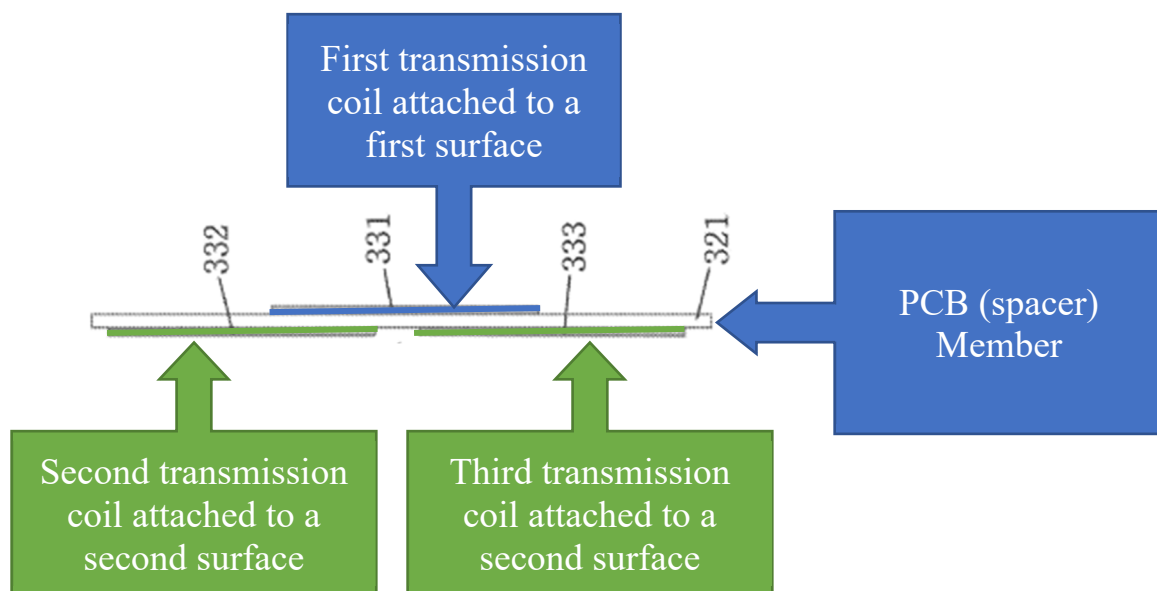
c. [1b] “a first transmission coil attached to a first surface of the PCB; a second transmission coil and a third transmission coil, each attached to a second surface of the PCB opposite to the first surface,”

81. Jung discloses or renders obvious [1b].

82. As discussed for [1a], Jung discloses one or more layers of copper “planar-spiral cores” formed “on the PCB,” including at least one “upper core and a lower core.” Jung, [0075], [0087].

83. A POSITA would have understood that the PCB core includes a first transmission coil attached to a first surface of the PCB, and second and third transmission coils attached to a second surface of the PCB opposite to the first surface, because Jung discloses a first lower **core 331** corresponding to a first copper transmission coil thread and **second and third upper cores 332, 333** corresponding to second and third copper transmission coil threads “formed in a planar shape on a PCB.” Jung, [0018], [0027] (“the induction pattern core includes

a power transmission PCB core having a planar-spiral core structure based on a planar unit core in which a plurality of fine coil threads are formed.”), [0075] (emphasis added), [0078] (the inductance pattern core “can be configured as a multi-layer structure including a base core 331, a first upper core 332 and a second upper core 333.”), FIGS. 2, 5, 6.

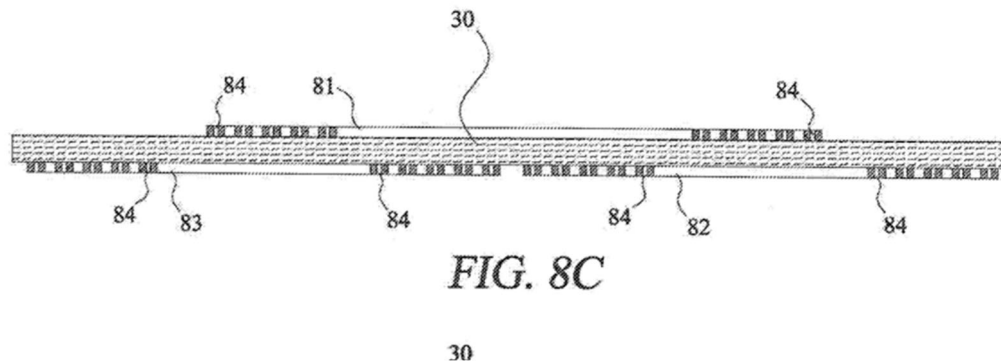


Jung, FIG. 5 (annotated).

84. A POSITA would have also understood that the “spacer” 321 identified in Figure 5 is the PCB because the coils are formed onto it and [0075] discloses “forming one or more layers of planar-spiral cores made of copper on a PCB.” *See also* Jung 538, [0115] (describing a power transmission (PT)-PCB Core “formed such that a single-layered or multi-layered copper planar spiral core is formed on a PCP (PCB having a Copper Clad Laminate (CCL), Flexible CCL

(FCCL) or the like)”; Schmelzer, [0031]-[0031], FIG. 2 (describing and illustrating a PCB Board 31 comprised of spacers having windings (copper coils) formed thereon). Furthermore, a two-layer PCB is conventionally a first surface with copper separated by a spacer from a second surface with copper.

85. Indeed, it was known in the art to form planar spiral cores to opposite surfaces of a PCB to promote “stable power transmission” to a power receiving device even when the device is displaced. Jung, [0107]; Chien, [0030], FIGS. 8A-D (describing and illustrating a “two-layer wireless charging coil PCB structure” including a PCB 30 and spiral coils 81-83, “where the first coil 31 is arranged on a first layer (first face) of the PCB 30, and the other two coils 82, 83 are arranged on a second layer (second face) of the PCB 30.”); Yamazaki, [0072], FIGS. 2, 7 (describing and illustrating a flexible circuit board 11 having copper spiral coils 12 etched onto “the top and bottom surfaces of the flexible circuit board 11.”); Kim, [0046]-[0048], [0062], FIGS. 2-5 (describing and illustrating flexible PCB 41 having etched copper spiral coils 42 and formed on opposite upper and lower sides of the flexible PCB).



Chien, FIG. 8C.

d. [1c] “both of the second and third transmission coils overlapping with the first transmission coil;”

86. Jung discloses [1c].

87. As discussed for [1b], Jung discloses or renders obvious a first core (transmission coil) formed onto (attached to) a first surface of the PCB, and second and third cores (transmission coils) formed onto (attached to) a second surface of the PCB opposite to the first surface. Jung, [0029], [0075], [0078].

88. Jung further discloses that the second and third coils (333, 332) “**overlap**” with the first coil 331. Jung, FIG. 5; [0107].

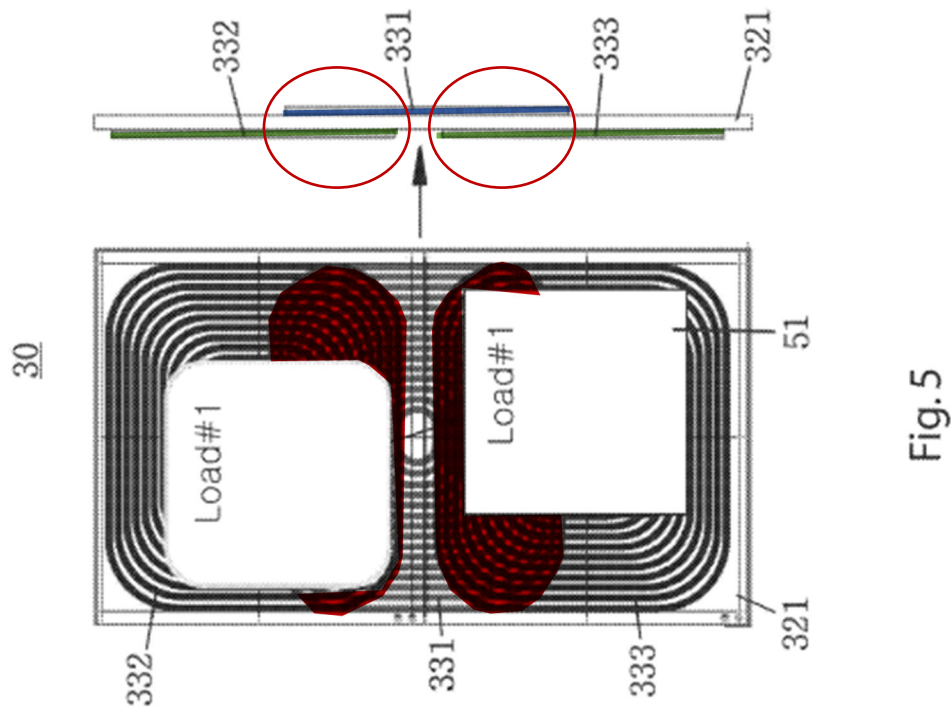


Fig. 5

Jung, FIG. 5 (annotated).

