UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.
Petitioner

v.

SCRAMOGE TECHNOLOGY LTD.
Patent Owner

U.S. Patent No. 9,553,476

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,553,476

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I. INTRODUCTION

Samsung Electronics Co., Ltd. ("Petitioner") requests *inter partes* review ("IPR") of claims 1-15 of U.S. Patent No. 9,553,476 ("the '476 patent") (Ex-1001), which, according to PTO records, is assigned to Scramoge Technology Ltd. ("Patent Owner" or "PO"). For the reasons set forth below, the challenged claims should be found unpatentable and canceled.

II. MANDATORY NOTICES

Real Parties-in-Interest: Petitioner identifies the following as the real parties-in-interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

Related Matters: PO has asserted the '476 patent against Petitioner in *Scramoge, Ltd. v. Samsung Elec. Co.*, No. 6:21-cv-00454-ADA (W.D. Tex. April 30, 2021).

Counsel and Service Information: Lead counsel is Naveen Modi (Reg. No. 46,224), and Backup counsel are (1) Joseph E. Palys (Reg. No. 46,508), (2) Phillip Citroën (Reg. No. 66,541), and (3) Paul M. Anderson (Reg. No. 39,896), Paul Hastings LLP, 2050 M St., N.W. Washington, DC 20036 (Telephone: (202) 551-1990; Fax: (202) 551-1705; Email: PH-Samsung-Scramoge-IPR@paulhastings.com). Petitioner consents to electronic service.

III. PAYMENT OF FEES

The PTO is authorized to charge all fees due at any time during this proceeding, including filing fees, to Deposit Account No. 50-2613.

IV. GROUNDS FOR STANDING

Petitioner certifies that the '476 patent is available for IPR and Petitioner is not barred or estopped from requesting IPR on the grounds identified herein.

V. PRECISE RELIEF REQUESTED

A. Claims Challenged

Petitioner requests review and cancellation of claims 1-15 ("challenged claims") of the '476 patent.

B. Grounds

Claims 1-15 should be canceled as unpatentable based on the following grounds:

Ground 1: Claims 1-15 are obvious under 35 U.S.C. § 103(a) in view of U.S. Patent Publication No. 2008/0164840 ("Kato") (Ex-1005), U.S. Patent No. 8,922,162 ("Park") (Ex-1006), U.S. Patent No. 8,995,910 ("Chong") (Ex-1007), WO 2008/016273 ("Hahn") (Ex-1008), and U.S. Patent No. 7,791,440 ("Ramadan") (Ex-1009).[1]

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[1] Other references discussed herein are only to show the state of the art.

Ground 2: Claims 13 and 14 are obvious under § 103(a) in view of Kato, Park, Chong, Hahn, Ramadan, and Korean Patent Application Publication KR 10-2013-000926 ("Yu") (Ex-1010)[2].

The '476 patent issued January 24, 2017, from U.S. App. No. 14/387,521 ("the '521 application"), filed September 23, 2014, which is a national stage application of PCT KR2013/002412, filed March 22, 2013. The '476 patent also claims priority to seven Korean Patent Applications. As discussed in Section VII.B, the earliest effective filing date of the '476 patent is March 15, 2013.

Kato published July 10, 2008, Ramadan issued September 7, 2010, and Hahn published February 7, 2008. Thus, Kato, Ramadan, and Hahn qualify as prior art under at least 35 U.S.C. § 102(b). Park issued December 30, 2014, from an application filed December 6, 2011. Chong issued March 31, 2015, from an application filed November 26, 2012. Therefore, Park and Chong qualify as prior art under at least 35 U.S.C. § 102(e). Yu published January 3, 2013, and is therefore prior art under at least 35 U.S.C. § 102(a).

[2] Ex-1010 is a compilation containing the English-language translation of Yu (pp. 1-21), its Korean language version (pp. 22-42), and an affidavit required by 37 C.F.R. § 42.63(b) (p. 43).

While Kato was cited in an IDS during prosecution of the ’521 application, it was not applied in a rejection. (Ex-1004.) None of the remaining references or the obviousness combinations relied upon in this Petition were before, or applied by, the examiner during prosecution. The combinations in this Petition have the support of expert testimony (Ex-1002), which the Examiner did not have the benefit of during prosecution. Accordingly, the prior art combinations and arguments in this Petition were never previously before the Office.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art as of the claimed priority date of the ’476 patent (“POSITA”) would have had a bachelor’s degree in electrical engineering, computer engineering, applied physics, or a related field, and at least one year of experience in the research, design, development, and/or testing of wireless charging systems, or the equivalent. (Ex-1002, ¶¶20-21.)[3] More education can supplement practical experience and vice versa. (*Id.*)

[3] Petitioner submits the declaration of R. Jacob Baker, Ph.D., P.E., (Ex-1002), an expert in the field of the ’476 patent. (Ex-1002, ¶¶5-15; Ex-1003.)

VII. OVERVIEW OF THE '476 PATENT

A. The '476 Patent

The '476 patent describes an antenna that supports wireless charging. (Ex-1001, Title, 1:19-23; Ex-1002, ¶¶31-35.) While the Abstract, Technical Problem, and Technical Solution portions of the '476 patent discuss the wireless charging antenna and the relationship between the inner angles of the antenna, the claims of the '476 patent are not directed to those angles. (Ex-1001, Abstract, 1:53-2:14, 38:65-40:57.) Instead, the sole independent claim of the '476 patent—which spans well over a column of text in the patent—is directed to a wireless power receiver that includes first and second antennas arranged on a flexible printed circuit board and covered by a magnetic sheet. Aside from those primary features, which are disclosed by the prior art referenced herein, the remaining features of claim 1 are very specific aspects of the interconnect used to connect the antennas to corresponding circuitry on the wireless power receiver. Indeed, claim 1 is nothing more than a "picture claim" that attempts to claim the very specific embodiment shown in figures 2 and 6 of the '476 patent.

Figure 2

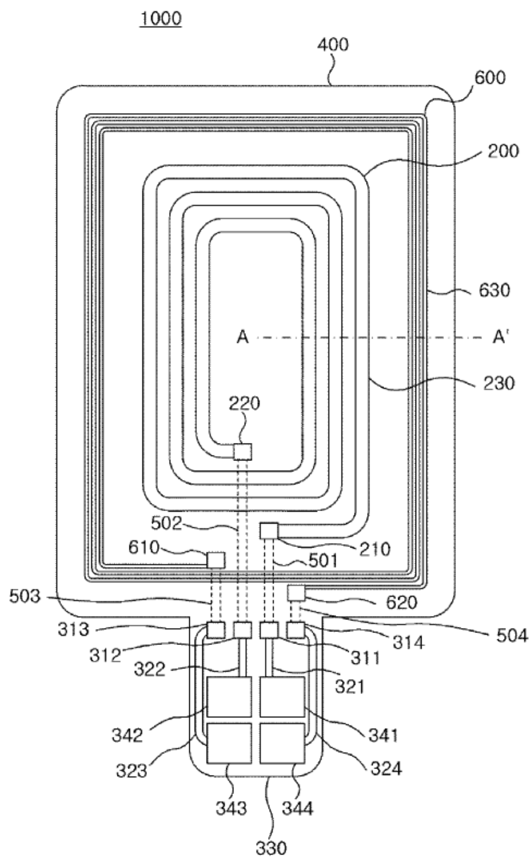
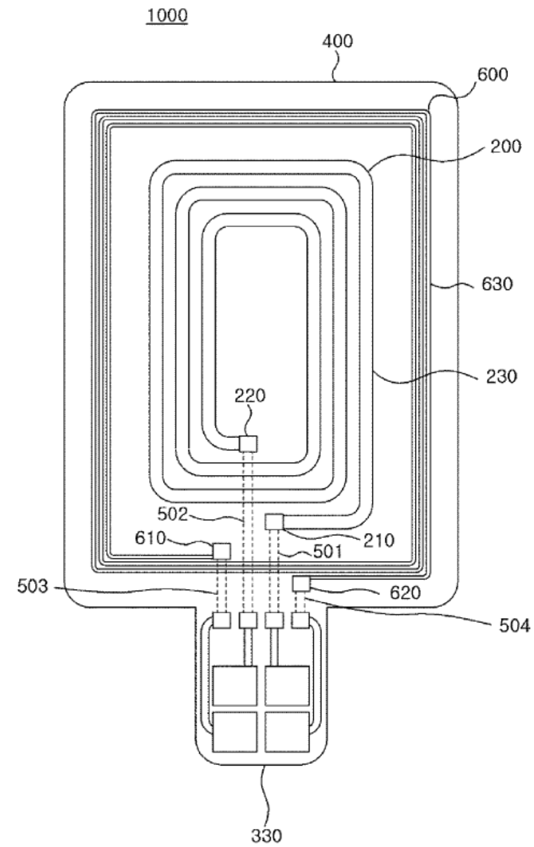


Figure 6



(*Id.,* FIGs. 2, 6.)

Those remaining features, however, were well known, widely used, and rudimentary design choices available in the industry; indeed, the specification attributes no unique advantage or criticality to them. For example, claim 1 recites subconnection parts (501-504) that connect the terminals (210, 220, 610, 620) of the coils to connectors (311-314), as well as connective conductive lines (321-324) that connect the connections (311-314) to the contact terminals (341-344). As another example, claim 1 recites that the contact terminals (341-344) "are disposed in a 2x2 matrix." The '476 patent does not explain why the specific subconnection parts and conductive lines are used or even mention a 2x2 matrix, likely because such connections and contact terminals can be arranged in a number of different ways that were well-known to those of skill in the art to achieve the same purpose. (Ex-1002, ¶¶27-30, 33-35.)

B. Earliest Effective Filing Date

While the '476 patent claims priority to seven Korean patent applications (Exs. 1016-1022), at best, only those filed on March 15, 2013, provide support for the subject matter recited in claim 1. Thus, the earliest effective filing date of the '476 patent is March 15, 2013.

During prosecution, Applicant referred to figures 1-3 as providing support for the amendments adding features regarding the magnetic sheet and various interconnect portions to claim 1, as issued. (Ex-1004, 271.) Figures 1-3, as well as any figures approximating figures 1-3, do not appear any of the pre-March 15, 2013, Korean applications. (Exs. 1016-1018.) Of the seven Korean applications, only the applications filed on March 15, 2013, include similar figures. (Ex-1004, 1622-1624; Exs-1019-1022.) Nor does the text of the pre-March 15, 2013, applications describe the claimed features. (Exs-1016-1018; Ex-1002, ¶¶36-38.) Indeed, as noted above, some of the features recited in claim 1 (e.g., 2x2 matrix) are not even described in the specification of the '476 patent, such that the only possible written description support for those features is provided by the figures. Therefore, the earliest effective priority date for the claims of the ’476 patent is March 15, 2013.

VIII. CLAIM CONSTRUCTION

During IPR, claims are construed according to the “*Phillips* standard,” as set forth in *Phillips v. AWH Corp*., 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 83 Fed. Reg. 51341 (Oct. 11, 2018). The Board only construes the claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport Systems, Inc.*, IPR2015-00633, Paper No. 11 at 16 (Aug. 14, 2015). Petitioner believes that no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims. (Ex-1002, ¶39.)

IX. DETAILED EXPLANATION OF GROUNDS

The challenged claims are unpatentable based on Grounds 1-2. (Ex-1002, ¶¶22-30, 40-190.)

A. Ground 1: Claims 1-15 Are Obvious over Kato, Park, Chong, Ramadan, and Hahn

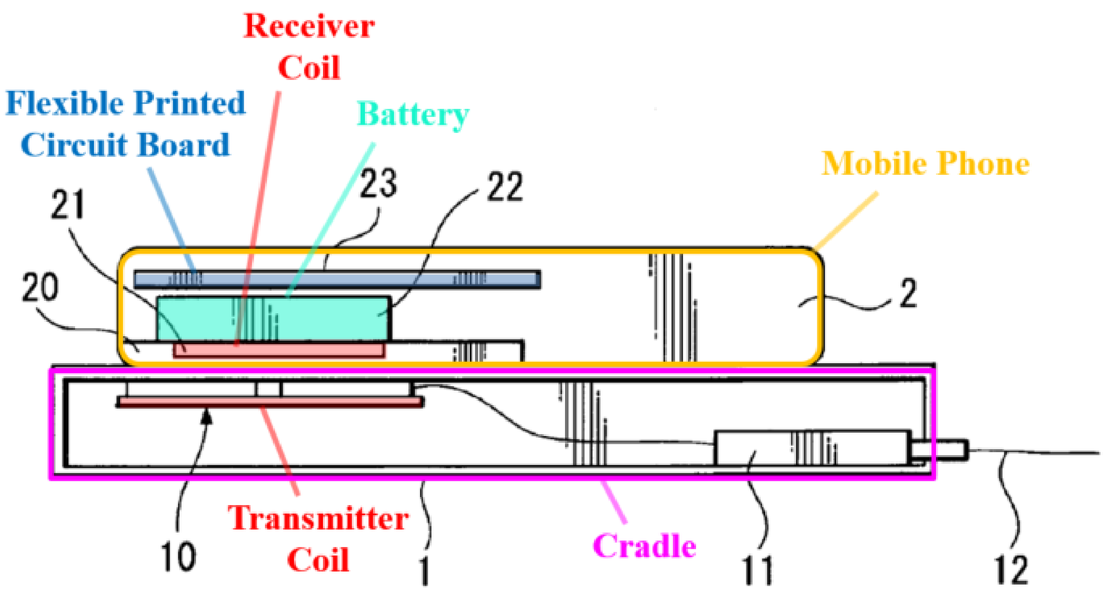
1. Claim 1

a) A wireless power receiver comprising:

To the extent the preamble is limiting, Kato discloses this feature. (Ex-1002, ¶¶55-56.) For instance, Kato discloses “a noncontact power-transmission coil for use in power transmission in a noncontact manner using electromagnetic induction.”

(Ex-1005, Title, ¶[0003].)[4] Referencing figure 3, Kato discloses a cradle 1 that includes a primary power-transmission coil 10 for transmitting power to a secondary power-transmission coil 21 for receiving power included in a mobile phone. (Ex-1005, ¶[0049], FIG. 3; Ex-1002, ¶55.)

FIG. 3



(Ex-1005, FIG. 3 (annotated); Ex-1002, ¶55.)

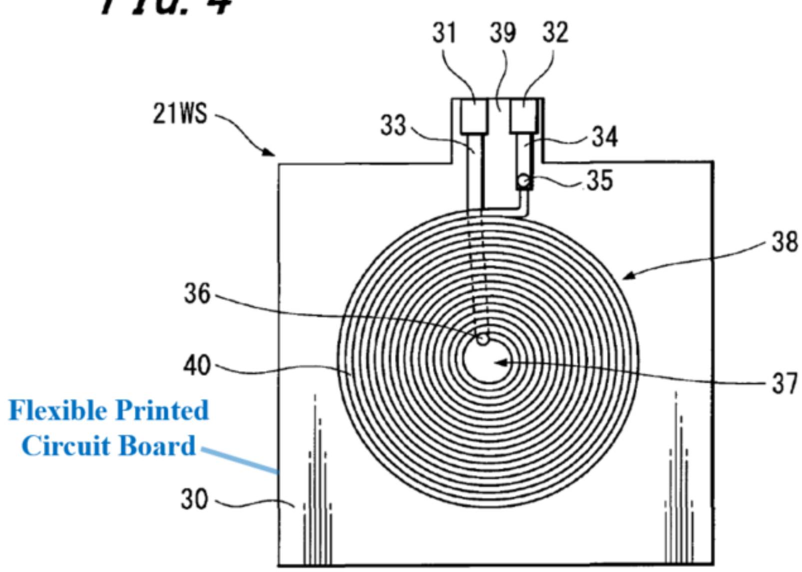
[4] A POSITA would have understood that "noncontact" in this context refers to wireless charging functionality. (Ex-1002, ¶55.)

Kato discloses that the secondary power transmission coil 21 receives power for charging the phone's battery 22. (Ex-1005, ¶[0049]; Ex-1002, ¶56.) Thus, the mobile phone 2 is a "wireless power receiver."

b) a flexible printed circuit board comprising a first surface and a second surface opposite the first surface;

Kato discloses this feature. (Ex-1002, ¶¶57-58.) Figures 4-6 of Kato show a power transmission coil 21WS for reception of power in a mobile phone like that in figure 3. (Ex-1005, ¶¶[0062], [0064], FIGs. 4-6.) "Figure 4 is a schematic front view of the noncontact power-transmission coil 21WS in which a planar coil is mounted on a flexible printed-circuit board 30." (Ex-1005, ¶[0064].)

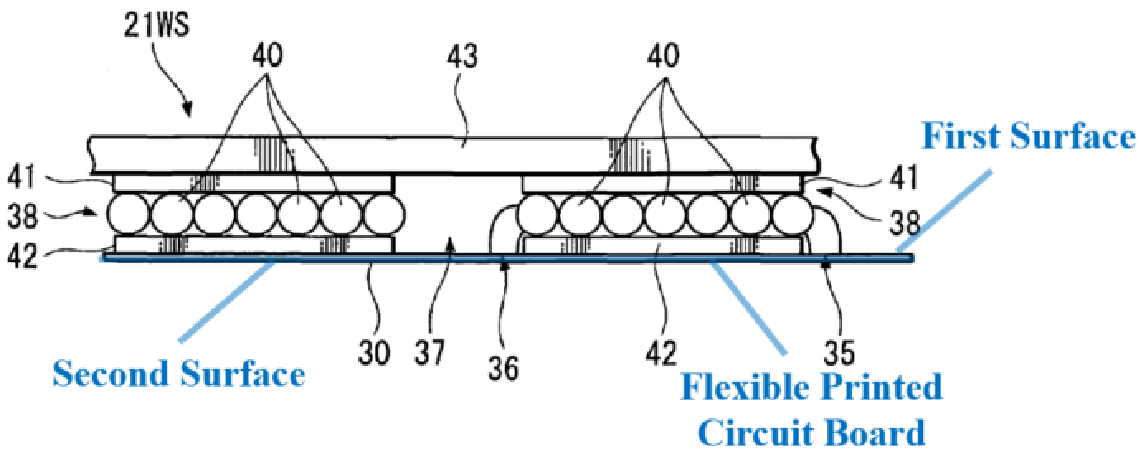
FIG. 4



(Ex-1005, FIGs. 4-5 (annotated); Ex-1002, ¶57.)

As shown in annotated figure 6 below, Kato discloses a flexible printed circuit board 30 that includes "a first surface" (top surface) on which the coil is mounted, and a "second surface" (bottom surface) opposite the first surface. (Ex-1002, ¶58.)