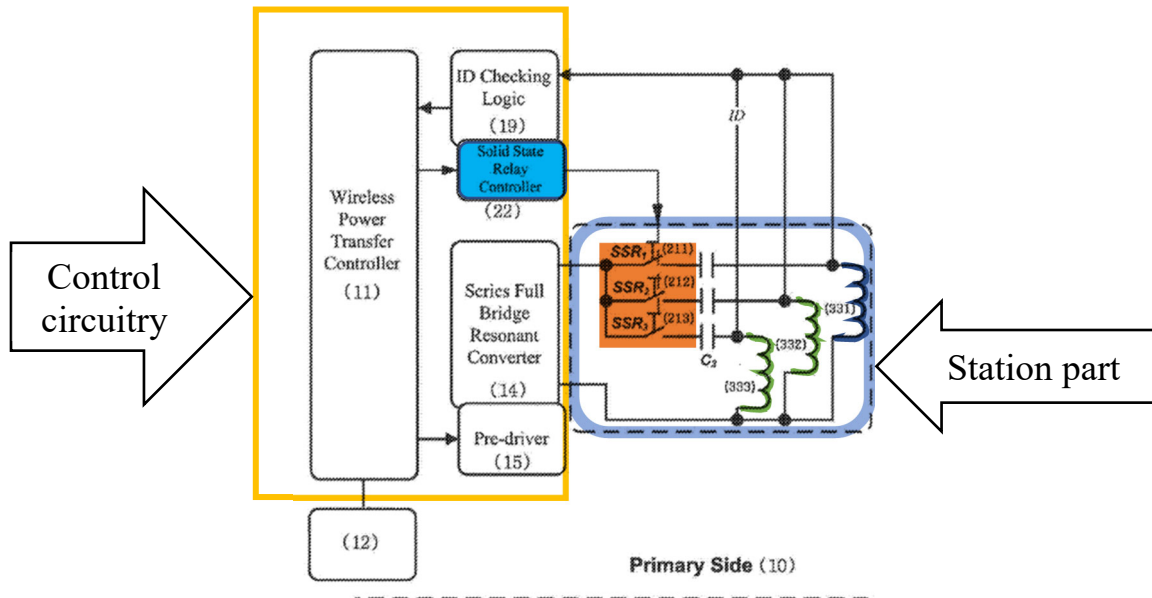
- e. [1d] “and a control circuit board for controlling wireless power transfer through the first to third transmission coils,”

89. Jung discloses or renders obvious [1d].

90. A POSITA would have understood “control circuitry” or “control circuit board” to be included in a wireless power transmitter, power amplifier, or power converter for wireless power. A wireless power transmitter, power amplifier, or power converter cannot operate without a controller.

91. Jung uses **control circuitry** including a solid-state relay controller to control power transfer through the cores (coils). Jung, [0091], [0109], FIG. 6. For example, Jung discloses a **solid state relay controller 22** “that allows the first

through third switches 211 to 213” connected to respective first, second, and third cores, “to be switched” “so that an induced magnetic field is generated from one of the three planar PCB cores (i.e., the planar-spiral power transmission PCB cores) of the primary core 31.” Jung, [0091] (emphasis added), [0109].



Jung, FIG. 6 (annotated, excerpted).

92. A POSITA would have understood that the control circuitry, including the solid state relay controller, is implemented on a distinct circuit board because it is separated from the PCB, cores 331-333, and switches 211-213 by an “enclos[ure]” formed by a station part. Jung, FIGS. 2, 5-6, [0027] (describing the “transmission controller provided inside the non-contact charging station” and the “station part enclosing a primary core electrically connected with the transmission controller to generate the induced magnetic field.”) (emphasis added), [0040],

[0107]. This is consistent with the arguments made during prosecution, during which Applicant did not dispute that control circuitry alone was indicative of a “control circuit board.” Ex. 1002, 33-39 (presenting arguments and amendments to distinguish the functions of the control circuit board but not that control circuitry alone was sufficient to anticipate a “control circuit board.”)

93. To the extent Patent Owner argues that Jung does not disclose a control circuitry *board*, it would have been obvious for a POSITA to place the control circuitry on a separate circuit board, as was well known at the time of the invention. *See, e.g.*, Levie, 29:58-63 (describing a “printer PCB” and “comm board 126 ha[ving] the control circuits” wherein “[t]he printer PCB and comm board 126 are connected through a card edge connector 110.”; Olsen, [0019] (describing a PCB “having contact points for componentry including ... an edge connector for coupling to power and control circuitry, and conductive runs that electrically connect componentry to terminals of the edge connector so as to allow for [a] functional lighting circuit.”; Wieloch, 1:45-47, 63-67, 2:1-2, 9-18, 2:60-63, 3:31-39, 46-62 (explaining that “high power applications such as ... power supplies, or other control devices often utilize a number of circuit boards” whereby “[t]he logic circuitry is typically mounted on ... [the] mother circuit board” and the “circuit board systems typically require ... circuit board interconnection systems (e.g., connectors, header assemblies, or other hardware) to interface each circuit board”

and describing connectors having a “small foot print” for optimizing “heat dissipation and ease of assembly.”).

94. Further still, it was well-known at the time of the invention to utilize separate circuit boards (one for control circuitry and another for supporting the coils) to reduce the potential for overheating, reduce magnetic interference, improve packaging, and simplify manufacturing.

i. Motivation

95. A POSITA would have been motivated to utilize a separate circuit board to simplify manufacturing and repair, and to reduce magnetic interference and the potential for overheating. Levie, 29:58-65 (explaining that the separate connector allows for simplified disassembly); Wieloch, 2:60-63, 3:31-39, 46-62 (describing connectors that optimize “heat dissipation and ease of assembly”).

ii. Expectation of Success

96. A POSITA would have had a reasonable expectation of success in using a distinct control circuit board containing the control circuitry because the modification would have only required the use of existing and well-known components (control circuitry boards) in accordance with their established function. Such a modification would have only required routine skill to implement, e.g., connecting the control circuit board to the PCB using a mechanical connector, and electrically coupling the PCB to the connector so as to “interface each circuit

board” and allow for a “functional” circuit and device. Wieloch, 2:14-18; Olsen, [0019]

- f. [1e] “wherein the second transmission coil is spaced apart from the third transmission coil by a middle area without overlapping with the third transmission coil,”

97. Jung discloses [1e].

98. As discussed for [1b], Jung discloses or renders obvious a first core (transmission coil) formed onto (attached to) a first surface of the PCB, and second and third cores (transmission coils) formed onto (attached to) a second surface of the PCB opposite to the first surface. Jung, [0029], [0075], [0078].

99. Jung further discloses that the second core (coil) 333 is spaced apart from the third core (coil) 332 by a middle area and that the second and third coils do not overlap. Jung, FIG. 5.

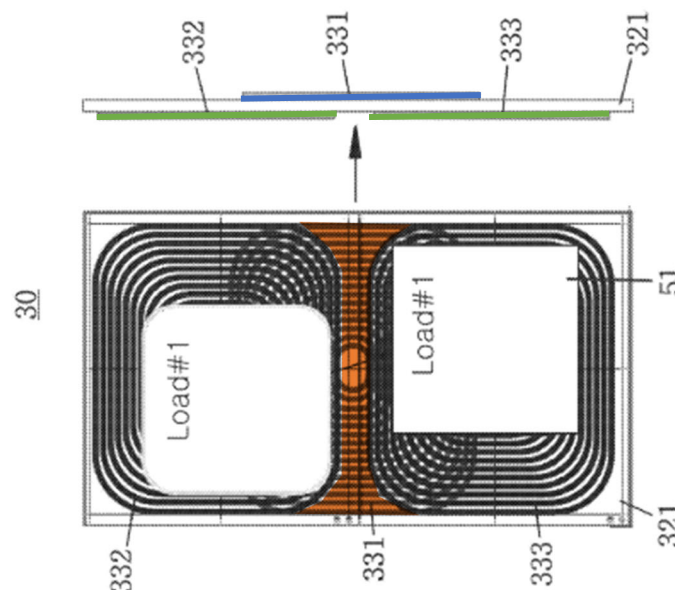


Fig. 5

Jung, FIG. 5 (annotated).

- g. [1f] “wherein the first transmission coil overlaps with the middle area and portions of the second and third transmission coils, and”**

100. Jung discloses [1f].

101. As discussed for [1e], Jung discloses that the second core (coil) 333 is spaced apart from the third core (coil) 332 by a middle area and that the second and third coils do not overlap. Jung, FIG. 5.

102. Jung further discloses that the first core (coil) 331 “overlaps” with the middle area and portions of the second and third coil. Jung, FIG. 5, [0107].