FIG. 6

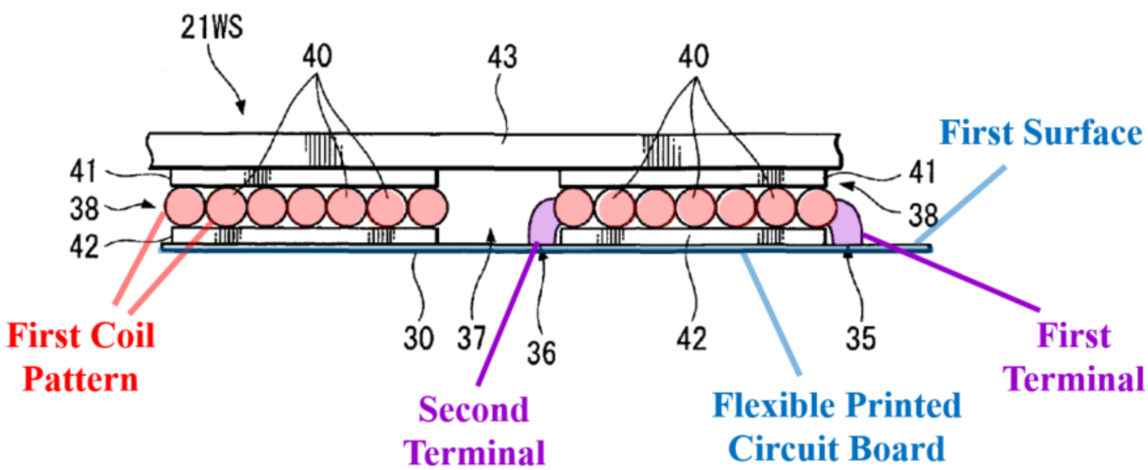


(Ex-1005, FIG. 6 (annotated); Ex-1002, ¶58.)

c) a first antenna disposed on the first surface of the flexible printed circuit board for wireless charging;

Kato discloses this feature. (Ex-1002, ¶¶59-65.) As recited in claim element 1[g], the "first antenna" includes a "first coil pattern," "a first terminal," and "a second terminal." (Section IX.A.1(g).) As shown in annotated figure 6 below, Kato discloses a "first antenna" that includes a spirally-wound electric wire 40 ("first coil pattern") and coil contact portions 35 ("first terminal") and 36 ("second terminal") on the first surface of the flexible circuit board. (Ex-1005, ¶¶[0065], [0082], FIG. 6; Ex-1002, ¶59.)

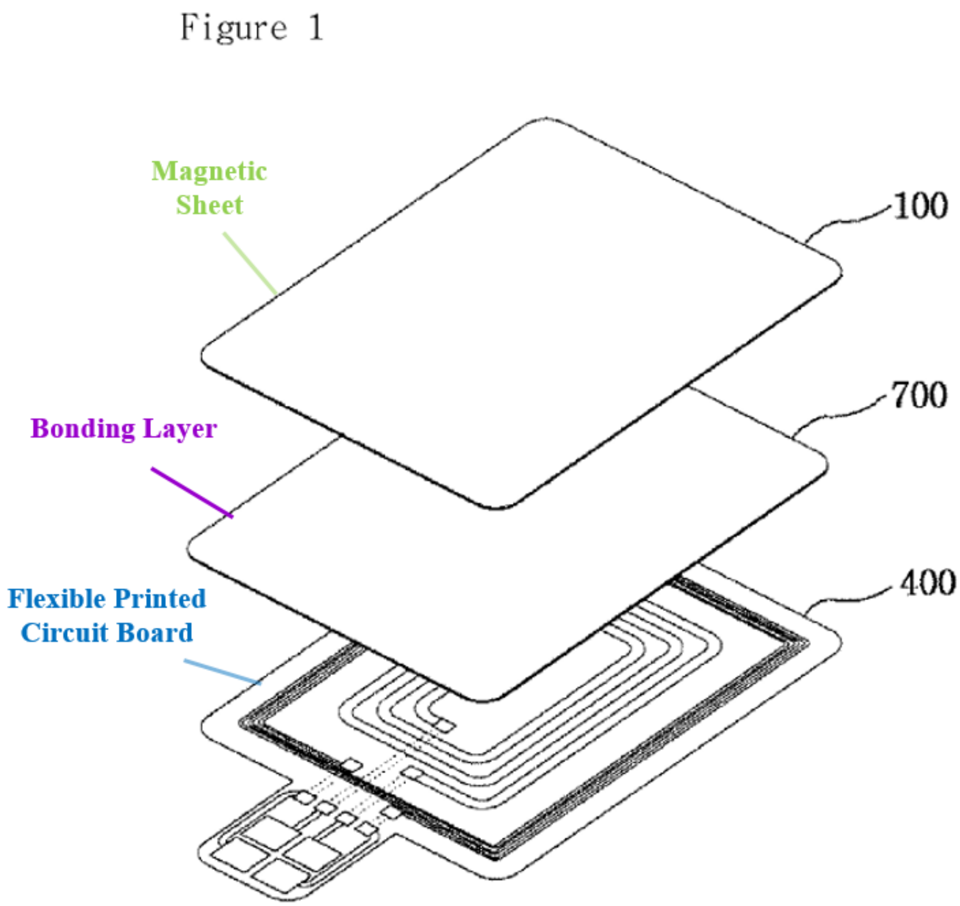
FIG. 6



(Ex-1005, FIG. 6 (annotated); Ex-1002, ¶59.)

A POSITA would have understood that the coil is "on" the first surface even though there is an adhesion sheet between the coil and the flexible substrate, as claim 1 does not require the coil to be "directly on" the first surface. (Ex-1002, ¶¶60-64.) Such an understanding is supported by the '476 patent, which differentiates a coil provided "directly on" a substrate from a coil that has a bonding layer (e.g., adhesion sheet) interposed between the coil and the substrate. (Ex-1001, 2:21-23 ("the coil part is directly provided on the top surface of the non-magnetic insulating substrate"), 2:42-44, 13:34-38 ("The inner antenna 200 may be directly provided on a top surface of the magnetic substrate 100. According to one embodiment, a bonding layer (not shown) may be further interposed between the inner antenna 200 and the magnetic substrate 100.”), 14:51-54; Ex-1002, ¶61.)

This understanding is also consistent with claim element 1[f], which recites “a magnetic sheet on the first antenna and the second antenna.” As shown in figure 1 of the ’476 patent, a bonding layer 700 is between the magnetic sheet 100 and the antennas on the flexible printed circuit board 400, thereby demonstrating that the ’476 patent uses “on” in a manner that allows for intervening bonding materials. (Ex-1001, 6:58-63, FIGs. 1, 49; Ex-1002, ¶63.)



(Ex-1001, FIG. 1 (annotated); Ex-1002, ¶63.)

Kato further discloses that the antenna is "for wireless charging," as claimed. (Ex-1005, ¶[0049] (secondary power transmission coil 21 receives power to "charge[] the battery 22" on the mobile phone 2), FIG. 3; Ex-1002, ¶65.)

d) a second antenna disposed on the first surface of the flexible printed circuit board for wireless communication such that it surrounds the first antenna;

Kato in combination with Park discloses or suggests this feature. (Ex-1002, ¶¶66-81.) As discussed in Sections IX.A.1(a)-(c), Kato discloses a mobile phone (i.e., portable terminal) that includes a wireless charging coil on a flexible printed circuit board.

Kato does not explicitly disclose a second antenna for wireless communication that surrounds the first antenna on the flexible printed circuit board. Such features, however, would have been obvious to a POSITA in view of Park. (Ex-1002, ¶67.)

Park, like Kato, is in the field of portable terminals like mobile phones and discloses a coil module 103 that includes both a first coil 133 for wireless charging and a second coil 135 for wireless communication, as shown in annotated figure 1 below. (Ex-1006, 1:24-31, 3:4-11, 3:29-32, 4:16-18, FIG. 1; Ex-1002, ¶68.)

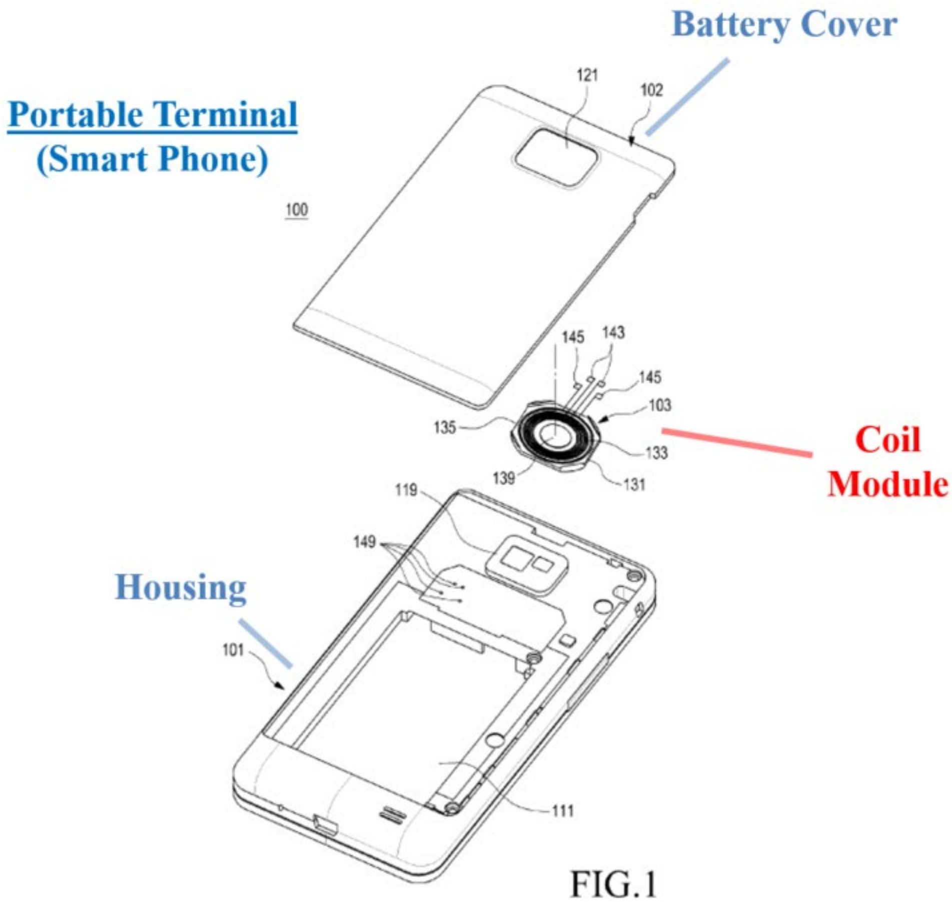


FIG.1

(Ex-1006, FIG. 1 (annotated); Ex-1002, ¶68.)

Park's coil module 103, shown in annotated figure 3 below, includes a wireless charging coil 133 and a wireless communication coil 135 that are "mounted on the same plane." (Ex-1006, 3:4-11, 4:16-24; Ex-1002, ¶¶69-70.)

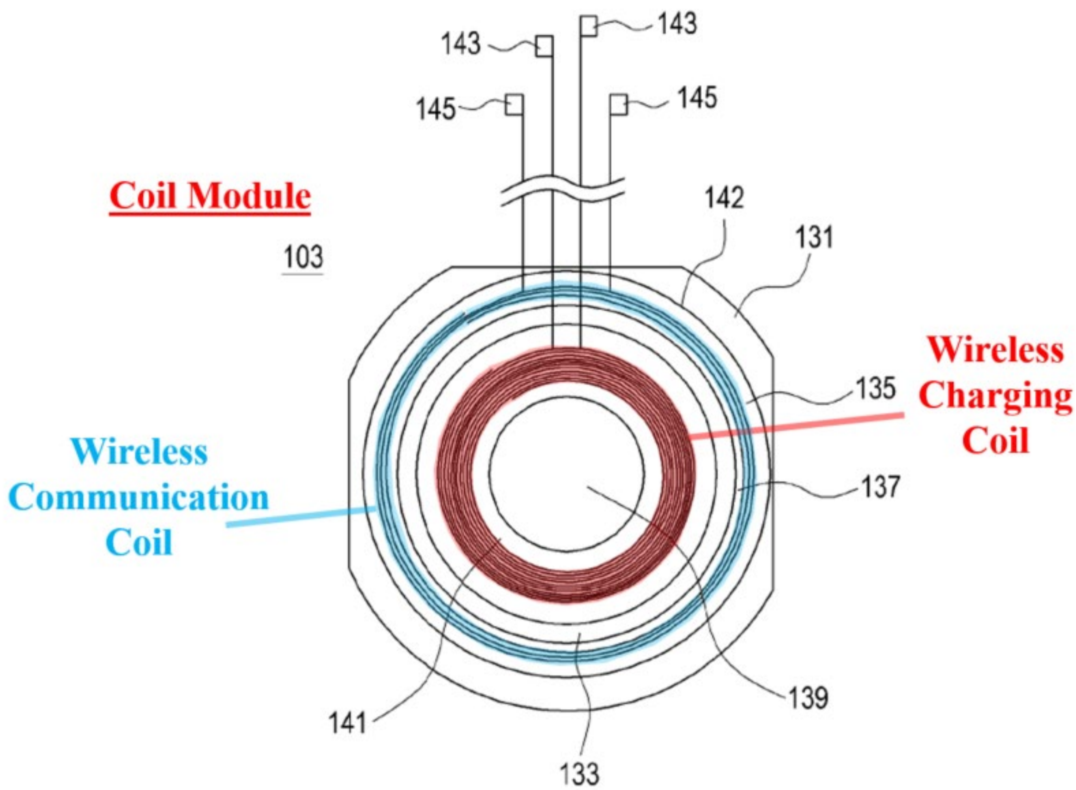


FIG.2

(Ex-1006, FIG. 2 (annotated); Ex-1002, ¶69.)[5]

Park discloses that including wireless communication functionality in the form of a Near Field Communication (NFC) in portable terminals like smart phones provides numerous advantageous, such as the ability to "make payment,"

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[5] Numerical label 133 is erroneously placed in figure 2, as the specification and other figures make clear that the inner coil is the wireless charging coil. (Ex-1006, FIGs. 1-3; Ex-1002, ¶69.)

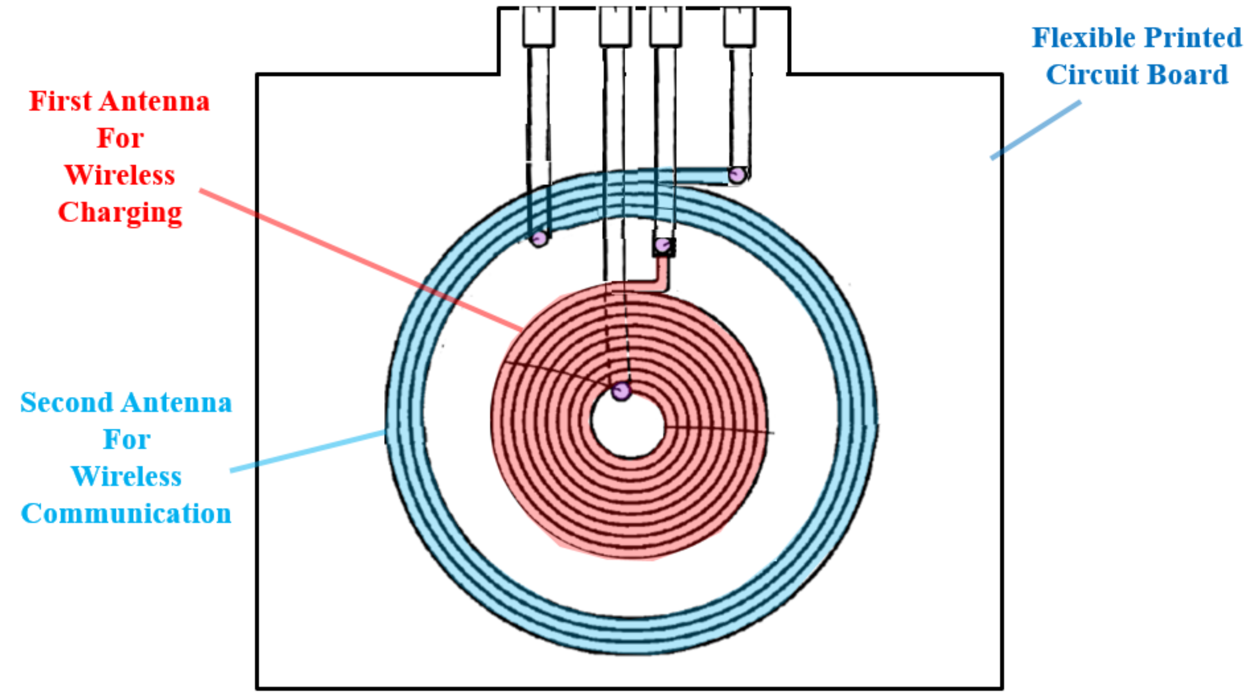
"authenticate a user," and "fast communication setup." (Ex-1006, 1:21-36.) Indeed, there was at the time of the alleged invention a trend to increase mobile device functionality by including NFC functionality. (*See, e.g.*, Ex-1007, 1:28-35, 3:6-10, 3:25-33, 11:33-46, 12:43-44 ("Therefore, the ongoing trend is to give the NFC function to the mobile terminal."); Ex-1010, ¶[0002]; Ex-1002, ¶¶23-26, 71, 76.)

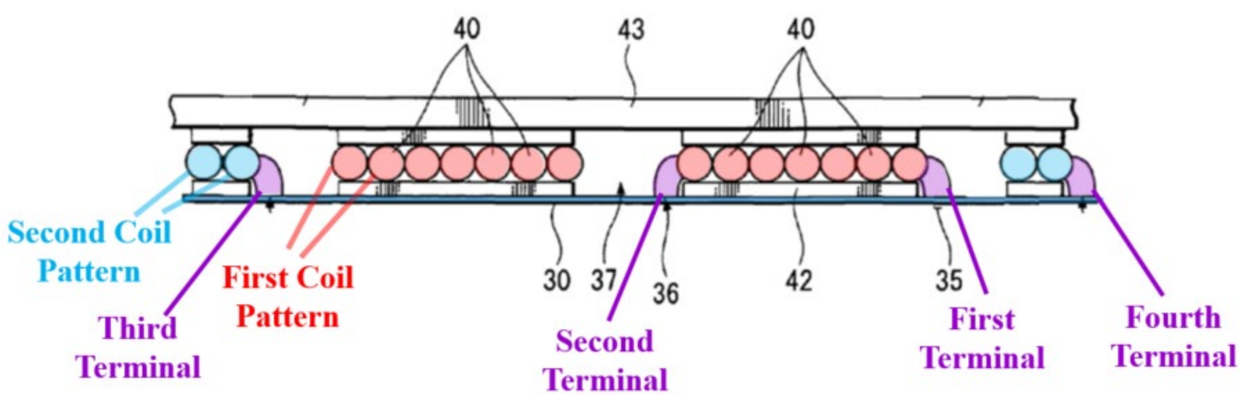
Moreover, Park discloses that such portable devices (e.g., mobile phones) can also include "wireless charging" functionality, where the NFC antenna 135 shown in the coil module of figure 2 "surrounds" the wireless charging antenna 133. (Ex-1006, Abstract, 1:44-58, 2:30-31 ("the second coil surrounding the first coil on a same plane"), 3:63-64, FIG. 2; Ex-1002, ¶¶72, 80.) A POSITA would have understood that such an arrangement minimizes the area required by the two antennas and allows for the NFC coil to be wide in order to promote improved communication. (Ex-1002, ¶¶80-81; Ex-1007, 12:48-53, FIG. 5; Ex-1011, ¶¶[0041], [0047]-[0048], FIGs. 1, 9; Ex-1010, ¶¶[0009], [0010].) Moreover, a POSITA would have recognized the benefits of including both antennas on the same flexible printed circuit board, as opposed to on separate boards, in order to reduce the number of components in the phone, reduce costs, and promote manufacturability, while still supporting Park's teaching of implementing the coils in the same plane to avoid increasing the thickness of the portable terminal. (Ex-1006, 2:10-15, 2:25-31, 5:57-

61, 5:61-64; Ex-1007, 11:65-12:14, 12:30-44, 13:27-30, 15:44-47, 15:51-54, 15:55-16:2, FIGs. 4-7; Ex-1010, ¶[0018]; Ex-1002, ¶77.)

A POSITA would have looked to Park for guidance regarding implementing a mobile phone like that disclosed in Kato, particularly because Park and Kato are in the same field. (Ex-1002, ¶74.) Accordingly, having looked to Park, a POSITA would have had good reason to include an NFC antenna that surrounds the wireless charging antenna, like that disclosed by Park, on a flexible printed circuit board including the wireless charging antenna, like that disclosed by Kato, to predictably provide a coil module for a portable terminal (e.g., mobile phone) that supports both wireless charging and wireless communication functionality. (*Id*, ¶¶74-77, 81.) *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416. Such a combination would have been straightforward for a POSITA to implement, because Kato discloses how to implement an antenna on a flexible printed circuit board, and Park discloses a two-antenna coil module used in a mobile phone like that disclosed by Kato. (Ex-1002, ¶79; Ex-1007, 11:65-12:14, FIG. 5.)

The non-limiting demonstratives below illustrate a flexible printed circuit board consistent with the Kato-Park combination, where the board includes two antennas that each include a coil pattern and terminals corresponding to the ends of the antenna. (Ex-1002, ¶78.) Consistent with Park's disclosure, the communications antenna surrounds the charging antenna.

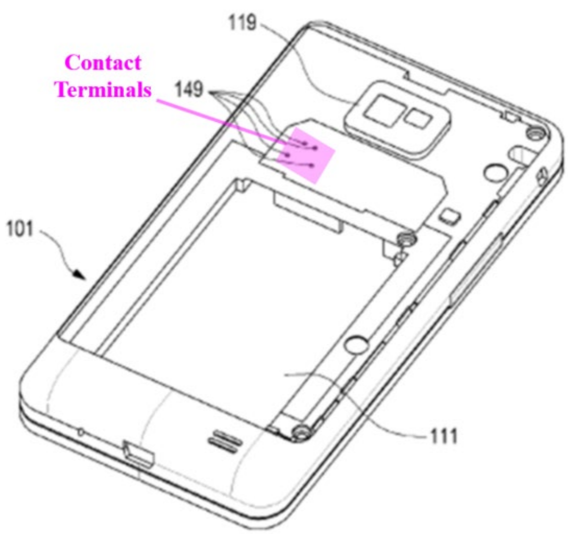

First Antenna For Wireless Charging
Flexible Printed Circuit Board
Second Antenna For Wireless Communication


40
43
40
Second Coil Pattern
Third Terminal
First Coil Pattern
30
37
36
Second Terminal
42
35
First Terminal
Fourth Terminal

(Ex-1002, ¶78.)

e) a plurality of contact terminals configured to electrically connect the first antenna to a battery for charging the battery and the second antenna to a wireless communication module; and

The Kato-Park combination discloses or suggests this feature. (Ex-1002, ¶¶82-87.) For example, as shown in annotated figures 1 and 5 below, Park discloses that terminals 149 ("plurality of contact terminals") provide connections to the phone's battery and a communication processor ("wireless communication module"). (Ex-1006, 4:1-6, 5:9-26, FIGs. 1, 4-6.)



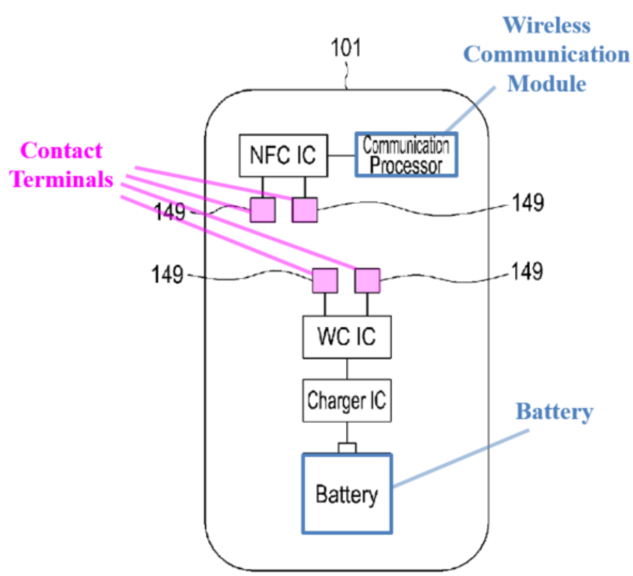


FIG.5

(*Id*., FIG. 1 (excerpt, annotated) (left), FIG. 5 (annotated) (right); Ex-1002, ¶82.)

Similarly, Park discloses that in a mobile phone with both wireless charging and wireless communication capabilities, such as the phone of Kato-Park combination, connections are provided between the coils and that circuitry that supports those functions. (Ex-1006, 5:9-16; Ex-1002, ¶83.) Park further discloses that these connections are facilitated by a plurality of terminals 149 ("plurality of connection terminals"). (Ex-1006, 5:17-26; Ex-1002, ¶84.)

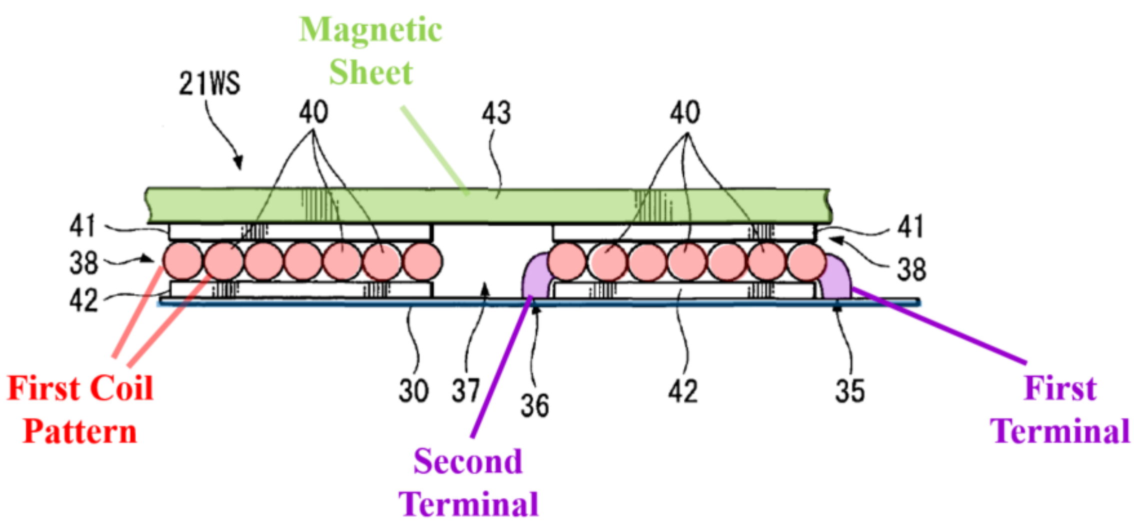
A POSITA implementing a mobile phone according to the Kato-Park combination would have found it obvious to use an arrangement of connection terminals, like that disclosed by Park, to provide the necessary connections between the wireless charging antenna, the wireless communication antenna, and the respective circuitry in the phone that supports those wireless functions. (Ex-1002, ¶85.) A POSITA looking to Park would have understood that the interconnection techniques disclosed by Park for a mobile phone that includes both a wireless charging antenna and a wireless communication antenna, including the relative positioning of the terminals with respect to each other, would be appropriate and effective in a mobile phone according to the Kato-Park combination. (*Id.*) Indeed, such terminals and connections are necessary in order for the wireless functions to be effective. (*Id.*)

In addition, a POSITA would have recognized that the connectors on the coil module, which are discussed in more detail with respect to claim features 1[l], 1[m], and 1[p] below, and are similar to connectors 143 and 145 shown in figures 1, 2, 4, and 6 of Park, also disclose or suggest the "plurality of contact terminals" of claim element 1[e], where the electrical connections and relative placement of those connectors are the same as the terminals 149. (Sections IX.A.1(l),(m),(p); Ex-1002, ¶¶86-87.)

f) a magnetic sheet on the first antenna and the second antenna;

Kato, Park, and Chong disclose or suggest this feature. (Ex-1002, ¶¶88-94.) For example, as shown in the annotated figure 6 below, Kato discloses a "magnetic sheet 43" on the wireless charging antenna ("first antenna") that includes the first coil pattern 40 and first and second terminals 35 and 36. (Ex-1005, ¶[0065].)[6]

FIG. 6



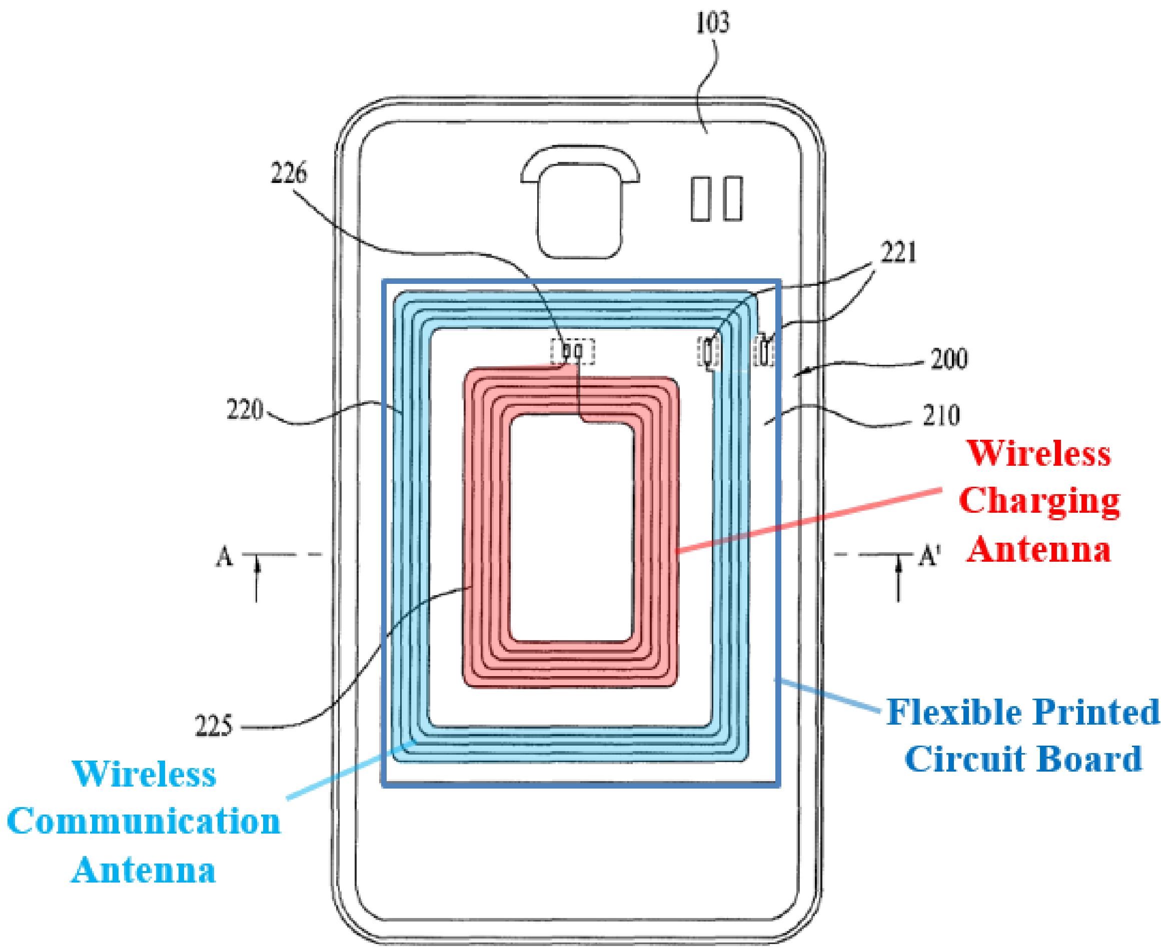
(*Id*., FIG. 6 (annotated); Ex-1002, ¶88.)

[6] As discussed with respect to claim element 1[c], a POSITA would not have understood "on" to require "directly on."

Kato further discloses that the "magnetic sheet 43 effectively forms magnetic paths for the planar coil and the non-contact power-transmission coil 10 of the cradle 1 to cause an increase in interlinkage magnetic flux, while preventing undesired radiation of magnetic fields." (Ex-1005, ¶[0065].) While Kato discloses a magnetic sheet on a wireless charging antenna, and it would have been obvious for the magnetic sheet to also be on the wireless communication antenna in the Kato-Park combination to form such beneficial magnetic paths, Kato does not explicitly disclose a magnetic sheet on both a wireless charging antenna and a wireless communication antenna. (Ex-1002, ¶89.) But it would have been obvious to a POSITA to include a magnetic sheet that covers both of the antennas in view of Chong. (*Id*.)

Chong, like Park and Kato, is also in the field of portable terminals like mobile phones and discloses, as shown in annotated figure 5 below, a wireless communication (e.g., NFC) antenna 220 formed on the same flexible printed circuit board as a wireless charging antenna 225. (Ex-1007, 11:65-12:14, 12:30-44, FIGs. 4-7; Ex-1002, ¶90.)

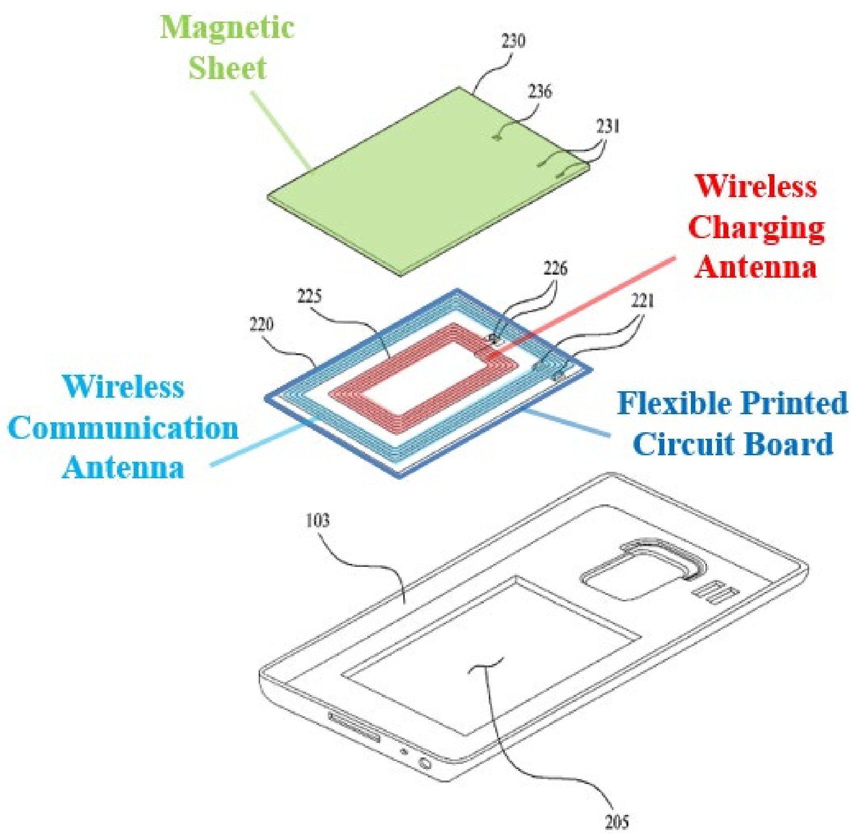
FIG. 5



(Ex-1007, FIG. 5 (annotated); Ex-1002, ¶90.)

As shown in annotated figure 7 below, Chong discloses a magnetic sheet covering both the NFC and wireless charging antennas in order to prevent performance degradation for the antennas. (Ex-1007, 13:48-14:59, FIGs. 6-7.)

FIG. 7



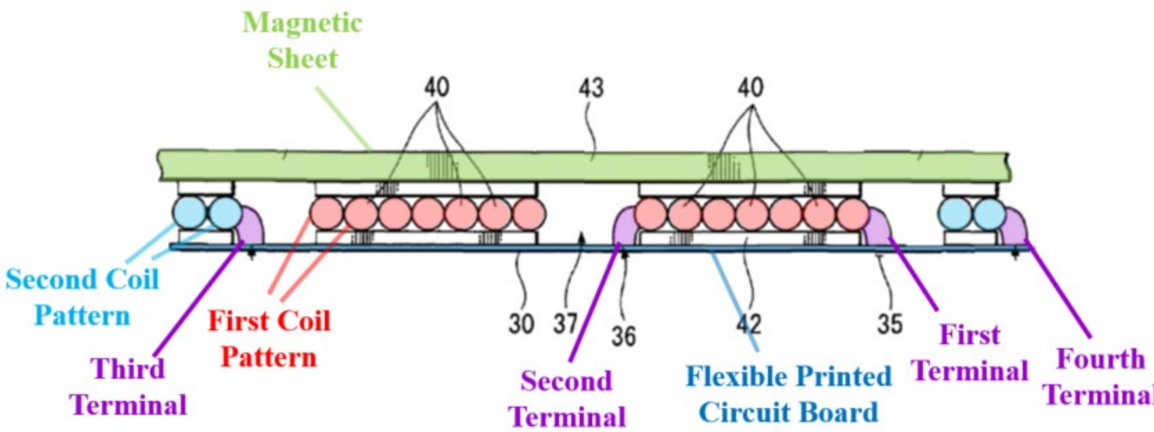
(*Id*., FIG. 7 (annotated); Ex-1002, ¶91.)