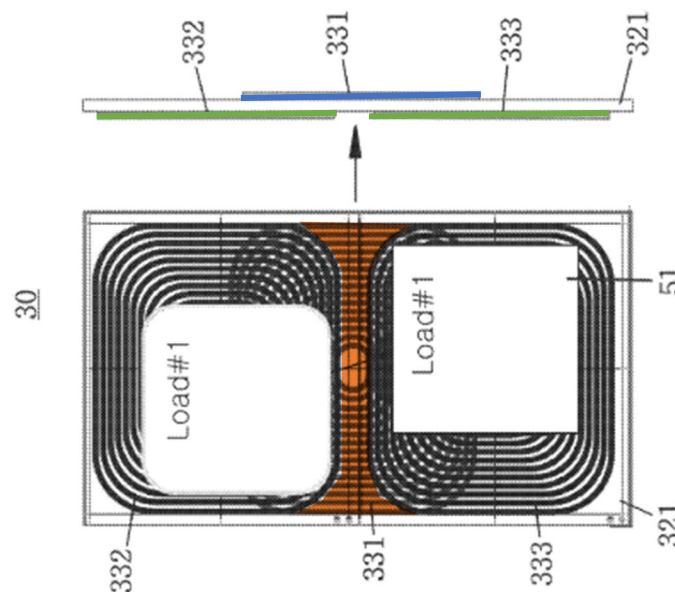


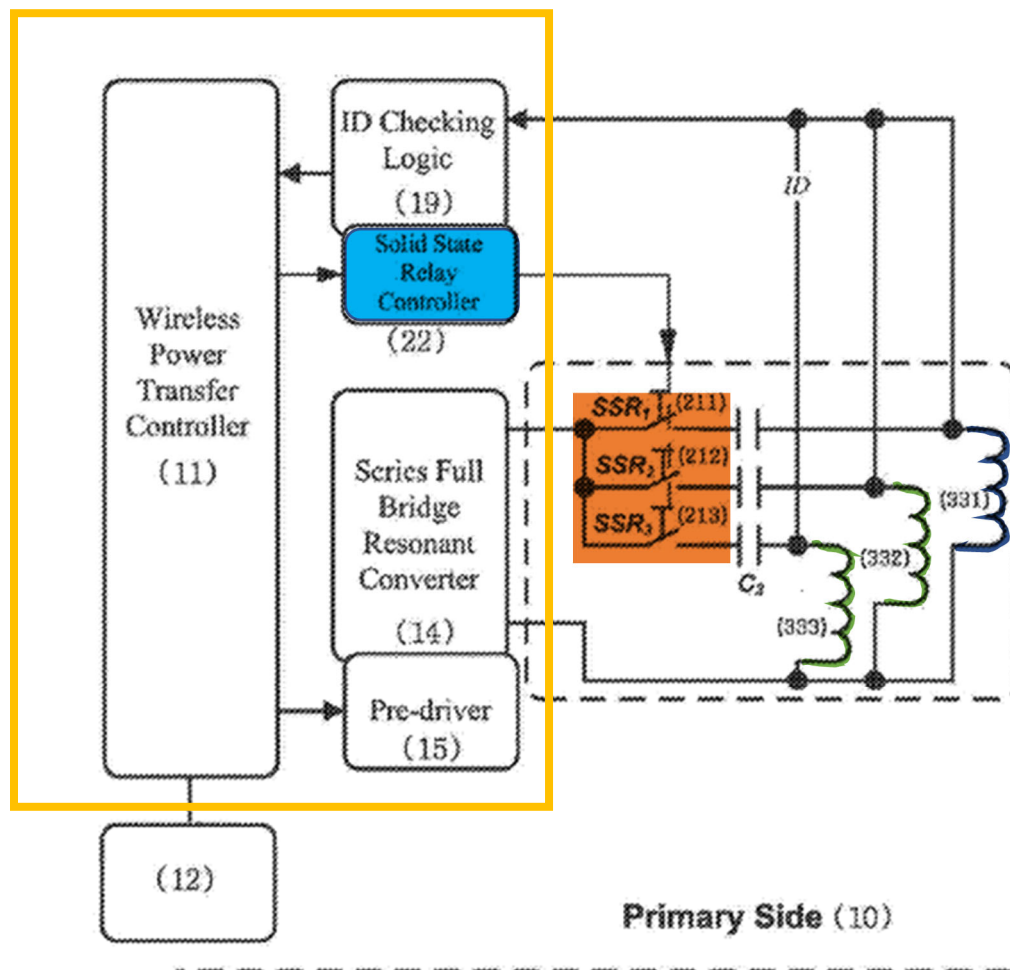
Fig. 5

Jung, FIG. 5 (annotated).

h. [1g] “wherein the control circuit board is configured to: individually select an aligned coil among the first, second and third transmission coils for transmitting wireless power, and”

103. Jung discloses [1g].

104. As explained for [1d], Jung discloses or renders obvious **control circuitry**, including a **solid state relay controller**, implemented on a circuit board.



Jung, FIG. 6 (annotated, excerpted).

105. Jung further discloses that the control circuitry is configured to individually select an aligned coil for transmitting wireless power by detecting and switching on the core (coil) with the “best sensitivity.” Jung, [0095], [0099]-[0100]. Specifically, Jung discloses that the control circuitry “detects the sensitivity of a signal (e.g., the intensity of an induced current and voltage) transmitted from the non-contact charging station 10, selects a core providing the best sensitivity,” i.e., an aligned coil, “transmits a response signal including the unique ID of the selected core,” and “transmits a switching signal for turning on a corresponding switch (e.g., a switch 211 when the first upper core is selected) to the solid state relay controller 22,” so “the resonant converter 14 supplies electric power to the corresponding [aligned] core via the turned-on switch,” and “the [selected/aligned] core generates an induced magnetic field to charge the ... non-contact power-receiving apparatus 50.” Jung, [0095], [0099]-[0100] (emphases added).

- i. **[1h] “control the aligned coil to transmit the wireless power without transmitting the wireless power via two unselected coils among the first, second and third transmission coils.”**

106. Jung discloses [1h].

107. As explained for [1g], Jung discloses individually selecting an aligned coil for transmitting wireless power by detecting and switching on the core (coil) with the “best sensitivity.” Jung, [0095], [0099]-[0100].

108. Jung further discloses that the unselected coils do not transmit power because “the other switches corresponding to the other cores except for the selected core” are “turned off in order to prevent waste of power.” Jung, [0100].

2. Claim 2: “The wireless power transmitter according to claim 1, wherein the first surface is a surface facing an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface at an opposite side of the interface surface.”

109. Jung renders obvious the additional limitations of claim 2.

110. As explained for [1b], Jung discloses or renders obvious a first core (transmission coil) formed onto (attached to) a first surface of the PCB, and second and third cores (transmission coils) formed onto (attached to) a second surface of the PCB opposite to the first surface. Jung, [0029], [0075], [0078].

111. Jung further discloses that the charging station includes a “a non-contact charging plate” (also called “station part” 30) having an interface surface on which the non-contact power-receiving apparatus 50 (wireless power receiver) is placed. Jung, [0058], [0059], [0088]; FIG. 5. The PCB core is “enclos[ed]” in the charging plate/station part such that the second (upper) surface containing the second and third coils faces the interface surface of the charging plate/ station part 30 and the first (lower) PCB surface containing core (coil) 331 is opposite the interface surface. Jung, [0027], [0088], FIG. 5. This configuration allows power receiving apparatus (load) 50 to be placed “downward on” the second coil or

“onto” the third coil, (Jung, [0088], FIG. 5), and is *the opposite* of the configuration recited in claim 2.

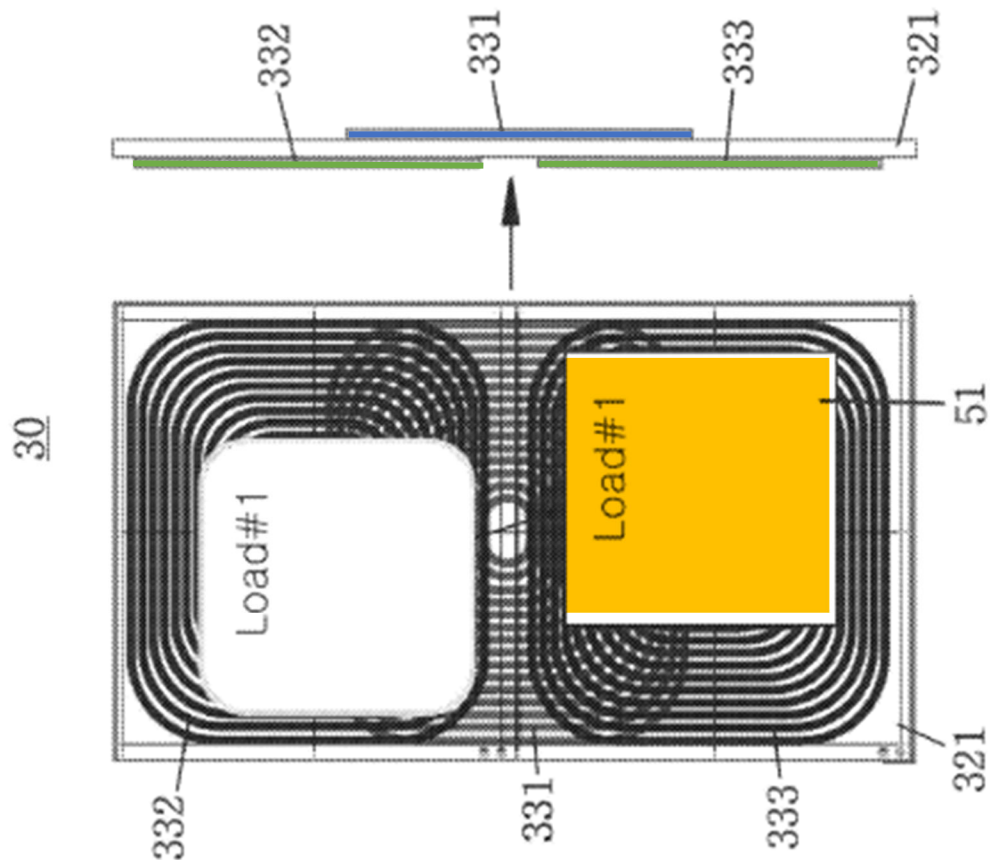


Fig. 5

Jung, FIG. 5 (annotated).