According to Chong, "the magnetic sheet 230 is attached to both of the wireless charging coil 225…and the NFC antenna 220…, thereby preventing the performance degradation caused by other electronic components of the mobile terminal 100." (Ex-1007, 13:66-14:4.)

In view of Chong, a POSITA would have found it obvious to include a magnetic sheet on both antennas of the Kato-Park-Chong combination to avoid performance degradation in the antennas. (Ex-1002, ¶92.) Moreover, consistent with Kato's disclosure, a POSITA would have understood the magnetic sheet would promote better linkage between the NFC antenna on the phone and the wireless communication devices with which that antenna communicates, while also reducing undesirable magnetic field leakage. (*Id*., Ex-1005, ¶[0065].)

A POSITA would have recognized that including such a magnetic sheet in the Kato-Park-Chong combination is also consistent with and encouraged by Park. (Ex-1002, ¶93.) For example, Park discloses forming the coils on a shielding member 131 that includes an iron (i.e., magnetic) component and prevents interference between the coils and other parts of the portable terminal, as well as each other. (*Id*.; Ex-1006, 3:4-11, 3:45-55, 4:38-42 ("paramagnetic material, i.e., the iron component"), 4:52-53.)

A POSITA would have found it straightforward to include such a magnetic sheet, as Chong provides detailed disclosure of how to implement such a magnetic sheet specifically configured for such an application. (Ex-1007, 14:31-59; Ex-1002, ¶94.) Therefore, as shown in the non-limiting demonstrative below, the Kato-Park-Chong combination discloses or suggests claim element 1[f].



(Ex-1002, ¶94.)

g) wherein the first antenna comprises a first coil pattern wound multiple times, a first terminal placed at an outside of the first coil pattern, and a second terminal placed at an inside of the first coil pattern;

The Kato-Park-Chong combination discloses or suggests this feature. (Ex-1002, ¶¶95-96.) For example, as discussed in Section IX.A.1(c), the wireless charging antenna of Kato includes a spirally-wound electric wire 40 ("first coil pattern") and coil contact portions 35 ("first terminal") and 36 ("second terminal"). Kato further discloses, as shown in annotated figures 4 and 6 below, that the "coil contact portion 35" ("first terminal") is placed "outside" the first coil pattern and "coil contact portion 36" ("second terminal") is placed inside the first coil pattern. (Ex-1005, ¶[0082], FIGs. 4, 6; Ex-1002, ¶95.) As also shown in figures 4 and 6, the electric wire of the first coil pattern is wound multiple times. (Ex-1005, ¶¶[0062], [0064], FIGs. 4, 6.)

FIG. 4

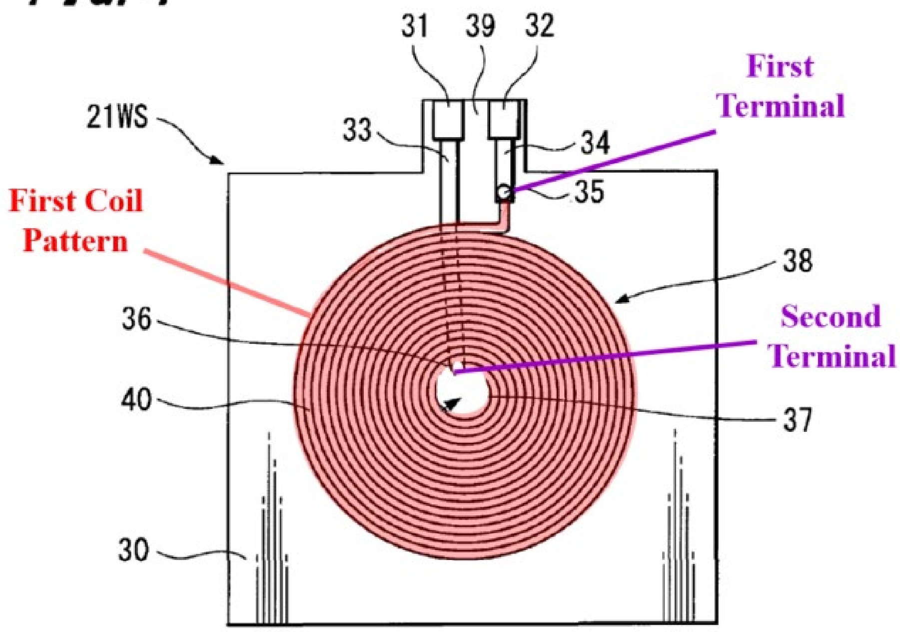
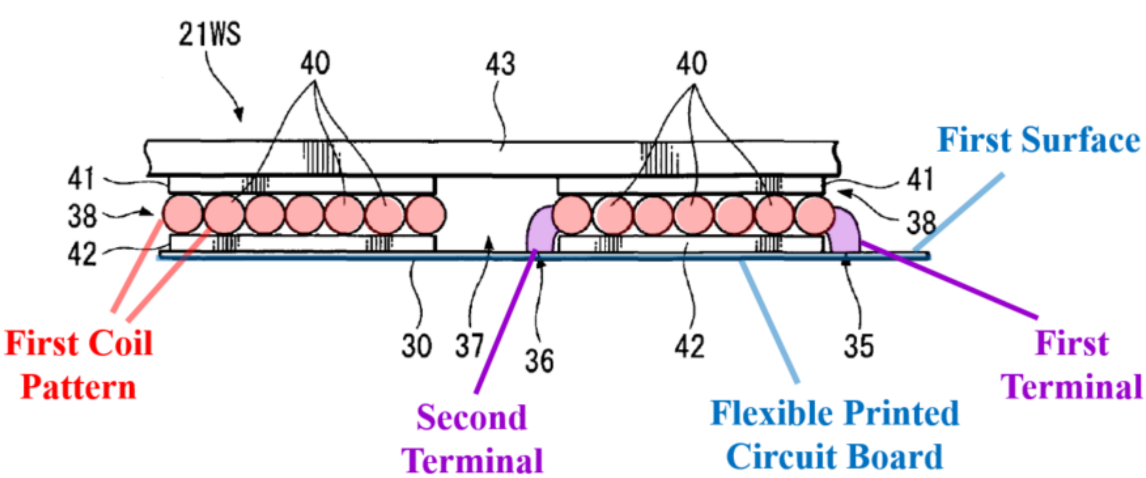
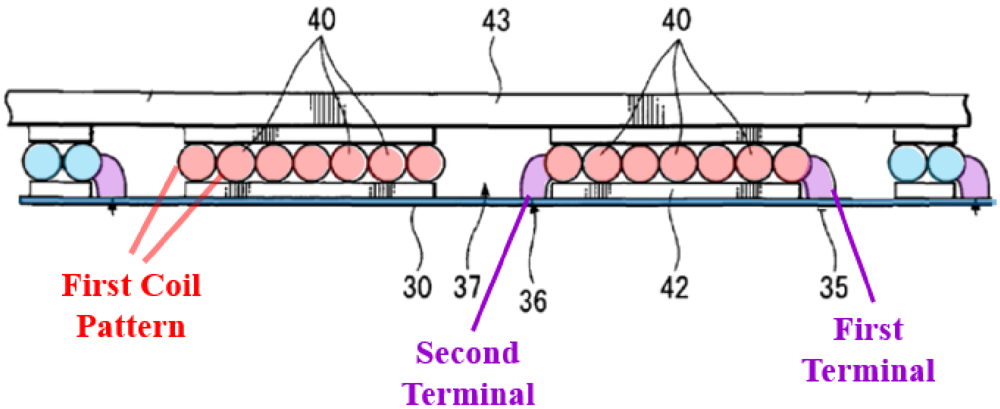


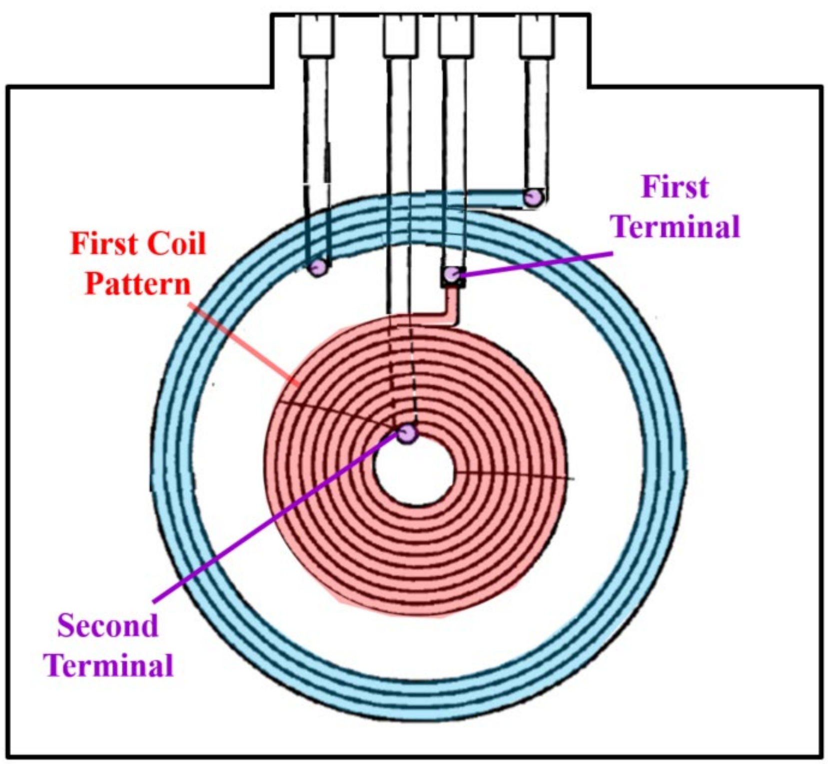
FIG. 6



(*Id*., FIGs. 4, 6 (annotated); Ex-1002, ¶95.)

The first coil pattern, first terminal, and second terminal for the Kato-Park-Chong combination are shown in the non-limiting demonstratives below. (Ex-1002, ¶96.)



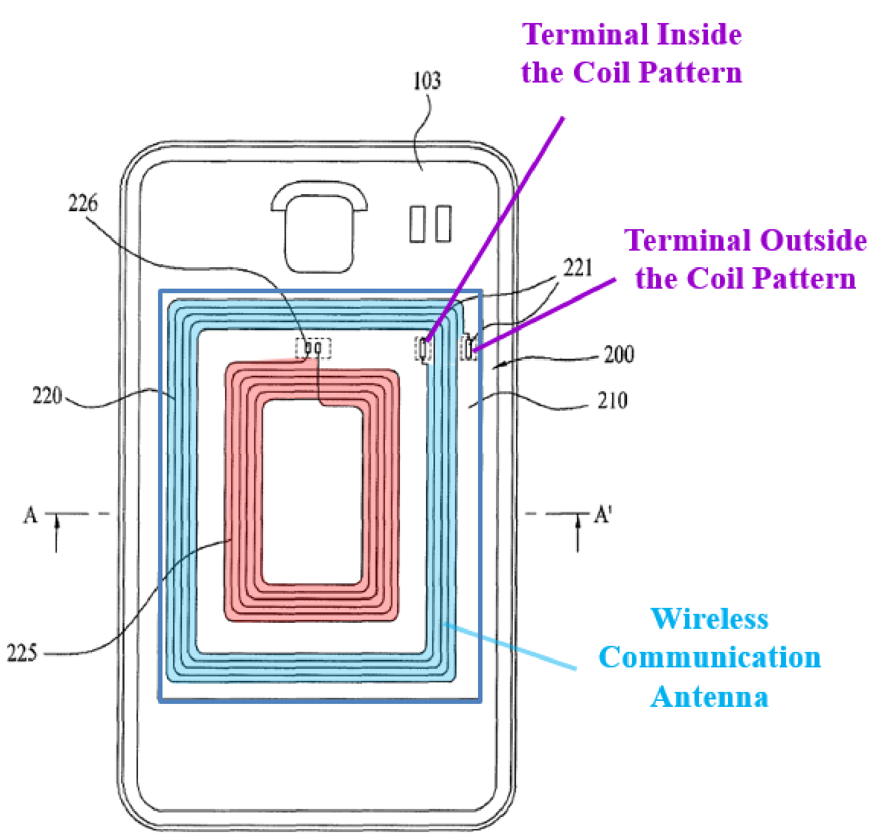


(*Id.*)

h) wherein the second antenna comprises a second coil pattern wound multiple times, a third terminal placed at an inside of the second coil pattern, and a fourth terminal placed at an outside of the second coil pattern;

The Kato-Park-Chong combination discloses or suggests this feature. (Ex-1002, ¶¶97-101.) For example, as discussed in Section IX.A.1(d), the Kato-Park-Chong combination includes a second antenna (e.g., NFC antenna) for wireless communication. Chong discloses that the NFC antenna includes a terminal on the inside of the coil pattern and another terminal on the outside of the coil pattern. (Ex-1007, 14:60-64, FIGs. 5-7; Ex-1002, ¶97.)

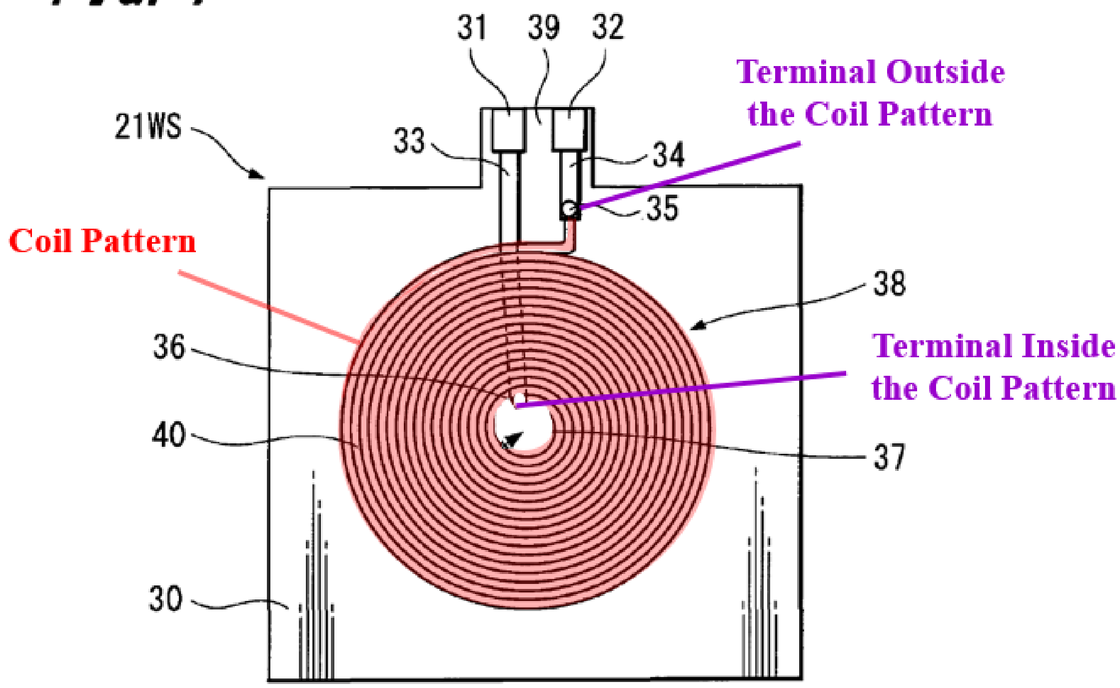
FIG. 5



(Ex-1007, FIG. 5 (annotated); Ex-1002, ¶97.)

Similarly, Kato discloses that the wireless charging antenna has the same configuration as that shown for the NFC antenna in figure 5 of Chong, where one terminal is inside the coil pattern and the other terminal is outside the coil pattern. (Section IX.A.1(g); Ex-1005, ¶[0082], FIGs. 4, 6; Ex-1002, ¶98.)

FIG. 4

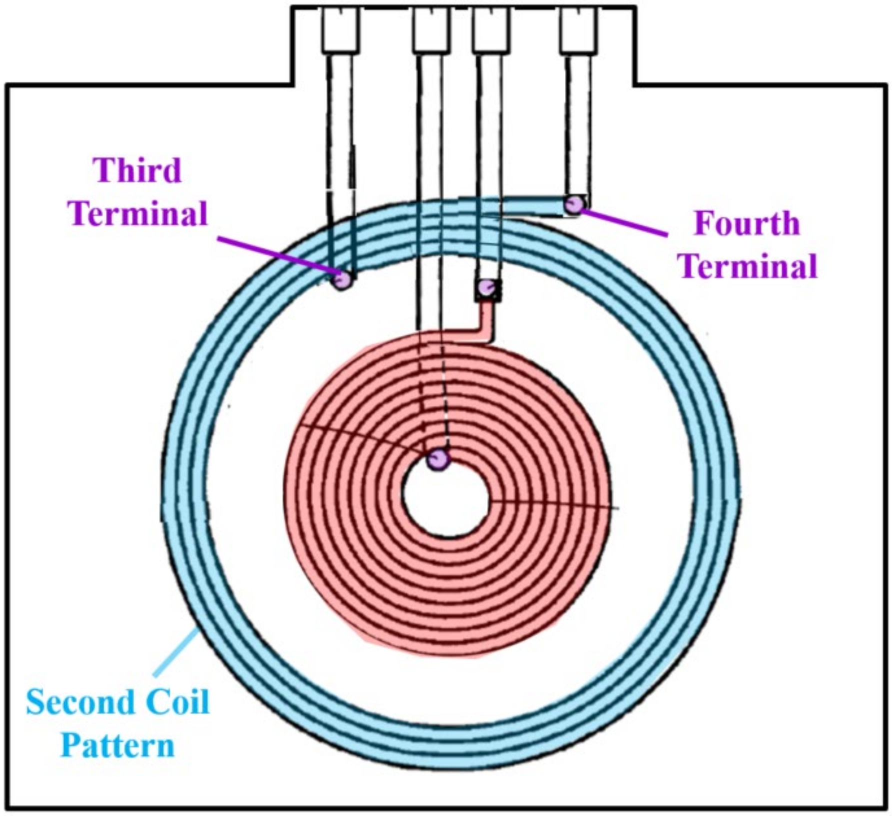


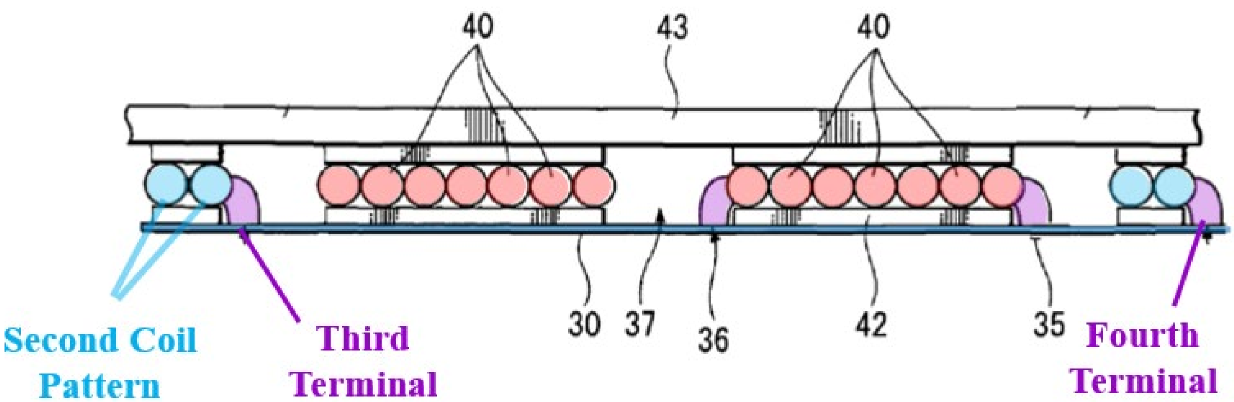
(Ex-1005, FIG. 4 (annotated); Ex-1002, ¶98.)