112. Jung also discloses that alternative coil configurations are possible as would occur to one of ordinary skill in the art. Jung, [0078], [0171]. A POSITA would have found it obvious to rearrange the coils such that the second surface contains the first coil and faces the interface of the “station part,” and the first surface opposite the interface surface contains the second and third cores (coils), as

was known in the art. Chien, [0032], [0034] (describing coil configurations in which a first coil is attached to a first or second opposite surface of a PCB, and second and third coils are attached to the other of the first or second surfaces of the PCB).

a. Motivation

113. A POSITA would have understood that both coil configurations are suitable for wireless power transmitting (charging) applications, and would have been motivated to try the alternative configuration to assess optimal coil configurations for wireless charging.

b. Expectation of Success

114. A POSITA would have also had a reasonable expectation in configuring the coils so that the first coil is arranged on an interface facing surface and the remaining coils are on an opposite side of the interface facing surface. Such a modification would have merely required the rearrangement of known existing elements in accordance with a known configuration.

3. Claim 3: “The wireless power transmitter according to claim 1, wherein the first surface is a surface at an opposite side of an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface facing the interface surface.”

115. Jung discloses the additional limitations of claim 3.

116. As discussed for claim 2, Jung further discloses that the charging station includes a “a non-contact charging plate” (also called “station part” 30)

having an interface surface on which the non-contact power-receiving apparatus 50 (wireless power receiver) is placed. Jung, [0058], [0059], [0088]; FIG. 5. The PCB core is “enclos[ed]” in the charging plate/station part such that the second (upper) surface containing the second and third coils faces the interface surface of the charging plate/ station part 30 and the first (lower) PCB surface containing core (coil) 331 is opposite the interface surface. Jung, [0027], [0088], FIG. 5. This configuration allows power receiving apparatus (load) 50 to be placed “downward on” the second coil or “onto” the third coil, (Jung, [0088], FIG. 5).

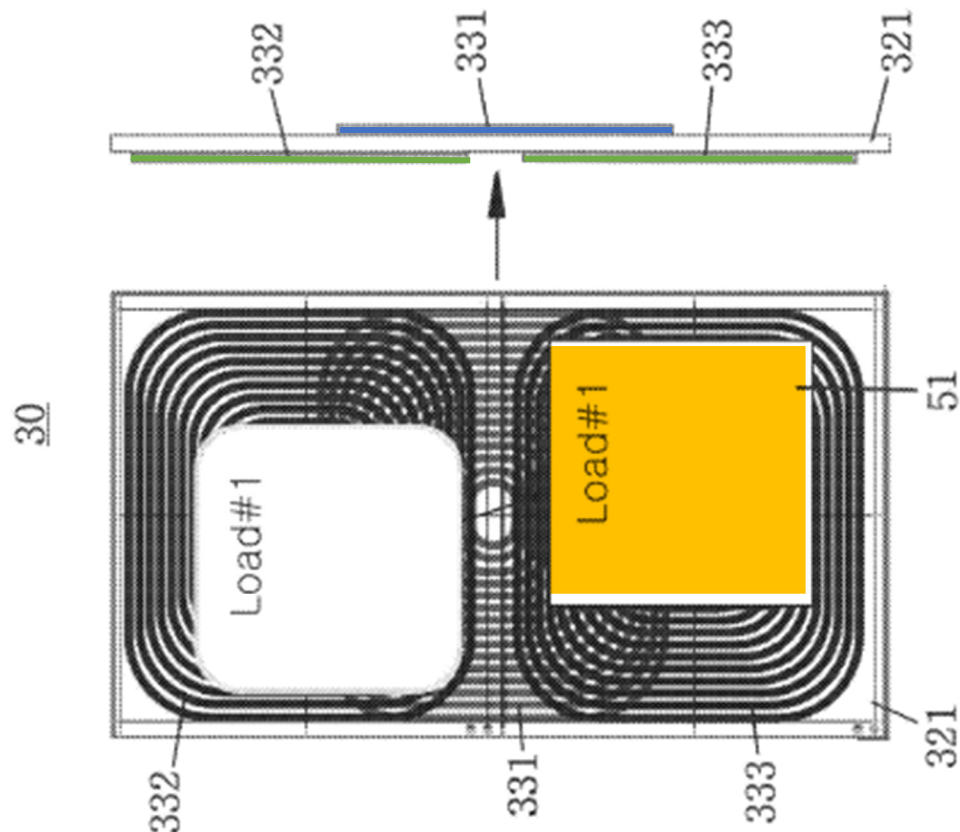


Fig. 5

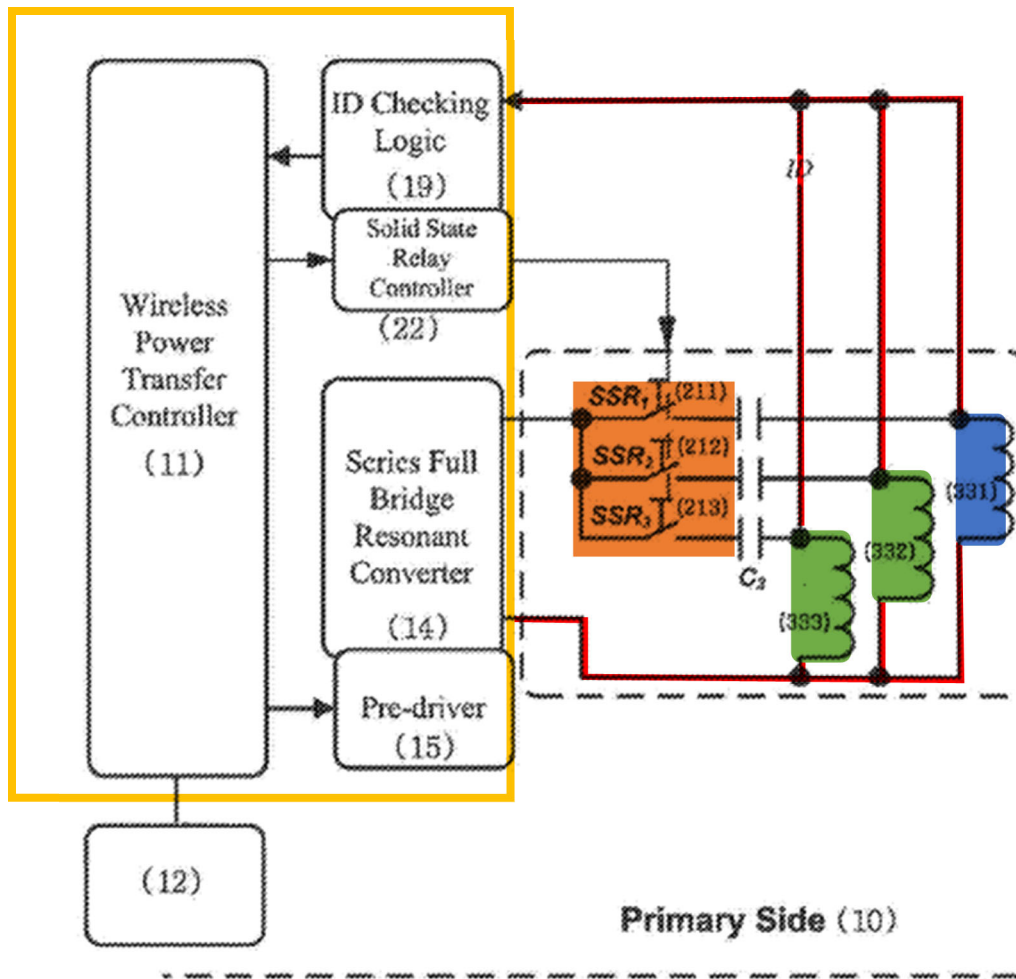
Jung, FIG. 5 (annotated).

4. Claim 5: “The wireless power transmitter according to claim 1, wherein each of the first to third transmission coils is connected to the control circuit board via a connector inserted into the PCB.”

117. Jung discloses or renders obvious the additional limitations of claim 5.

118. As explained for [1d], Jung discloses or renders obvious control circuitry on a circuit board. Jung also discloses the circuit board being connected to the first, second, and third cores/coils 331-333 via a connector inserted into the PCB.

119. For example, as illustrated in annotated Figure 6 below, each core 331-333 in the “station part [is] electrically **connected** with the transmission controller” of the control circuitry (board). Jung, [0020], [0027].



Jung, FIG. 6 (annotated, excerpted).

120. A POSITA would have understood that the control circuitry is conventionally electrically connected to the coils via a connector inserted into the PCB because the control circuitry is separate from the PCB (as explained in [1d]) and would have required a connector to maintain electrical connection and communication between the control circuitry and the electrical components of the station part to facilitate power transmission through the coils. Jung, [0099]-[0109]. Such a connector would have been configured to couple the control circuitry to the

PCB using pins inserted into the PCB (as with conventional mechanical connectors).

121. This is consistent with the arguments made during prosecution, during which Applicant did not dispute that “usage of the connector ... is a mere or routine skill in the art.” Ex. 1002, 51 (rejecting the connector as obvious for being well-known in the art), 38 (arguing that the connector’s proximity to the first coil was not obvious but not the use of a connector for connecting the coils to the circuit board and inserted into the PCB).