A POSITA would have recognized that such a configuration avoids the conductive material of the coil from having to overlap itself (e.g., the coil) to form both terminals at the outside of the coil. (Ex-1005, ¶[0067]; Ex-1002, ¶99.) Therefore, based on the disclosure of Chong and Kato, a POSITA would have found it obvious to form the wireless communication antenna on the flexible printed circuit board in the Kato-Park-Chong combination such that the wireless communication antenna includes an interior terminal ("third terminal placed at an inside of the second coil pattern") and an exterior terminal ("fourth terminal placed at an outside of the second coil pattern"). (Ex-1002, ¶99.)

Such a POSITA would have understood that while the characteristics of the antennas of the Kato-Park-Chong combination in terms of inductance, trace width, trace spacing, and the like might be different, it would be advantageous to keep the basic structure of the antennas the same in terms of a coil pattern with terminals at the inner and outer ends. (*Id.*, ¶100.) Indeed, Chong discloses "form[ing] a wireless charging coil and an NFC antenna at the same time to simplify a manufacturing process, thereby reducing a processing time and a manufacturing cost." (Ex-1007, 15:51-54.) Therefore, a POSITA would have had good reason to maintain the same basic structure for both antennas in order to, for example, simplify the design and manufacturing of the antennas. (*Id.*)

The non-limiting demonstratives below show the second coil pattern, third terminal, and fourth terminal in the Kato-Park-Chong combination. (Ex-1002, ¶101.)





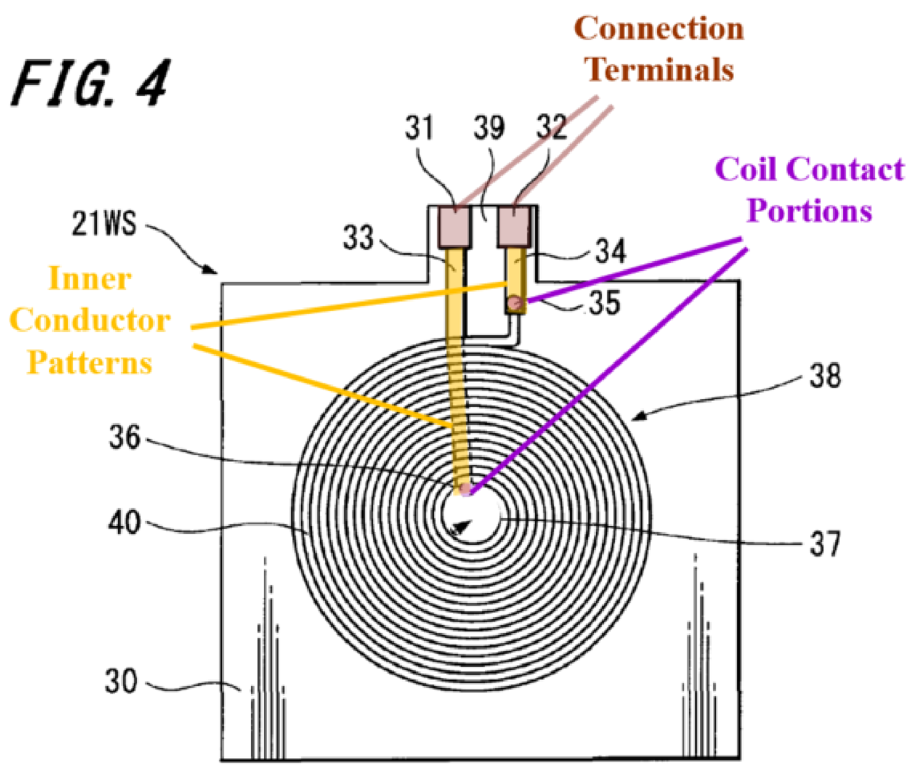
(*Id.*)

As shown in the demonstratives above, the second coil pattern is wound multiple times (as is disclosed by both Park and Chong) and includes a terminal at the inside of the second coil pattern ("third terminal") and a terminal at the outside of the second coil pattern ("fourth terminal"). (*Id.*)

i) wherein the first terminal is electrically connected to a first connector by a first sub-connection part that crosses, and is physically insulated from, the second coil pattern, and the first sub-connection part is disposed on the second surface of the flexible printed circuit board;

Kato, Park, Chong, and Hahn disclose or suggest this feature. (Ex-1002, ¶¶102-116.) For example, as shown in annotated figure 4 below, Kato discloses that the flexible printed circuit board includes external connection terminals 31 and 32 connected to the coil contact portions 35 and 36 through inner conductor patterns 33 and 34. (Ex-1005, ¶[0066]; Ex-1002, ¶102.)

FIG. 4



(Ex-1005, FIG. 4 (annotated); Ex-1002, ¶102.)

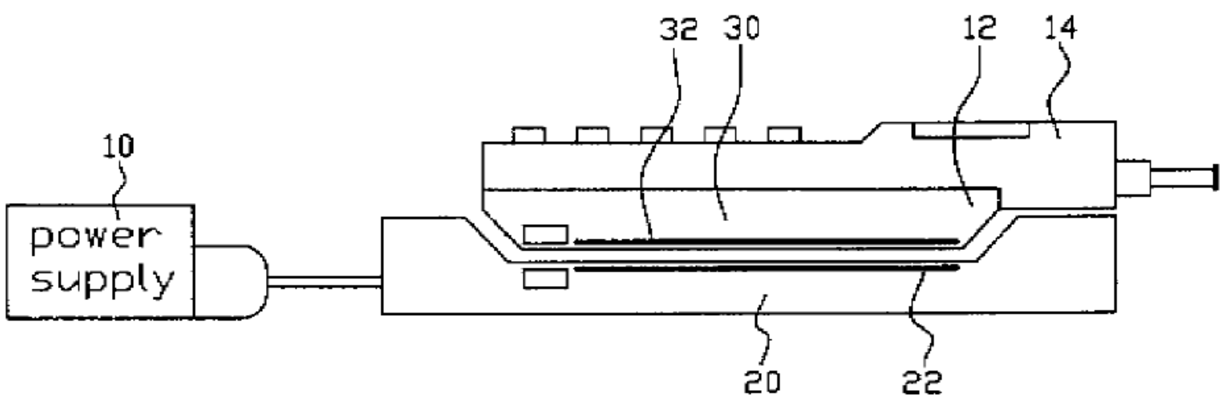
Kato discloses that the inner conductor patterns are insulated from the top surface of the board, thereby allowing the connection to the inner end of the coil to be made through the inner conductor 33 that passes underneath the coil. (Ex-1005, ¶[0066]; Ex-1002, ¶103.) Kato teaches that such inner conductor patterns allow a connection to the inner part of the coil that avoids "overlapping" the wire of the coil with itself so that coil "thickness…can be reduced." (Ex-1005, ¶[0067]; Ex-1002, ¶103.)

Therefore, a POSITA would have recognized the benefit of using conductor patterns like Kato's conductor patterns in the Kato-Park-Chong coil module to provide connections between the terminals outside of the coils and the ends of the coils. (Ex-1002, ¶104.) Indeed, Kato discloses using such conductor patterns with a wireless charging coil, and a POSITA would have recognized that such conductor patterns would have been applicable for providing connections to the wireless communications coil in the Kato-Park-Chong combination. (*Id.*) Such conductor patterns extend under, and are insulated from, the coil patterns on the surface of the circuit board. (*Id.*; Ex-1005, ¶¶[0066], [0067].)

Kato does not, however, explicitly disclose forming the inner conductor patterns ("sub-connection parts") on the backside ("second surface") of the circuit board. Nevertheless, this limitation would have been obvious to a POSITA based on the teachings of Hahn. (Ex-1002, ¶105.)

Hahn, like Kato, Park, and Chong, is directed to magnetic coils for wireless power transfer in mobile phones, including coils formed in a spiral shape on a substrate. (Ex-1008, Title, ¶[29]; Ex-1002, ¶106.) Figure 1 of Hahn below shows a "structure and an operation condition of an induction coil for cordless energy charging and data transfer." (Ex-1008, ¶[13].)

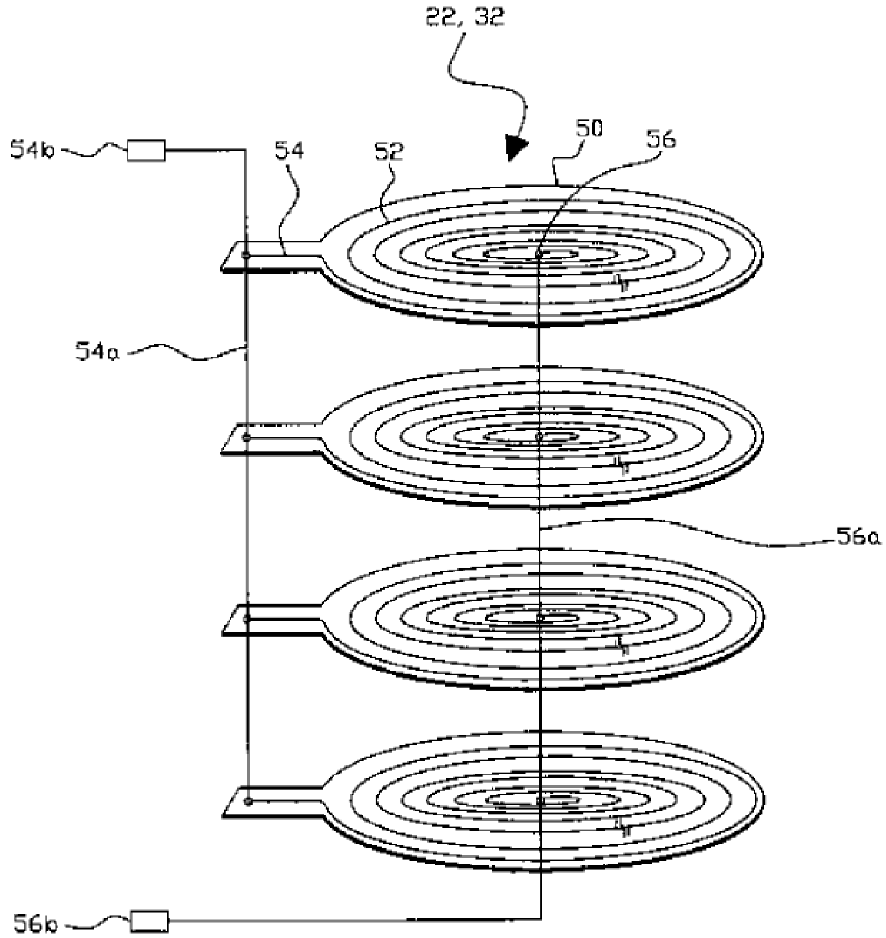
[Fig. 1]



(*Id.*, FIG. 1.)

Hahn discloses a multi-layer coil constructed using a plurality of flexible printed circuit boards laminated together, where coil patterns on the boards are connected in parallel. (*Id.*, ¶¶[14], [23] ("Flexible Printed Circuit (FPC)"), FIG. 2, claim 7; Ex-1002, ¶107.)

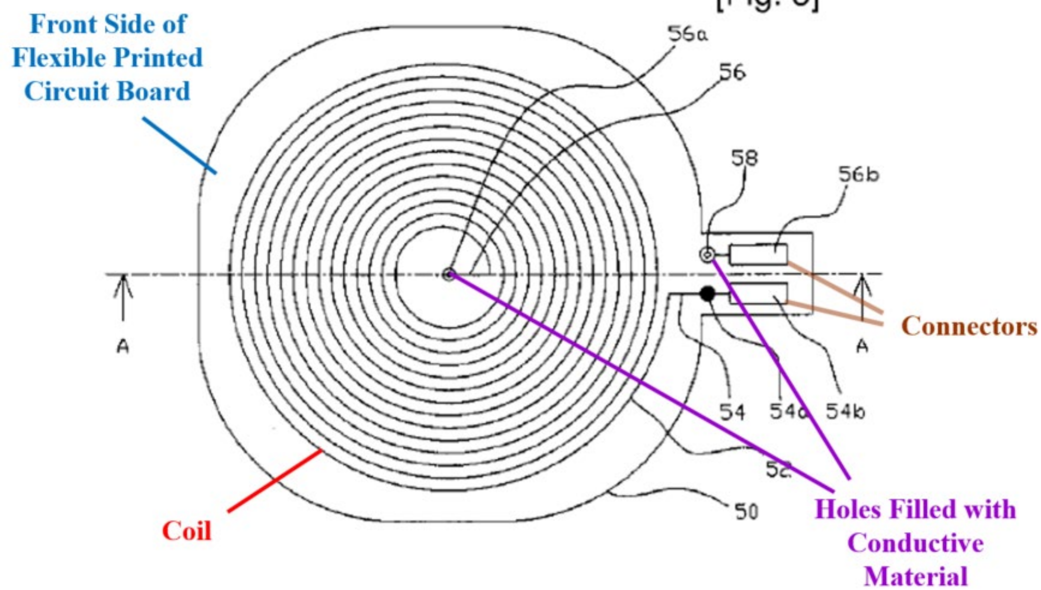
[Fig. 2]



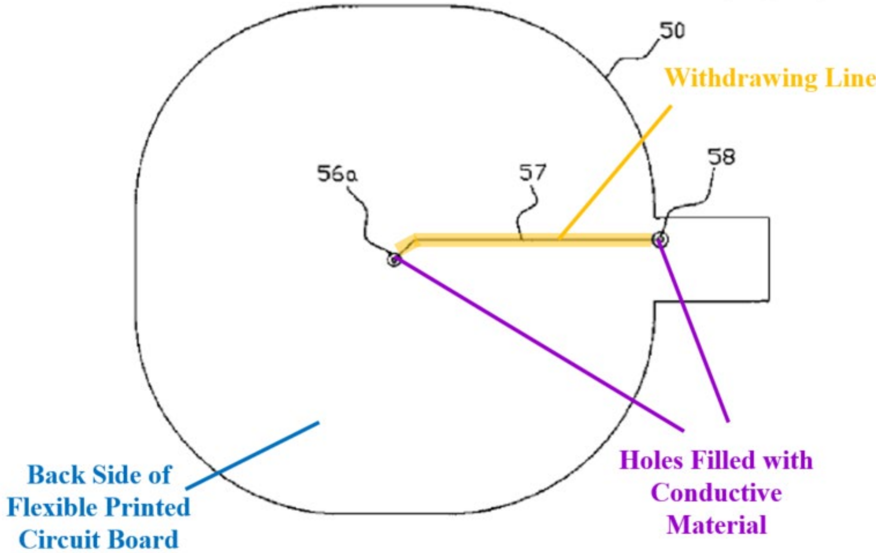
(Ex-1008, FIG. 2.)

Figures 3 and 4 show front and rear views of the coil, where, as shown in figure 4, a conductive withdrawing line that connects to the middle of the coil pattern is routed on the backside of the printed circuit board. (*Id.*, ¶¶[15], [21] ("a withdrawing line 57, which withdraws the second connection part 56a connecting the second ends 56 of the multiple spiral circuit patterns 52 out of the windings 22, 32, can be **formed on the back side** of the most bottom printed circuit board 50 of the windings 22, 32") (emphasis added).)

[Fig. 3]



[Fig. 4]



(Ex-1008, FIGs. 3, 4 (annotated); Ex-1002, ¶108.)

Hahn further discloses that connection parts 56a and 58, which are holes filled with conductive material, are used to provide connections to the withdrawing line on the back side of the circuit board. (Ex-1008, ¶¶[21], [25].) A POSITA would have looked to Hahn for guidance regarding implementing interconnect circuitry for the coils in a mobile phone according to the Kato-Park-Chong combination because these references are in the same field of wireless power transfer for portable devices like mobile phones. (Ex-1002, ¶109.) Having looked to Hahn, such a POSITA would have had good reason to implement the conductor patterns between the coil ends and the terminals on the periphery of the coils ("sub-connection parts") on the backside of a flexible printed circuit board in the Kato-Park-Chong-Han combination. (*Id*.)

Kato discloses that the flexible printed circuit board is formed of polyimide (Ex-1005, ¶[0066]), which is an insulative material, and a POSITA would have understood that forming the conductor patterns on the bottom surface of the circuit board as disclosed by Hahn would provide the advantage of obviating the need to form an additional insulating layer to insulate the conductor patterns from the coils. (Ex-1002, ¶110.) A POSITA would have understood that connections between the coils on the first surface and the conductor patterns on the second surface would have been realized using holes in the substrate filled with conductive material (i.e., "vias"), which were well-known in the art and explicitly disclosed by both Kato and Hahn. (*Id*.; Ex-1005, ¶[0071]; Ex-1008, ¶[25]; Ex-1009, 3:62-63, 4:55-56; Ex-1011, ¶[0045].) For example, Kato explicitly discloses using "through holes" 55, 56, and

61 (i.e., "vias") that connect different conductive layers in multi-layer printed circuit boards. (Ex-1005, ¶[0071].)