122. To the extent that Patent Owner argues that Jung does not disclose the circuit board being connected to the first, second, and third cores/coils 331-333 via a connector inserted into the PCB, it would have been obvious for a POSITA to do so. As explained above, a POSITA would have understood that a connector is needed to maintain electrical connection and communication between the control circuitry and the electrical components of the station part to facilitate power transmission through the coils. Jung, [0099]-[0109]; Wieloch, 2:14-18; Olsen, [0019]. A POSITA would have also understood that there are limited options for ensuring such a connection, namely soldering or mechanical pin connectors. In use, mechanical connectors are inserted to the PCB at one end, and receive the circuitry to be linked at the other end.

a. Motivation

123. A POSITA would have been motivated to utilize a mechanical connector instead of a soldered connection to simplify and thus reduce the cost of assembly during the manufacturing process. For example, the connector would have merely required securing the connector to the PCB and control circuitry board via, e.g., insertion (inserting the control circuit board into the connector and inserting the connector into the PCB); whereas a soldered connection would have required a more permanent connection between the control circuit board to the PCB. This relatively permanent connection would have required additional time and precision to avoid soldering the wrong circuit components, and would have taken additional time to correct (e.g., melting the solder to undo the connection and adding new solder to reconnect the components); whereas the mechanical connector would have merely required detachment and repositioning to correct wrongful placement. The modification would have also simplified and reduced the cost of repair because the mechanical connector allows for replacement of the faulty connection, whereas soldering would have required replacement of the connection and even the soldered components (PCB and control circuitry board).

124. A POSITA would also have been motivated to utilize a mechanical connector instead of soldering to reduce the mechanical stress on the PCB. As discussed above, mechanical connectors are easily attached to PCBs and other

circuit boards via, e.g., insertion, whereas soldering requires heating and a more permanent connection. The increase in temperature caused by soldering imparts mechanical stress onto the PCB and potential losses in PCB integrity.

b. Expectation of Success

125. A POSITA would have had a reasonable expectation of success in connecting the circuit board to the PCB via a connector inserted into the PCB because the modification would have only required the use of known components in accordance with their known function and would have only required routine skill to implement, e.g., connecting the circuit board to the PCB via a mechanical connector to retain the electrical connection between the control circuitry and the electrical components of the station part.

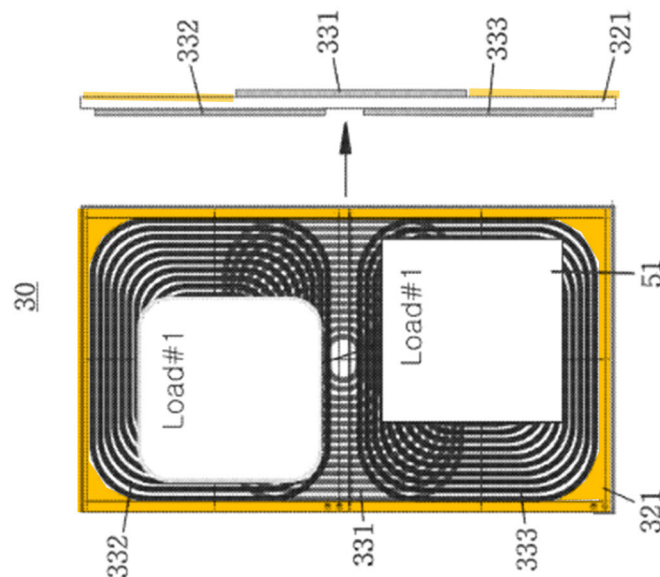
5. Claim 8: “The wireless power transmitter according to claim 5, wherein the connector is located closest to the first transmission coil, among the first transmission coil, the second transmission coil and the third transmission coil.”

126. Jung renders obvious the additional limitations of claim 8.

127. As explained for claim 5, Jung renders obvious a connector inserted into the PCB, wherein each of the first to third transmission coils is connected to the control circuit board via the connector.

128. Jung also renders obvious the connector being located closest to the first transmission coil. As illustrated in annotated Figure 5 below, there are a finite number of locations on which the connector could have been inserted into the

PCB—namely, the first surface or the second surface. An obvious choice would have been at a location on the first (lower) surface (where there is only one coil element and therefore increased space for attachment) and near a midline of the PCB (where the first coil overlaps the second and third coils and provides the greatest degree of charging freedom).



Jung, FIG. 5 (annotated).

a. Motivation

129. A POSITA would have been motivated to place the connector at a location closest to the first transmission coil, because doing so would have only required selecting the location from a finite number of predictable locations and would have been a matter of design choice.

b. Expectation of Success

130. A POSITA would have had a reasonable expectation of success in placing the connector at a location closest to the first core 331 because it would have only required the use of conventional materials for their intended purpose, as discussed for claim 5.

6. Claim 9: “The wireless power transmitter according to claim 1, wherein each of the first, second and third transmission coils is connected to two switches among a plurality of switches, and wherein the plurality of switches are disposed between a signal generator and the first, second and third transmission coils.”

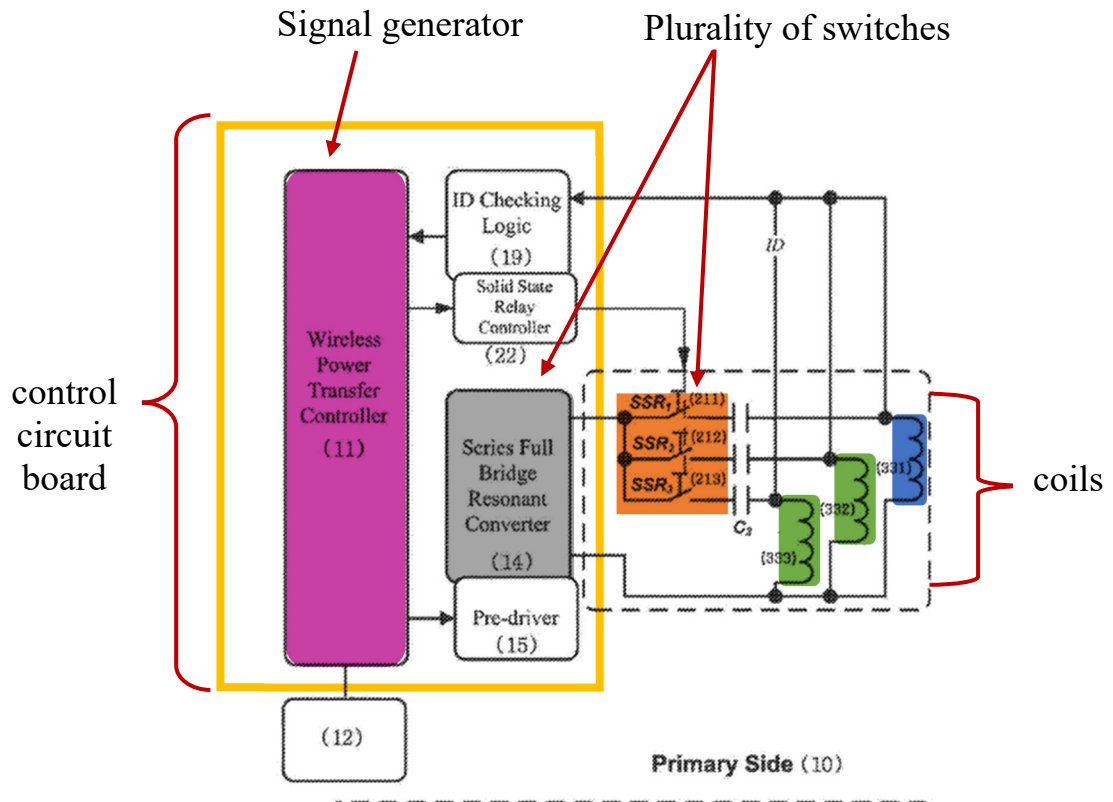
131. Jung discloses the additional limitations of claim 9.

132. As discussed for [1d] and [1g], Jung discloses control circuitry including a solid-state relay controller for controlling power transfer through the cores (coils) via switches 211-213. Jung, [0091], [0109], FIG. 6.

133. Jung further discloses that the charging station includes a transmission controller (signal generator) and that each core (coil) is connected two switches among a plurality of switches disposed between the signal generator and the coils. Specifically, Jung discloses that the charging station includes a “**transmission controller 11** (i.e., a wireless power transfer controller)” that “transmits a switching signal” for “turning on” one of switches 211, 212, 213 corresponding to respective cores/coils 311, 312, 313, and a plurality of switches, including the switches

211-213 and “a four-phase switch” of “serial [(series)] resonant converter” 14.

Jung, [0092], [0099], [0108]-[0109].



Jung, FIG. 6 (annotated, excerpted).

134. As illustrated in annotated Figure 6 above, each core is connected to two switches of the plurality of switches—base core 331 (first transmission coil) to switch 211 and the four-phase switch, upper core 332 (second transmission coil) to switch 212 and the four-phase switch, and upper core 333 (third transmission coil) to switch 213 and the four-phase switch. Jung, FIG. 6, [0099]-[0100],

[0107]-[0109]. The switches are also disposed between transmission controller 11 (signal generator) and the coils. Jung, FIG. 6.