FIG. 7

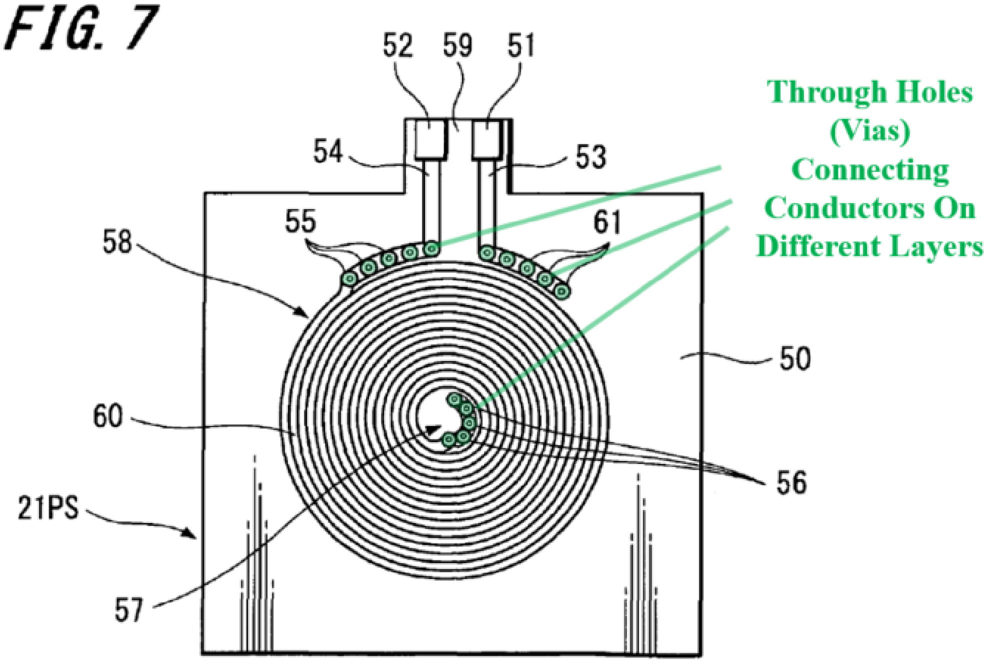
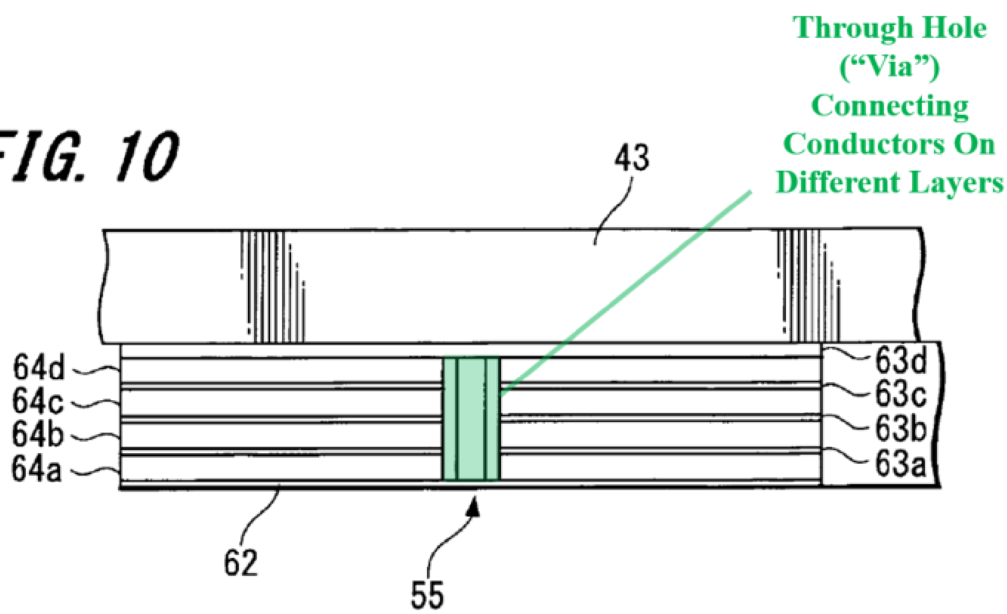


FIG. 10



(Ex-1005, FIGs. 7, 10 (annotated); Ex-1002, ¶110.)

While not shown in figure 7, Kato discloses that the vias in the interior of the coil are connected to the vias at the exterior of the coil, thereby providing a bridge from one set of vias to the other. (Ex-1005, ¶[0077]; Ex-1002, ¶111.)

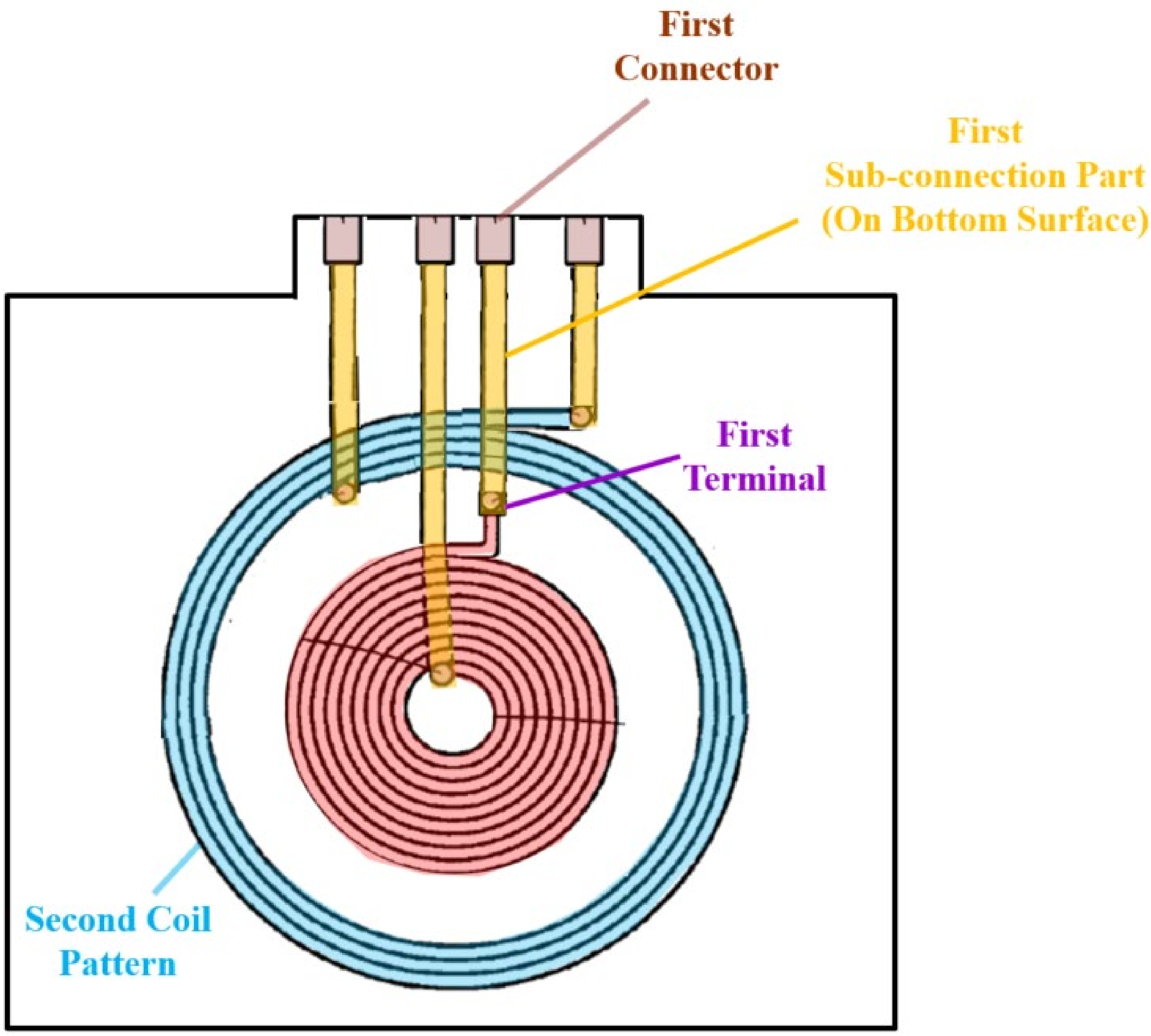
Therefore, in view of Hahn, a POSITA would have had good reason to form the conductor patterns between the coil ends and the terminals on the periphery of the coils ("sub-connection parts") on the backside of the circuit board in the Kato-Park-Chong-Han combination. (Ex-1002, ¶111.)

Implementing such connections would have been straightforward for a POSITA, because Hahn provides explicit disclosure of connections on the backside of a flexible printed circuit board, and a POSITA would have been well aware of how to form such well-known and common conductive traces on printed circuit boards. (*Id*., ¶112.) The resulting coil module would have been a predictable combination of known components according to known methods (e.g., applying Hahn's teachings regarding connective traces on the bottom side of a flexible printed circuit board to the connections to the ends of the coils in the Kato-Park-Chong combination), and would have predictably provided a functional interconnection between the coils and the external wireless charging and communication circuitry. (*Id*.) *KSR*, 550 U.S. at 416.

Indeed, a POSITA would have found it obvious to form those conductor patterns on the bottom surface ("second surface") of the printed circuit board, because, for example, a POSITA would have been aware of a number of different ways to provide connections between the ends of a coil and the external terminals of the coil module. (Ex-1002, ¶113.) Printed circuit boards, including flexible printed circuit boards, have been widely used for decades, and forming coils and traces on both sides of such boards, as well as within interior conductive layers, was well known and commonplace. (*Id.*; *see*, *e.g*., Ex-1005, ¶¶[0023]-[0026], FIGs. 7-10; Ex-1011, ¶¶[0041]-[0043], [0056], FIGs. 1, 9; Ex-1012, 7:40-63, FIGs. 3, 4.) Indeed, a POSITA would have understood that implementing the conductor patterns disclosed by Kato on either an intermediate layer within the printed circuit board or on the bottom surface of the board is nothing more than a simple design choice, as both achieve the required functionality of providing a conductive path that is insulated from the coils on the top surface. (Ex-1002, ¶113.) Implementing the conductor patterns on the bottom surface of the circuit board is one of a finite number of known, predictable solutions to achieve the required conductive path in a functional manner that advantageously avoids contacting the coils on the top surface and obviates the need for an additional insulating layer. (*Id.*)

The '476 patent does not describe any reasons for, or advantages achieved by, disposing the sub-connection parts on the second surface of the circuit board. (*Id.*, ¶114; Ex-1001.) In fact, the '476 patent confirms that a number of interconnection options were available, as it also discloses conductive bridges formed on the top surface of the coils. (Ex-1001, 8:33-61, FIG. 4.) The lack of any reason, let alone criticality, for placing the sub-connection parts on the second surface, in addition to the readily-available, well-known alternatives, supports the understanding that forming the sub-connection parts on the second surface is nothing more than a design choice. (Ex-1002, ¶114.)

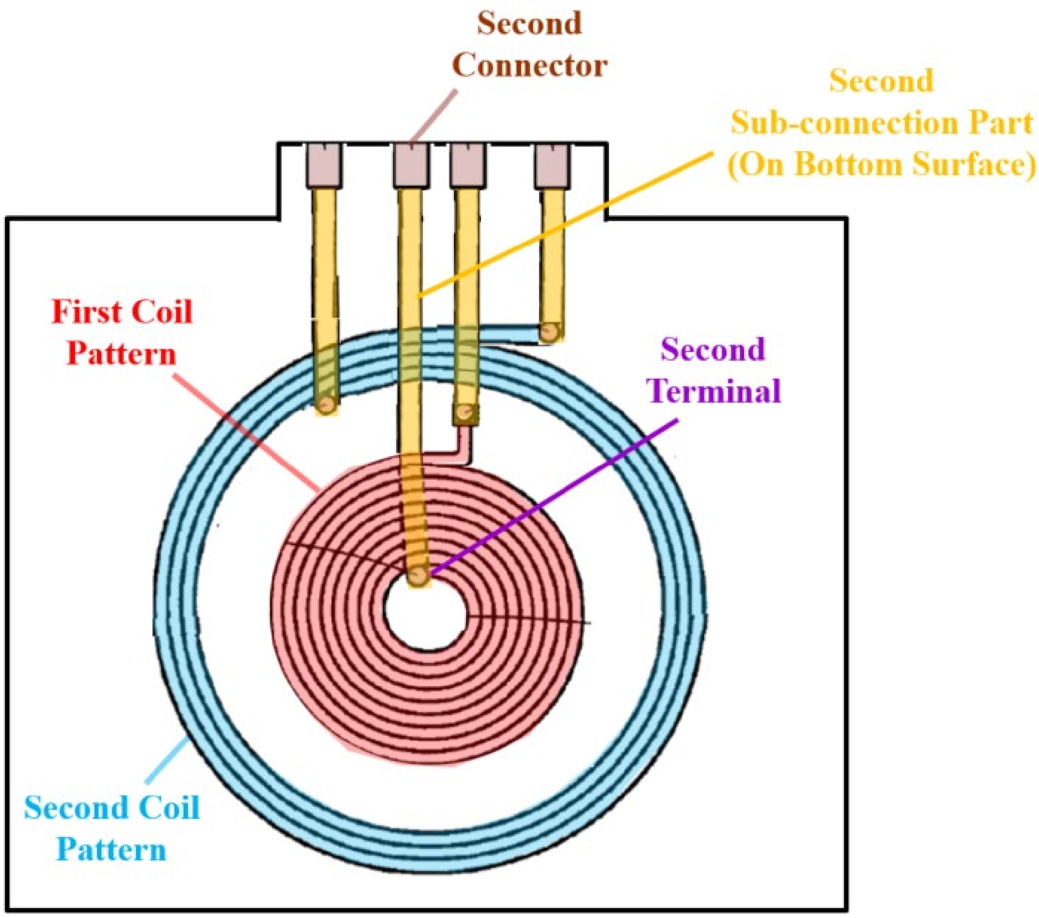
For all of these reasons, it would have been obvious to implement the conductor patterns in the Kato-Park-Chong-Hahn combination on the second surface of the circuit board. (*Id*., ¶115.) Therefore, as shown in the non-limiting demonstrative below, the Kato-Park-Chong-Hahn combination discloses or suggests that the outer end of the wireless charging coil ("first terminal") is connected to the connection terminal ("first connector") at the periphery of the coils with a conductor pattern ("first sub-connection part") that crosses the wireless communication coil ("second coil pattern"), and is disposed on the bottom ("second surface") of the flexible printed circuit board. (*Id*., ¶116.) The conductor pattern ("first sub-connection part") is physically insulated from the wireless communication coil ("second coil pattern") by the insulative board.



(*Id.*)

j) wherein the second terminal is electrically connected to a second connector by a second sub-connection part that crosses, and is physically insulated from, both the first coil pattern and the second coil pattern, and the second sub-connection part is disposed on the second surface of the flexible printed circuit board;

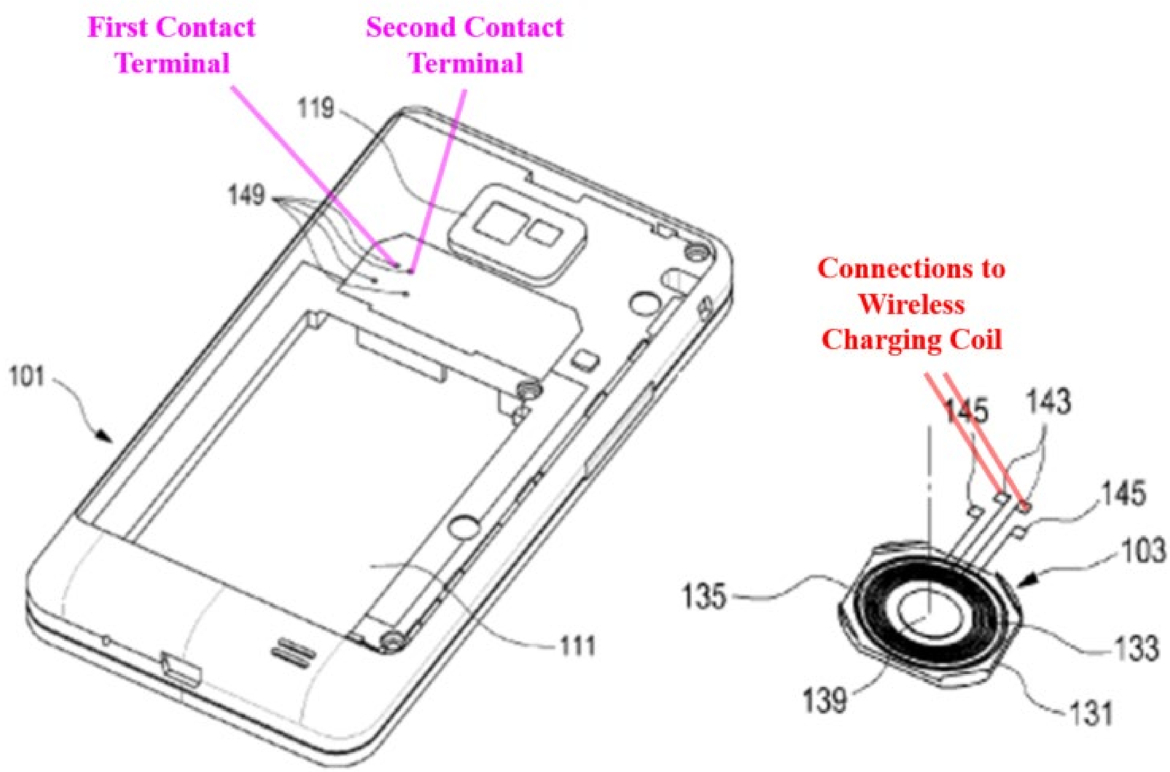
The Kato-Park-Chong-Hahn combination discloses or suggests this feature for reasons similar to those in Section IX.A.1(i). (Ex-1002, ¶117.) As discussed in Section IX.A.1(i), the combination discloses or suggests sub-connection parts on the bottom side of the circuit board that connect the coil contact portions and the external terminals on the periphery of the coils. As shown in the non-limiting demonstrative below, the combination discloses or suggests that the outer end of the wireless charging coil ("second terminal") is connected to another terminal at the periphery of the coils ("second connector") with a conductor pattern ("second sub-connection part") that crosses the wireless charging coil ("first coil pattern") and the wireless communication coil ("second coil pattern"), and is disposed on the bottom ("second surface") of the board. The conductor pattern ("second sub-connection part") is physically insulated from the coils ("first coil pattern" and "second coil pattern") by the insulative board. (*Id*.)