7. Independent Claim 10

135. Claim 10 is similar to claim 1, except it recites the connector of claims 5 and 8. Claim 10 is obvious over Jung for the reasons discussed in claims 1, 5, and 8.

a. [10Preamble] “A wireless power transmitter comprising:”

136. Jung discloses [10Preamble] for the same reasons discussed for [1Preamble].

b. [10a] “a first layer including a first transmission coil; a second layer including a second transmission coil and a third transmission coil;”

137. Jung discloses [10a] for the same reasons discussed for [1b]

c. [10b] “a first transmission coil attached to a first surface of the PCB; a second transmission coil and a third transmission coil, each attached to a second surface of the PCB opposite to the first surface,”

138. Jung discloses or renders obvious [10b] for the same reasons discussed for [1b].

d. [10c] “a control circuit board for controlling wireless power transfer through the first, second and third transmission coils; and”

139. Jung discloses or renders obvious [10c] for the same reasons discussed for [1d].

- e. **[10d] “a connector inserted into the PCB, the connector electrically connecting the first, second and third transmission coils to the control circuit board,”**

140. Jung renders obvious [10d] for the same reasons discussed for claim

5.

- f. **[10e] “wherein the connector is located closer to the first transmission coil than the second and third transmission coils.”**

141. Jung renders obvious [10e] for the same reasons discussed for claim 8.

- 8. **Claim 11: “The wireless power transmitter according to claim 10, wherein the first transmission coil included in the first layer and the second transmission coil included in the second layer overlap each other.”**

142. Jung discloses the additional limitations of claim 11 for the same reasons discussed for [1f].

- 9. **Claim 13: “The wireless power transmitter according to claim 10, wherein the first surface is a surface facing an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface at an opposite side of the interface surface.”**

143. Jung renders obvious the additional limitations of claim 13 for the same reasons discussed for claim 2.

- 10. Claim 14: “The wireless power transmitter according to claim 10, wherein the first surface is a surface at an opposite side of an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface facing the interface surface.”**

144. Jung discloses the additional limitations of claim 14 for the same reasons discussed for claim 3.

- 11. Claim 17: “The wireless power transmitter according to claim 10, wherein the second transmission coil and the third transmission coil are spaced apart from each other.**

145. Jung discloses the additional limitations of claim 17 for the same reasons discussed for [1e].

12. Independent Claim 18

146. Claim 18 is substantially similar to claim 1, except the control circuit board is configured to individually select and control a “best aligned coil,” as recited in [18d] and [18e]. Claim 18 is obvious over Jung for the reasons discussed in claim 1.

- a. [18Preamble] “A wireless power transmitter comprising:”**

147. Jung discloses [18Preamble] for the same reasons discussed for [1Preamble].

- b. [18a] “a Printed Circuit Board (PCB);”**

148. Jung discloses [18a] for the same reasons discussed for [1a].

- c. **[18b] “a first transmission coil attached to a first surface of the PCB; a second transmission coil and a third transmission coil, each attached to a second surface of the PCB opposite to the first surface,”**

149. Jung discloses or renders obvious [18b] for the same reasons discussed for [1b].

- d. **[18c] “both of the second and third transmission coils overlapping with the first transmission coil;”**

150. Jung discloses or renders obvious [18c] for the same reasons discussed for [1c].

- e. **[18d] “and a control circuit board for controlling wireless power transfer through the first to third transmission coils,”**

151. Jung discloses or renders obvious [18d] for the same reasons discussed for [1d].

- f. **[18e] “wherein the control circuit board is configured to: individually select a best aligned coil among the first, second and third transmission coils for transmitting wireless power, and”**

152. Jung discloses [18e].

153. As discussed for [1g], Jung further discloses individually selecting an aligned coil for transmitting wireless power by detecting and switching on the core (coil) with the “best sensitivity.” Jung, [0095], [0099]-[0100]. Specifically, Jung discloses that the control circuitry “detects the sensitivity of a signal (e.g., the intensity of an induced current and voltage) transmitted from the non-contact

charging station 10, selects a core providing the best sensitivity,” i.e., a best aligned coil, “transmits a response signal including the unique ID of the selected core,” and “transmits a switching signal for turning on a corresponding switch (e.g., a switch 211 when the first upper core is selected) to the solid state relay controller 22,” so “the resonant converter 14 supplies electric power to the corresponding [best aligned] core via the turned-on switch,” and “the [selected/aligned] core generates an induced magnetic field to charge the ... non-contact power-receiving apparatus 50.” Jung, [0095], [0099]-[0100] (emphases added).

154. A POSITA would have understood that the core with the “best sensitivity” corresponds to the “best aligned coil” within the meaning of the ’400 patent because it describes the coil having the “most” stability and “induced current and voltage” in response to the device to be charged. Jung, [0092], [0095]; Ex. 1001, 5:21-31 (explaining that the best aligned coil is the coil that “has better power transfer efficiency (or charging efficiency).”).

- g. [18f] “control the best aligned coil to transmit the wireless power without transmitting the wireless power via two unselected coils among the first, second and third transmission coils.”**

155. Jung discloses [18f].

156. As discussed for [1g] and [18e], Jung discloses individually selecting a best aligned coil for transmitting wireless power by detecting and switching on

the core (coil) with the “best sensitivity.” Jung, [0095], [0099]-[0100]. Jung further discloses that the unselected coils do not transmit power because “the other switches corresponding to the other cores except for the selected core” are “turned off in order to prevent waste of power.” Jung, [0100].

B. Ground 2: Claims 2 and 13 are obvious over Jung and Chien.

- 1. Claim 2: “The wireless power transmitter according to claim 1, wherein the first surface is a surface facing an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface at an opposite side of the interface surface.”**

157. As discussed in Ground 1, Jung at least suggests that the first PCB surface faces the charging plate interface surface on which the power receiver is placed, and that the second PCB surface is on an opposite side of the interface surface.

158. Chien also renders obvious the additional limitations of claim 2 because Chien expressly discloses the suitability of the recited coil configuration for wireless charging applications.

159. Specifically, Chien discloses a wireless power transmitter comprising a PCB (30) and first, second, and third transmitting coils disposed on opposite surfaces of the PCB. Chien, Abstract, FIGS. 8-10. Like Jung, there are certain embodiments having “two coils 88 and 89 arranged on top layer [surface] of the PCB 30 and a coil 90 arranged on bottom layer [surface] of the PCB 30.” Chien,

[0034], FIGS. 10A-10B. In other embodiments, however, the “first coil 31 is arranged on a first layer (first [sur]face) of the PCB 30, and the other two coils 82, 83 are arranged on a second layer (second [sur]face) of the PCB 30.” Chien, [0032], [0034], FIGS. 8A-8C. Both coil configurations are suitable for wireless charging applications, and Chien expressly discloses that the later configuration advantageously “provide[s] wireless charging from almost every portion on the PCB.” Chien, [0032].

160. A POSITA would have found it obvious to modify the PCB core of Jung such that first core/coil 331 is disposed on the upper (first) surface of the PCB and the second and third cores/coils 332, 333 are disposed on the lower (second) surface of the PCB, as taught by Chien. The modification is such that the upper (first) PCB surface (now containing coil 331) faces the charging plate interface surface on which the power receiver is placed, and the lower (second) PCB surface (now containing coils 332, 333) is on an opposite side of the interface surface.

a. Motivation to Combine

161. A POSITA would have been motivated to at least try the alternative configuration disclosed in Chien because of its known suitability for wireless charging applications and because the modification would not have altered the operation of the charging station. A POSITA would have also been motivated to modify Jung’s coil configurations in accordance with the teachings of Chien to

“provide wireless charging from almost every portion on the PCB,” (Chien, [0032]), an objective also contemplated by Jung. Jung, [0107].

b. Expectation of Success

162. A POSITA would have also had a reasonable expectation of success in making the modification because it would have merely required the rearrangement of known existing elements in accordance with a known successful configuration.

- 2. Claim 13: “The wireless power transmitter according to claim 10, wherein the first surface is a surface facing an interface surface on which a wireless power receiver is placed, and wherein the second surface is a surface at an opposite side of the interface surface.”**

163. Jung and Chien render obvious the additional limitations of claim 13 for the same reasons discussed for claim 2.

C. Ground 3: Claims 4, 12, and 19 are obvious over Jung, Yamazaki, and NPL1.

- 1. Claim 4: “The wireless power transmitter according to claim 1, wherein each of the first to third transmission coils is formed by symmetrically etching both surfaces of a copper plate, and wherein each of the first to third transmission coils is thicker than the PCB.”**

164. Jung, Yamazaki, and NPL1 render obvious the additional limitations of claim 4.

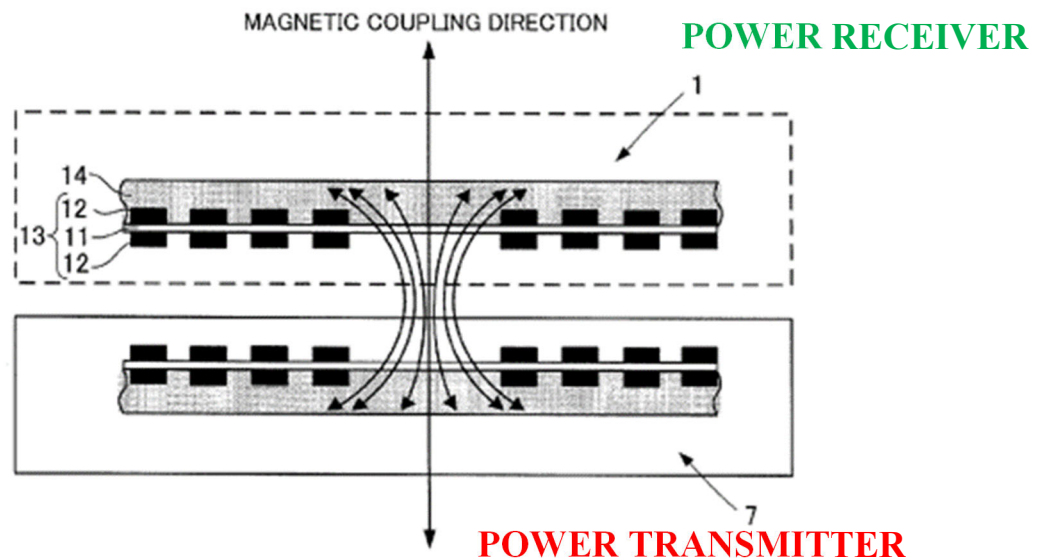
165. As explained for [1a], Jung’s charging station includes a PCB having one or more layers of planar, copper, spiral cores formed thereon. Jung, [0075],

[0080], [0129]. Jung also contemplates a “thin film-like” PCB core, but is silent as to an etching process and the relative thickness of the PCB and spiral copper cores.

a. Yamazaki

166. Yamazaki discloses a wireless power transmitting module for transmitting power to a mobile terminal power receiver. Yamazaki, [0043], FIGS. 2 and 4. The modules are “structured in a similar manner,” so as to be “thin, small, and light” and include a flexible circuit board 11 having top and bottom surfaces on which copper, spiral, flat coils 12 are formed. Yamazaki, FIGS. 2, 7, [0007], [0044], [0072].

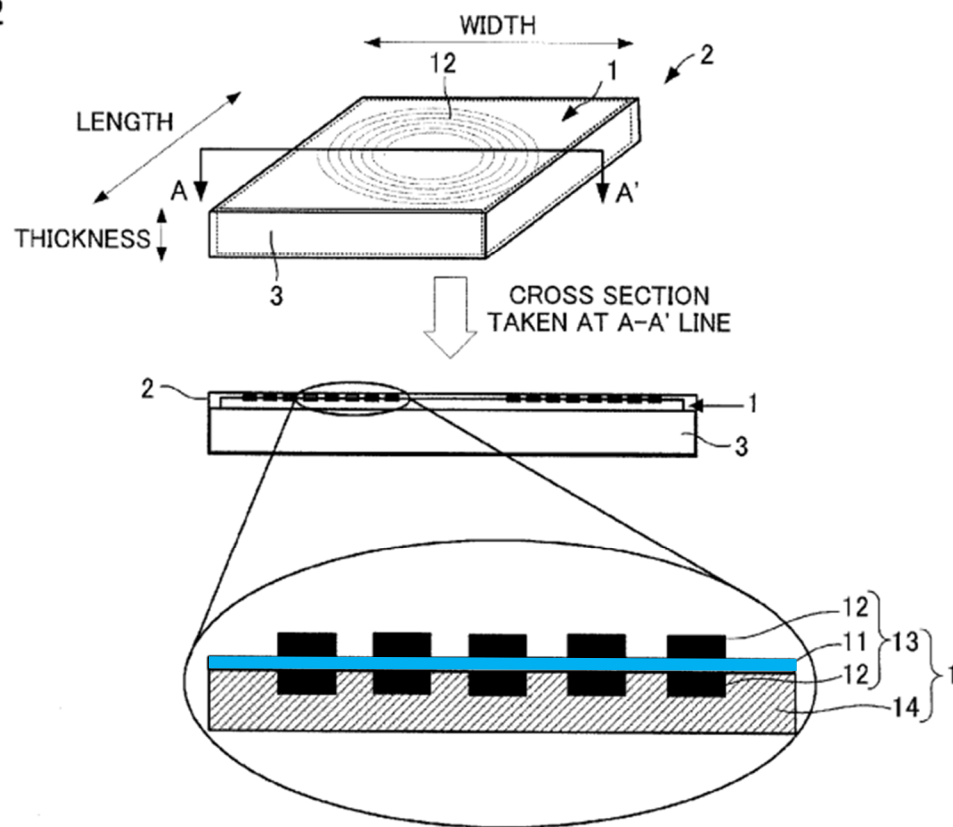
FIG.4



Yamazaki, FIG. 4 (annotated).

167. Yamazaki further discloses a method of making the copper coils including symmetrically etching a copper foil “attached” to the top and bottom surfaces of the **circuit board**. Yamazaki, [0051], [0072]. For example, Yamazaki discloses “mask[ing]” the copper foil “with ink or paint,” and “etch[ing] the masked copper foil with “a metal corrosive agent” to form symmetrical coils 12 “on the top and bottom surfaces of the flexible circuit board 11 as circuit patterns.” Yamazaki, [0051], [0072], FIGS. 2 and 4.

FIG.2



Yamazaki, FIG. 2 (annotated).

168. Yamazaki further discloses that the copper foil¹ and etched coils are thicker than the flexible circuit board. Yamazaki, [0052]. Specifically, Yamazaki discloses that the circuit board is “12 μm to 75 μm [and] preferably 12 μm to 25 μm ” thick, and that etched coils 12 “protrude from the respective surfaces of the flexible circuit board 11 for about 60 μm .” Yamazaki, [0051], FIG. 2 (demonstrating that “thickness” corresponds to a vertical dimension and thus the degree to which the coils protrude from the circuit board).

b. NPL1

169. NPL1 teaches a photochemical machining process “for manufacturing high-precision flat metal parts by chemically etching away the unwanted materials, using a photographically prepared mask (a Fototool) to protect the metal that is to remain after the etching process.” NPL1, 1; Ex. 1021, 6-8. In practice, images of the desired product design are transferred “to a sheet of clean flat metal which has been coated on both sides with a photosensitive, etchant-resistant polymer called photoresist” and “metal not covered by the photoresist is dissolved, leaving precisely the” design of the desired product. NPL1, 1, FIG. 1 (illustrating a metal product formed by symmetrically etching both surfaces of the metal); Ex. 1021, 6-8.

¹ The '400 patent only discloses a copper plate thicker than the PCB. Ex. 1001, 9:17-19.

170. NPL1 further teaches that the process provides numerous “design advantages,” including easy and economical etching of “extremely thin metal ... without distortion” and increased dimensional accuracy. NPL1, 1; Ex. 1021, 6-8.

c. Motivation to Combine Jung, Yamazaki, and NPL1

171. Both the etching process and thickness of the coil and substrate (circuit board) contribute to the desirable low profile of the power transmitting module. Yamazaki, [0029], [0030]. A POSITA would have been motivated to use etching to form the coils on the PCB of Jung, whereby the resultant coils are thicker than the circuit board on to which they are etched, as taught by Yamazaki, to maintain a desirable low profile wireless charging device.

172. A POSITA would have also been motivated to symmetrically etch both surfaces of the copper foil, an “extremely thin metal,” according to the method taught by NPL1, to “easily and economically” improve the dimensional accuracy of the etched coil design without distorting the metal itself. NPL1, 1; Ex. 1021, 6-8.

d. Expectation of Success

173. Etching is a well-known method for forming copper coils on a circuit board. Yamazaki, [0029], [0030]; Kim, [0047], [0062]. A POSITA would have had a reasonable expectation of success in forming the coils to be thicker than the PCB, as taught by Yamazaki, using photochemical machining (chemical etching), as

taught by NPL1, because such a modification would have merely required the use of established techniques (chemical etching) to achieve a well-known purpose (forming copper coils on PCB). Yamazaki, [0029], [0030]; Kim, [0047], [0062]; NPL2 (explaining that NPL1's "photochemical machining process is capable of producing" parts from metal sheets of copper.); Ex. 1021, 5-8.

174. A POSITA would have also expected the etching process of NPL1 to succeed because it is capable of being performed on the copper foil of Yamazaki, which is "preferably 35 μ m to 50 μ m thick." Yamazaki, [0051] (emphasis added); NPL2 (further explaining that the photochemical machining process of NPL1 is capable of producing parts from metal sheets of copper "ranging in thickness from .0005 inch (0.013 mm) up to .090 inch (2.286 mm) [13 μ m - 2,286 μ m])") (emphasis added); Ex. 1021, 5-8.

2. Claim 12: "The wireless power transmitter according to claim 10, wherein the first, second and third transmission coils are formed by symmetrically etching both surfaces of a copper plate, and wherein each of the first to third transmission coils is thicker than the PCB."

175. Jung, Yamazaki, and NPL1 render obvious the additional limitations of claim 12 for the same reasons discussed for claim 4.

- 3. Claim 19: “The wireless power transmitter according to claim 18, wherein each of the first to third transmission coils is formed by symmetrically etching both surfaces of a copper plate, and wherein each of the first to third transmission coils is thicker than the PCB.”**

176. Jung, Yamazaki, and NPL1 render obvious the additional limitations of claim 19 for the same reasons discussed for claim 4.

D. Ground 4: Claims 6, 7, 15, and 16 are obvious over Jung and Jung 719.

- 1. Claim 6: “The wireless power transmitter according to claim 1, wherein the second transmission coil and the third transmission coil are spaced apart from each other, and wherein an overlapping area between the first transmission coil and the second and third transmission coils is 50% or more of an entire area of the first transmission coil.”**

177. Jung and Jung 719 render obvious the additional limitations of claim 6.

178. As discussed for [1e] and [1f], Jung discloses that the second and third coils are spaced apart by a middle area and that the first coil overlaps with the second and third coil. Jung, [0107], FIG. 5. The overlap enables constant, stable power transmission, “even if” the device to be charged “shakes and is thus displaced.” Jung, [0107].