(*Id*.)

k) wherein the plurality of contact terminals comprises a first contact terminal and a second contact terminal that connect the first antenna and the battery for charging the battery;

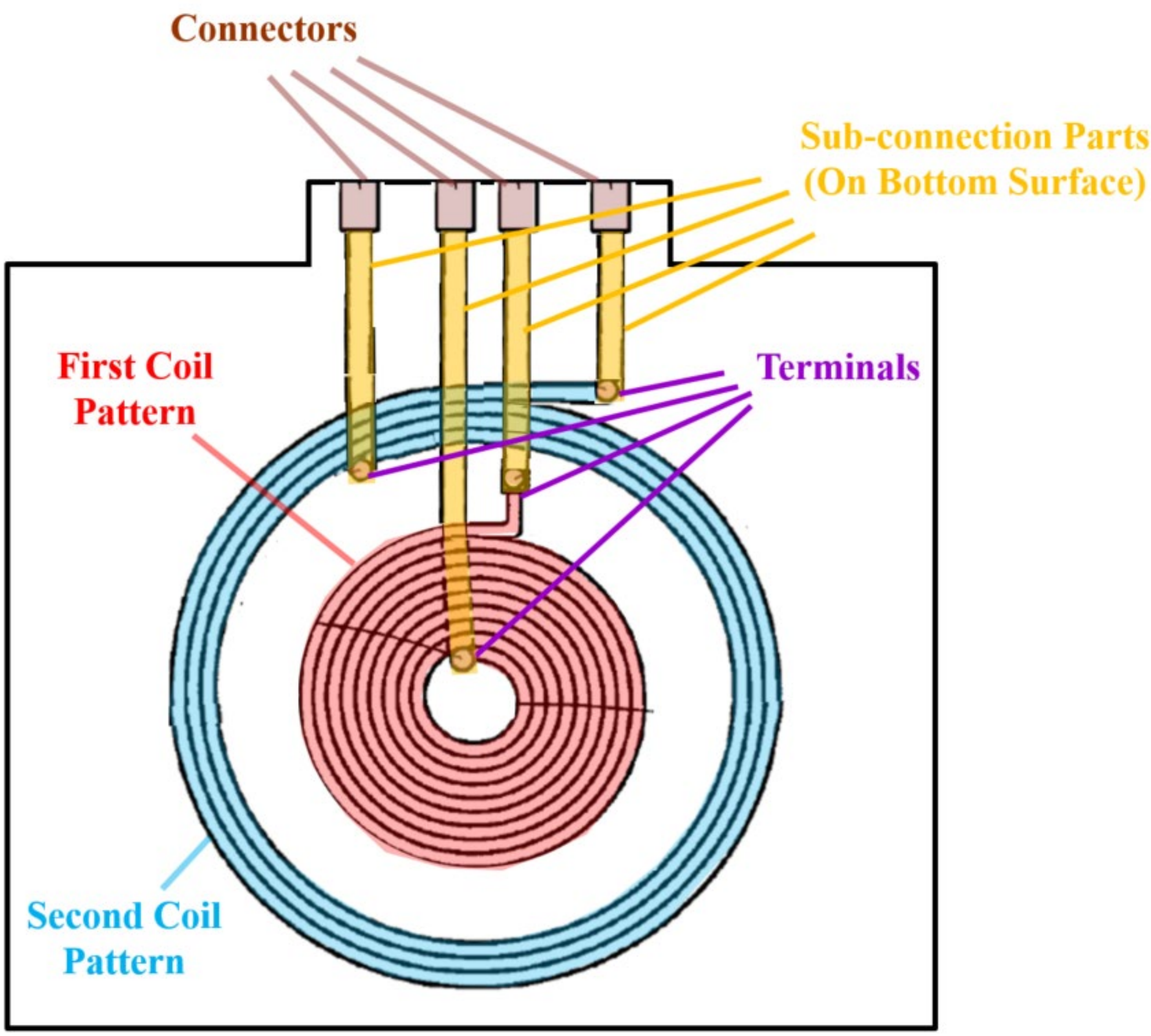
The Kato-Park-Chong-Hahn combination discloses or suggests this feature. (Ex-1002, ¶118.) For example, as discussed in Section IX.A.1(e), Park discloses terminals 149 ("plurality of contact terminals") that connect the antennas to a battery and a communication processor ("wireless communication module") that are included in the mobile phone. (Ex-1006, 4:1-6, 5:9-26, FIGs. 1, 4-6.) As also discussed in Section IX.A.1(e), a POSITA would have found it obvious to use the same arrangement and relative positioning of contact terminals as disclosed by Park in a mobile phone as disclosed by Kato. Therefore, as shown in the annotated excerpts of figure 1 of Park below, where the terminal placement corresponds to that of the Kato-Park-Chong-Hahn combination, the wireless charging coil (the inner coil) is connected to connection ends 143 that provide connections to two of the contact terminals 149 ("first contact terminal" and "second contact terminal"). (Ex-1006, 4:1-6, 5:9-26, FIGs. 1, 2, 4-6; Ex-1002, ¶118.)



(Ex-1006, FIG. 1 (excerpts, annotated); Ex-1002, ¶118.)

l) wherein the first connector is electrically connected to the first contact terminal by a first connection conductive line, and the first connection conductive line is disposed on the first surface of the flexible printed circuit board;

Kato, Park, Chong, Hahn, and Ramadan disclose or suggests this feature. (Ex-1002, ¶¶119-139.) As discussed in Section IX.A.1(i) and shown in the demonstrative below, the Kato-Park-Chong-Hahn combination discloses or suggests a flexible printed circuit board that includes sub-connection parts on the backside of the circuit board that connect the terminals at the coil ends with connectors on the periphery of the coils. (Ex-1002, ¶119.)



(*Id*.)

Kato, Park, Chong, and Hahn do not explicitly disclose connecting the contacts at the periphery of the coils ("connectors") to the contact terminals providing connections to the wireless charging and communication circuitry with connection conductive lines on the first surface of the board. Ramadan, however, discloses bridging leads that connect smaller bonding pads close to the antenna coils with larger bonding pads used to make connections to other devices and circuitry, and a POSITA would have found it obvious to combine the teachings of Ramadan with those of Kato, Park, Chong, and Hahn. (*Id.*, ¶120.)

Ramadan, like Kato, Park, Chong, and Hahn, is directed to magnetic coils, including coils on a substrate used for energy transfer. (Ex-1009, 2:37, 6:1-4, 7:59-63, 8:3-5; Ex-1002, ¶121.) Annotated figures 1e and 1g of Ramadan below show coils and associated interconnect used to provide connections to those coils, including inner bond pads 18, bridging leads 17, and larger outer bonding pads 15. (Ex-1009, 5:59-61, 8:40-50, 9:58-62, 10:8-11, 11:20-25; Ex-1002, ¶¶122-123.)

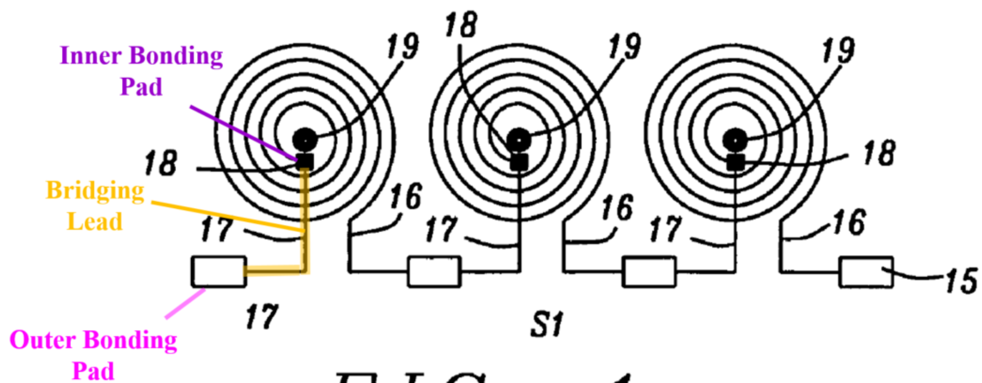


FIG. 1e

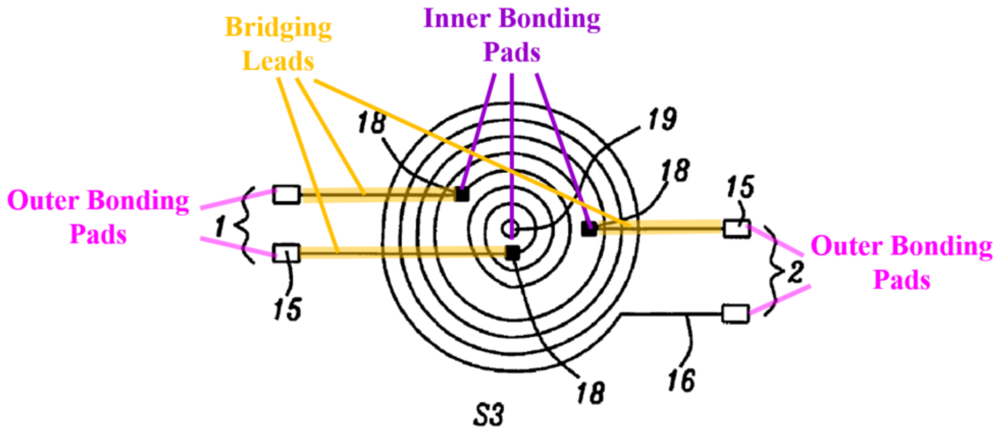
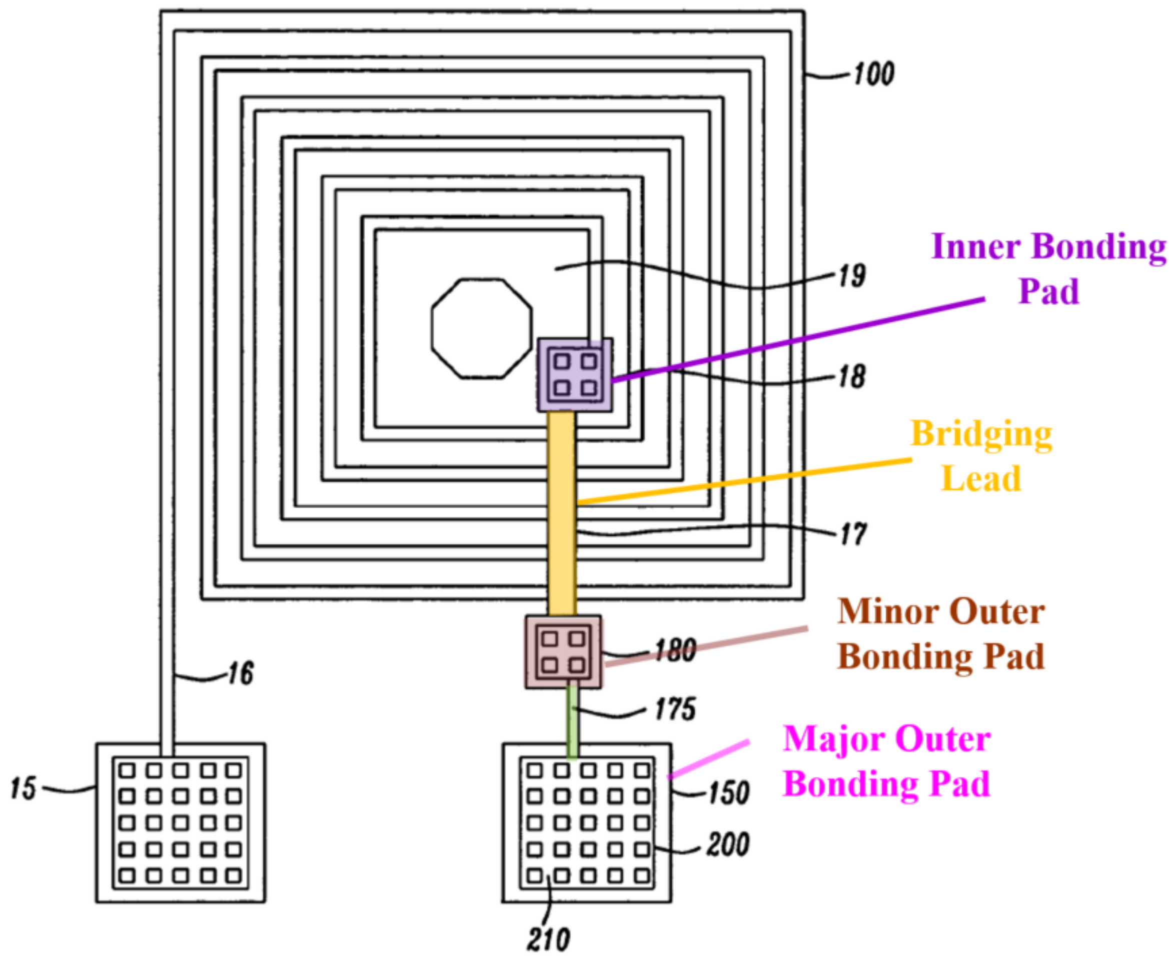


FIG. 1g

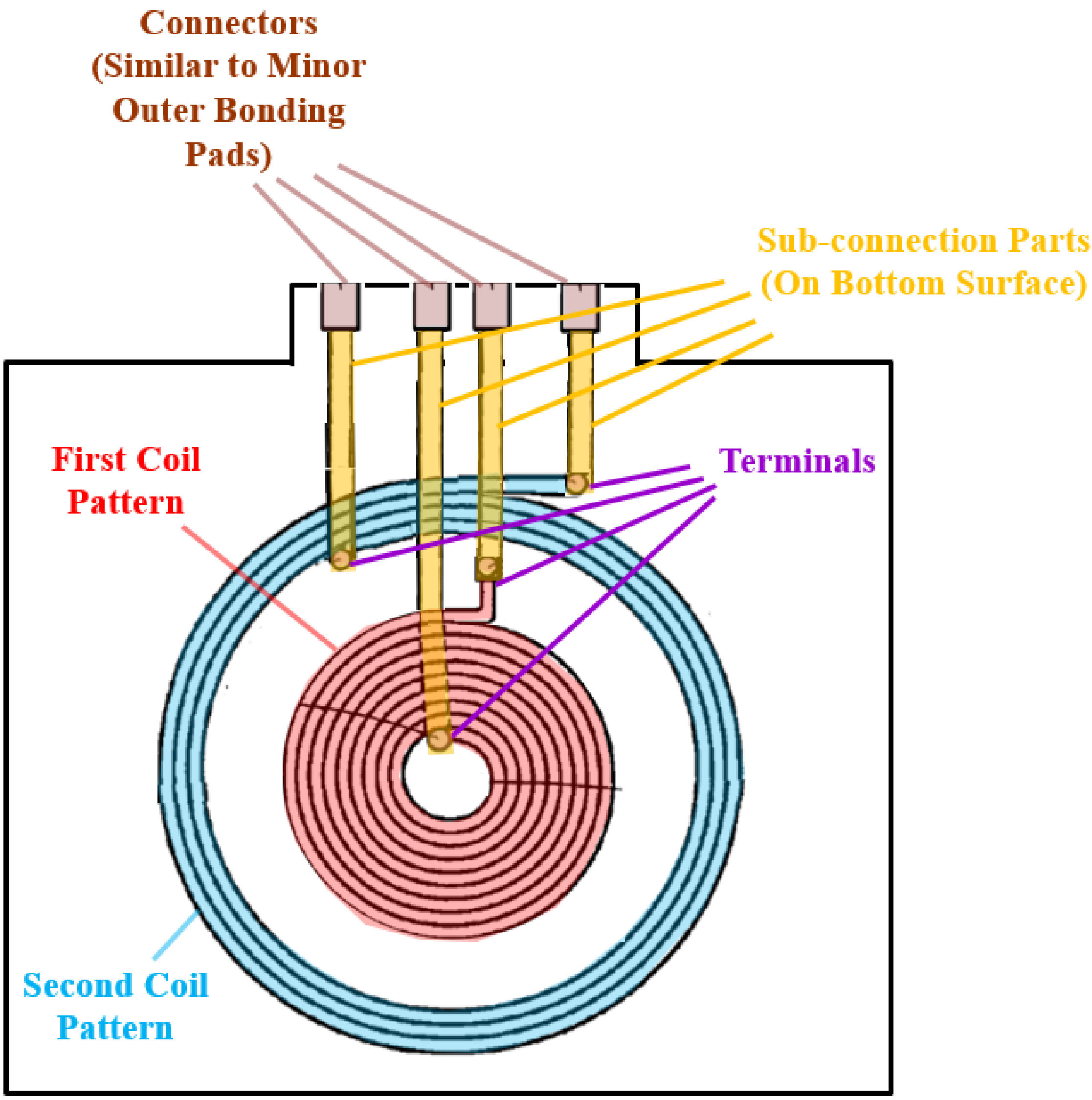
(Ex-1009, FIGs. 1e, 1g (annotated); Ex-1002, ¶122.)

As shown in annotated figure 4a below, Ramadan further discloses minor outer bonding pads 180 that are smaller than the larger outer bonding pads 15 and 150. (Ex-1009, 13:14-22.) The larger outer bonding pads are "used to make connections to external circuitry," whereas "the inner pads (and minor outer pads), typically used to connect inner coil ends by bridging leads to outer bonding pads are substantially smaller." (Ex-1009, 13:16-21; Ex-1002, ¶124.)



(Ex-1009, FIG. 4a (annotated); Ex-1002, ¶124.)

The wireless charging antenna of the Kato-Park-Chong-Hahn combination includes coil patterns with terminals at the ends of the coils connected to connectors that are similar to Ramadan's minor outer bonding pads on the periphery of the coil. (Section IX.A.1(i); Ex-1002, ¶125.)



(Ex-1002, ¶125.)

As is the case with the coils in the Kato-Park-Chong-Hahn combination, Ramadan includes conductive traces (e.g., "bridging leads") insulated from the coils to provide connections between ends of the coils and bonding pads outside of the coils. (Ex-1009, 15:2-12, 15:62-16:9.) For example, bridging lead 17 connects inner bonding pad 18 to a minor outer bonding pad 180. (Ex-1009, 16:24-27, FIG. 4a.)

An additional connector connects the minor bonding pad 180 to the major outer bonding pad 150, which "is used to connect the micro-coil to external circuitry." (Ex-1009, 16:27-31; Ex-1002, ¶126.)

Therefore, Ramadan discloses interconnect techniques to provide connections from the ends of coils to external circuitry, including the use of both minor and major outer bonding pads. (Ex-1002, ¶127.) Having looked to Ramadan, which is in the same field, a POSITA would have had good reason to implement the coil interconnect circuitry in the Kato-Park-Chong-Hahn-Ramadan combination such that it includes both minor outer bonding pads and major outer bonding pads like those shown in figure 4a of Ramadan. (*Id*.)