179. Jung at least suggests that an overlapping area between the first transmission coil and the second and third transmission coils is 50% or more of an entire area (orange) of the first transmission coil, as illustrated in annotated Figure 5 below.

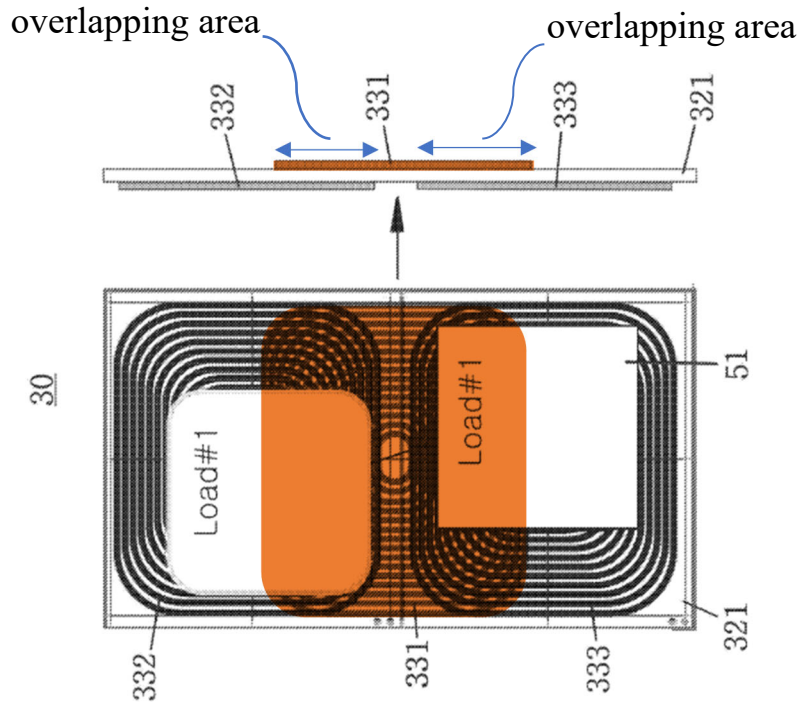
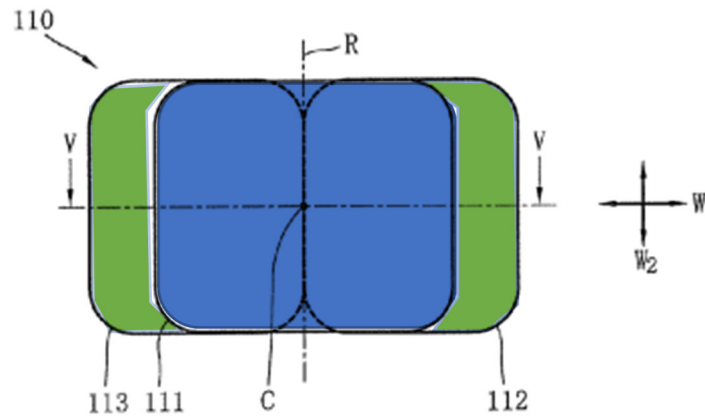


Fig. 5

Jung, FIG. 5 (annotated).

180. Jung 719 discloses a wireless power transmitter 100 including a first (main) coil 111 and second and third (sub) coils 112, 113 disposed in a partially overlapping arrangement. Jung 719, FIGS. 2-4. The main (first) coil, like the base (first) coil in Jung, is centrally located with respect to and overlaps with the second and third coils.

FIG. 4



Jung 719, FIG. 4 (annotated).

181. Jung 719 further discloses that an overlapping area between the first transmission coil and the second and third transmission coils is 50% or more of an entire area of the first transmission coil. Specifically, Jung 719 describes an embodiment in which the coils are dimensioned such that the widths of the coils in the W_2 direction are the same, and the width of the main coil 111 in the direction W_1 is “60-80% of the sum of the widths of the first sub coil 112 and the second sub coil 113.” Jung 719, [0070], FIG. 4 (illustrating coil overlap, W_1 and W_2).

182. Jung 719 also teaches that the coils have a “quadrangular shape;” therefore, the area of each coil is approximated by $W_1 * W_2$. Jung 719, [0053], [0072]. Thus, when W_2 is the same for all coils, and the width of the main coil 111 in the direction W_1 is “60-80% of the sum of the widths of the first sub coil 112

and the second sub coil 113,” the overlapping area between the first coil and the second and third coils is approximately 60-80%. Jung 719, [0070].

183. Jung 719 also discloses an alternate embodiment in which the coils are dimensioned such that the width of the first coil 111 is “100% of the sum of the widths of the first sub coil 112 and the second sub coil 113,” such that “any one portion of the first sub coil 112 and the second sub coil 113 in the direction W_1 is not exposed to the outside.” Jung 719, [0070]. That is, Jung 719 discloses a coil configuration in which the overlapping area is 100%, which is 50% or more of an entire area of the first transmission coil. The overlap “is proper when the main coil 111 mainly transmits a power signal to the wireless power receiving device 200 and the first sub coil 112 and the second sub coil 113 assist the main coil 111.” Jung 719, [0070].

a. Motivation to Combine

184. The overlapping configurations “minimize[] deterioration of a power transmitting efficiency by ... increasing a freedom degree of a correct position in which the wireless power receiving device for receiving power from the wireless power transmitting device is to be disposed.” Jung 719, [0008].

185. Thus, a POSITA would have been motivated to configure the coils of Jung such that an overlapping area between the first transmission coil and the second and third transmission coils is 50% or more of an entire area of the first

transmission coil, as taught by Jung 719, to increase the number of positions a power receiving device, such as Jung's device 50, could be placed for charging while maintaining power transmitting efficiency. This is consistent with Jung's objective to promote stable power transmission, "even if" the device to be charged "shakes and is thus displaced." Jung, [0107].

b. Expectation of Success

186. A POSITA would have had a reasonable expectation of success in configuring the overlapping area between the first transmission coil and the second and third transmission coils to be 50% or more of an entire area of the first transmission coil, because it would have only required routine skill to implement (e.g., altering to the dimension or proximity of the coils) and would not have adversely affected the power transmitting function of the coils, as evidenced by Jung 719.

2. Claim 7: "The wireless power transmitter according to claim 6, wherein the overlapping area between the first transmission coil and the second and third transmission coils is 90% or more of the entire area of the first transmission coil."

187. Jung and Jung 719 render obvious the additional limitations of claim 7.

188. As explained for claim 6, Jung 719 discloses an alternate embodiment in which the coils are dimensioned such that the width of the first coil 111 is

“100% of the sum of the widths of the first sub coil 112 and the second sub coil 113” such that “any one portion of the first sub coil 112 and the second sub coil 113 in the direction W_1 is not exposed to the outside.” Jung 719, [0070]. That is, Jung 719 discloses a coil configuration in which the overlapping area is 100%, which is 90% or more of an entire area of the first transmission coil. The overlap “is proper when the main coil 111 mainly transmits a power signal to the wireless power receiving device 200 and the first sub coil 112 and the second sub coil 113 assist the main coil 111.” Jung 719, [0070].

a. Motivation to Combine

189. As discussed for claim 6, the overlapping configurations “minimize[] deterioration of a power transmitting efficiency by ... increasing a freedom degree of a correct position in which the wireless power receiving device for receiving power from the wireless power transmitting device is to be disposed.” Jung 719, [0008].

190. A POSITA would have been motivated to configure the coils of Jung such that an overlapping area between the first transmission coil and the second and third transmission coils is 90% or more of an entire area of the first transmission coil, as taught by Jung 719, to increase the number of positions a power receiving device, such as Jung’s device 50, could be placed for charging while maintaining power transmitting efficiency. This is consistent with Jung’s

objective to promote stable power transmission, “even if” the device to be charged “shakes and is thus displaced.” Jung, [0107].

b. Expectation of Success

191. A POSITA would have had a reasonable expectation of success in configuring the overlapping area between the first transmission coil and the second and third transmission coils to be 90% or more of an entire area of the first transmission coil, because it would have only required routine skill to implement (e.g., altering to the dimension or proximity of the coils) and would not have adversely affected the power transmitting function of the wireless power transmitter, as evidenced by Jung 719.

3. Claim 15: “The wireless power transmitter according to claim 10, wherein an overlapping area between the first transmission coil and the second and third transmission coils is 50% or more of an entire area of the first transmission coil.”

192. Jung and Jung 719 render obvious the additional limitations of claim 15 for the same reasons discussed for claim 6.

4. Claim 16: “The wireless power transmitter according to claim 10, wherein the overlapping area between the first transmission coil and the second and third transmission coils is 90% or more of the entire area of the first transmission coil.”

193. Jung and Jung 719 render obvious the additional limitations of claim 16 for the same reasons discussed for claim 7.

XII. CONCLUSION

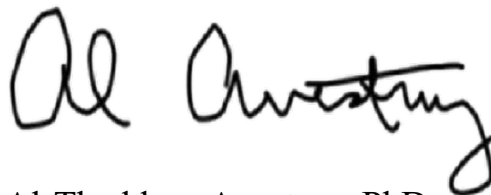
194. For the reasons set forth in Section XI, it is my opinion that one skilled in the art would have found claims 1-19 of the '400 patent obvious.

195. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

196. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: 6/6/2023

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Al Avestruz', written in a cursive style.

Al-Thaddeus Avestruz, PhD