A POSITA would have combined the teachings in such a way to implement a mobile phone having a coil module with larger outer bonding pads configured to provide connections to external circuitry such as the phone's wireless charging and communication circuitry. (*Id*., ¶128.) Such a POSITA would have recognized that Ramadan provides another example of the many types of interconnect for achieving such connections, which supports the understanding that a "connection conductive line" electrically connecting minor outer bonding pads ("connectors" at the periphery of the coils) with major outer bonding pads that provide connections to the contact terminals corresponding to the external charging and communication circuitry of the phone would have been obvious to a POSITA. (*Id*.) Moreover, such a POSITA would have understood that while connections from the periphery of the coils (e.g., minor outer bonding pads) to the ends of the coils (e.g., inner bonding pads) can be accomplished with smaller bonding pads, connections to, for example, the battery or the wireless communication circuitry are better facilitated with larger bonding pads (e.g., major outer bonding pads) that promote easier and more reliable connections when the coil module is mounted within the mobile phone. (*Id*.) For example, "pressure contacts," which are larger bonding pads, were known for providing connections between the wireless power transfer and communications antennas to corresponding charging and communication circuitry in mobile phones. (*Id*.; Ex-1015, 5 (Step 8: "A number of pressure contacts power the NFC antenna and connect the induction coil needed for wireless charging to the motherboard.").)

A POSITA would have found it beneficial to include both minor and major bonding pads and connectors connecting those pads on the same circuit board as the coils, as opposed to discrete wires or traces on another substrate, in order to reduce the number of components in the phone, promote manufacturability, minimize thickness, and reduce the likelihood of a failed connection when additional components are interconnected. (Ex-1002, ¶129; Ex-1007, 15:51-54.) A POSITA would have had good reason to use conductive traces on the top side of the circuit board for connections between the minor and major outer bonding pads (as opposed to the bottom side) in order utilize the insulative nature of the circuit board to prevent unwanted electrical connections (e.g., short circuits) with other circuitry. (Ex-1002, ¶129.)

Moreover, the circuitry in the phone to which the coils are connected is located opposite the backside surface of the circuit board. As such, in order to provide connections to that circuitry, connections from the traces on the backside of the board to the topside are required. (*Id*., ¶130.)

A POSITA would have understood that there are a finite number of known, predictable solutions to achieve this. One option is an intermediate-position via (e.g., corresponding to a minor outer bonding pad), where an additional connector on the topside of the circuit board (e.g., a connection between a minor and major outer bonding pad, as in Ramandan) provides the connection to the terminal on the coil unit and the device circuitry. Another option is to extend the sub-connection part further on the backside of the board and have a via at the terminal on the coil unit. (*Id*., ¶131.) A POSITA would have understood that the former is preferable in situations where an extended trace on the backside of the board can cause short circuits with other parts of the device and/or where having a via in the same location as the terminal on the coil unit complicates manufacturing or compromises the structure of the terminal (e.g., when the terminal includes "pressure contacts" on which pressure is applied). (*Id*.; Ex-1015, 5.) Indeed, vias were commonly used to provide connections between the bottom and top surface of the board along with additional connectors to larger terminals on the coil unit. (Ex-1011, ¶¶[0040]-[0045], FIGs. 1, 9, 10; Ex-1002, ¶132.)

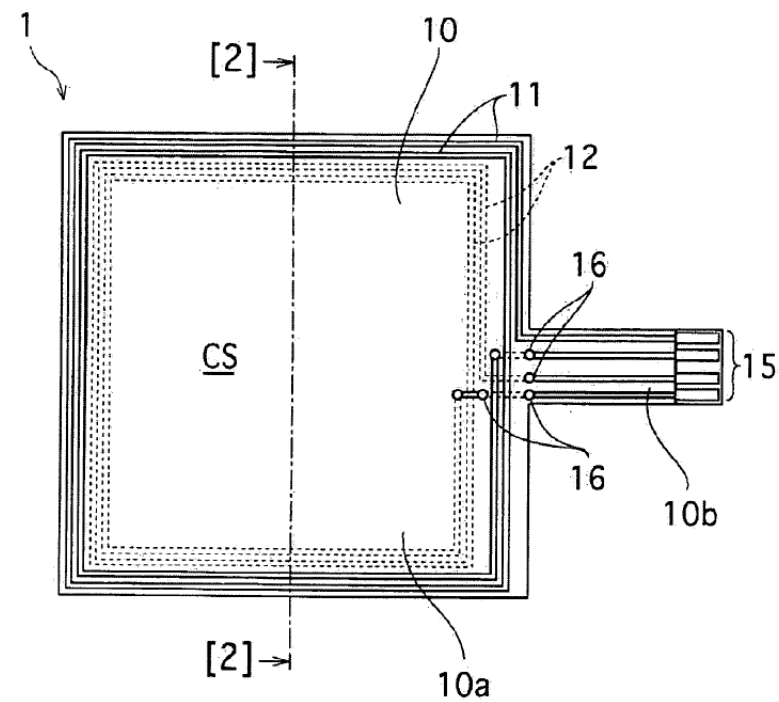
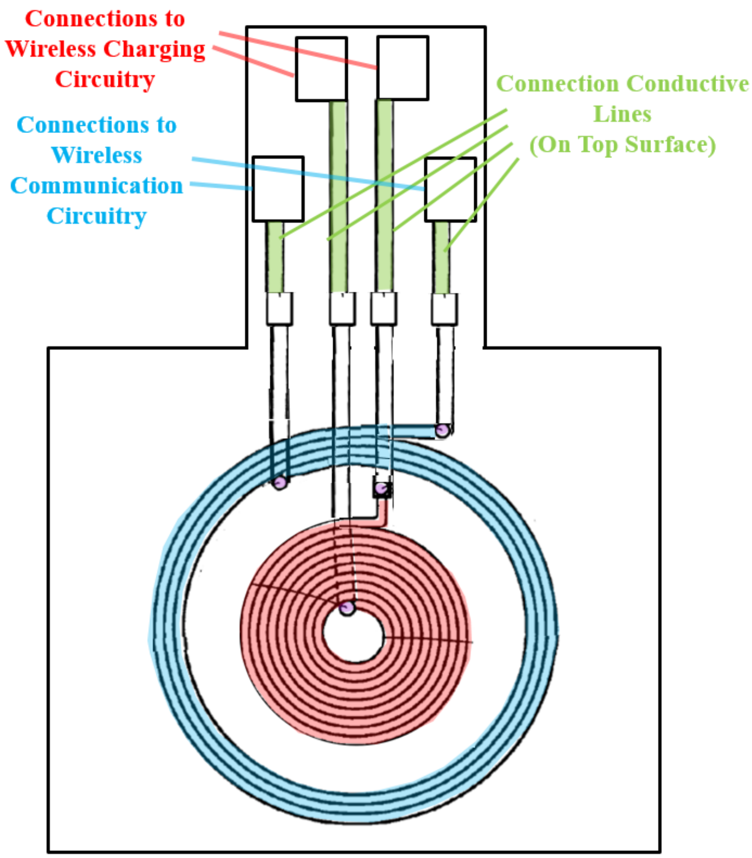


Fig.1

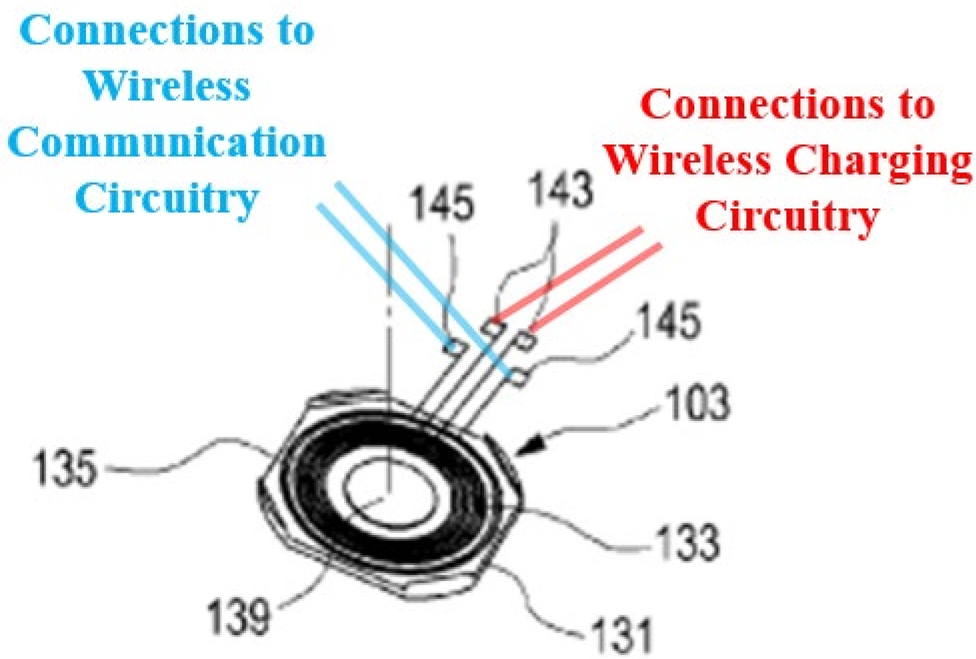
(Ex-1011, FIG. 1.)

The non-limiting demonstrative below illustrates a flexible printed circuit board consistent with the Kato-Park-Chong-Hahn-Ramadan combination, where the flexible printed circuit board includes minor outer bonding pads ("connectors") and major outer bonding pads that provide connections to the contact terminals on the mobile phone. (Ex-1002, ¶133.) Connectors ("connection conductive lines") on the top surface of the board connect the minor outer bonding pads ("connectors") to the major outer bonding pads (connections to the "contact terminals").



(*Id.*)

The demonstrative shows the connection conductive lines on the top surface of the flexible printed circuit board, where the positioning of the lines and major outer bonding pads is consistent with the disclosure shown in figure 1 of Park below. (*Id.*, ¶134.)



(Ex-1006, FIG. 1 (excerpt, annotated); Ex-1002, ¶134.)

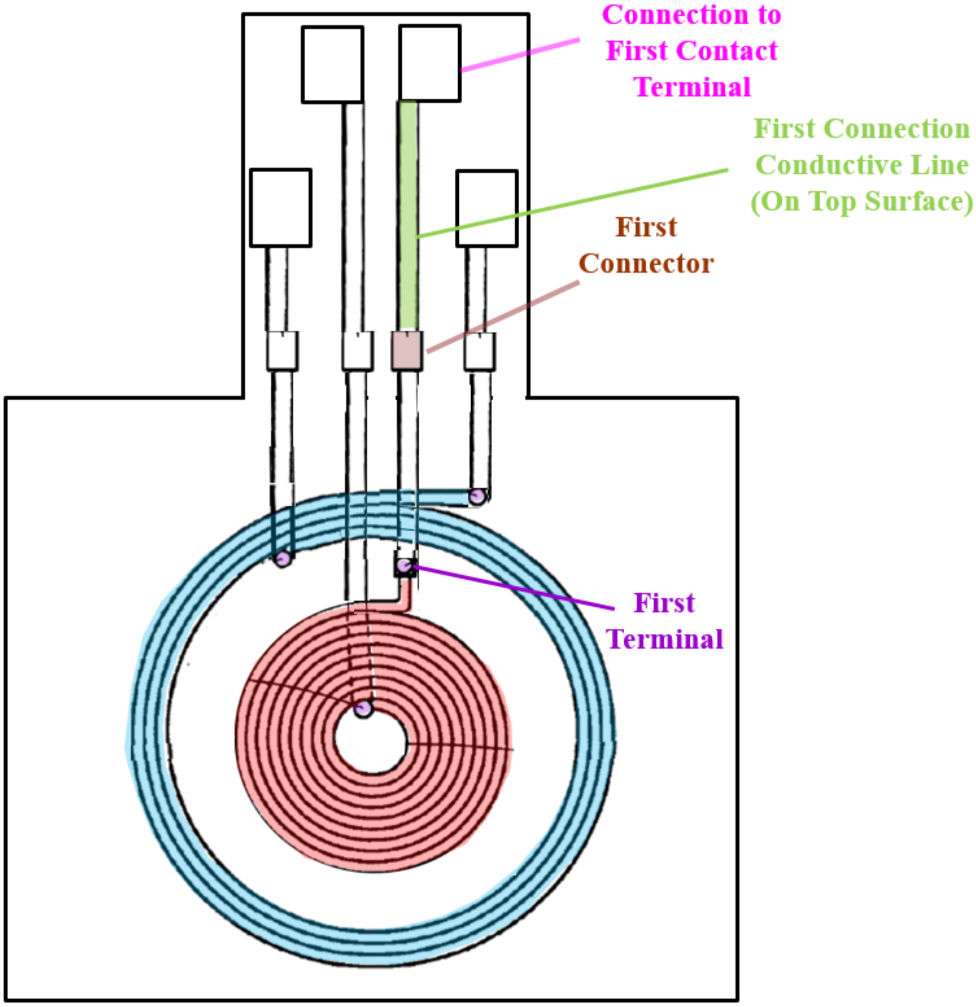
Including both minor and major outer bonding pads on the circuit board of the Kato-Park-Chong-Hahn-Ramadan combination would have been straightforward for a POSITA because Ramadan discloses such pads, and a POSITA would have readily understood how to implement such pads and interconnect on circuit boards, which have been widely used for many years. (Ex-1002, ¶135.) The resulting coil module would have been a predictable combination of known components according to known methods (e.g., applying Ramadan's teachings regarding major outer bonding pads to the Kato-Park-Chong-Hahn coil module), and would have provided predictable results in the form of functional connections between the coils and the external wireless charging and communication circuitry. (*Id.*) *See KSR*, 550 U.S. at 416.

Moreover, a POSITA would have found it obvious to include additional connection conductive lines on the top surface of the circuit board, as discussed and recited in claim 1, because using such conductors is nothing more than a simple design choice. (Ex-1002, ¶136.) A POSITA would have been aware of a number of different ways to provide connections between the connectors at the periphery of the coils and the contact terminals. Printed circuit boards have been widely used for decades, and forming traces on such boards was well known and commonplace. (*Id.*; s*ee*, *e.g.*, Ex-1005, ¶¶[0023]-[0026], FIGs. 7-10; Ex-1011, ¶¶[0041]-[0043], [0056], FIGs. 1, 9; Ex-1012, 7:40-63, FIGs. 3, 4.)

Park demonstrates that the terminals that connect to the wireless charging and communication circuitry of the phone can be located some distance from the coils. (Ex-1006, FIGs. 1, 2.) A POSITA would have understood that connecting the coils to those terminals could be accomplished in a number of different ways, including, for example, discrete wires, jumpers formed separate from the flexible printed circuit board, or with traces included on the printed circuit board. (Ex-1002, ¶137.) A POSITA would have understood that how the conductors that achieve those connections are implemented is nothing more than a design choice, where one of the known options is to use conductive traces on the top surface of the flexible printed circuit board as disclosed by, for example, Ramadan. (*Id.*)

Indeed, the ’476 patent does not describe any advantages achieved by using “connection conductive lines” on the first surface of the flexible printed circuit board to provide the specified electrically connections. (*Id*., ¶138.) The lack of criticality or reason for the connection conductive lines 321-324 supports the understanding that using such lines to provide the connections is nothing more than an obvious design choice. (*Id*.)

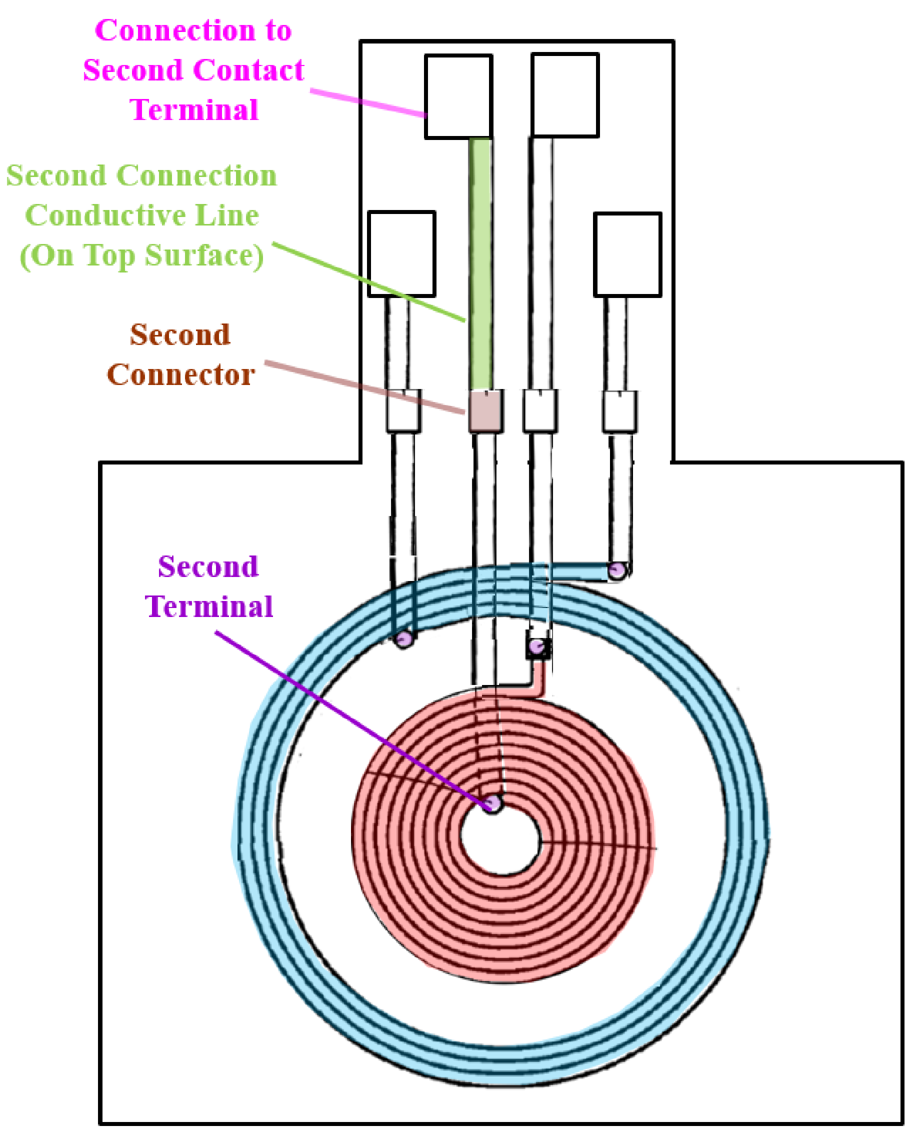
For these reasons, it would have been obvious to implement connection conductive lines on the first surface of the board in the Kato-Park-Chong-Hahn-Ramadan combination, as shown in the demonstrative above. (*Id*., ¶139.) As shown, the combination discloses or suggests claim element 1[l], as the terminal on the periphery of the coils that is connected to the outer end of the wireless charging coil (“first connector”) is connected to another terminal that connects to the first contact terminal (“electrically connected to the first contact terminal”) by a conductive line on the top surface of the flexible printed circuit board (“first connection conductive line” “disposed on the first surface of the flexible printed circuit board”).



(*Id.*)

m) wherein the second connector is electrically connected to the second contact terminal by a second connection conductive line, and the second connection conductive line is disposed on the first surface of the flexible printed circuit board;

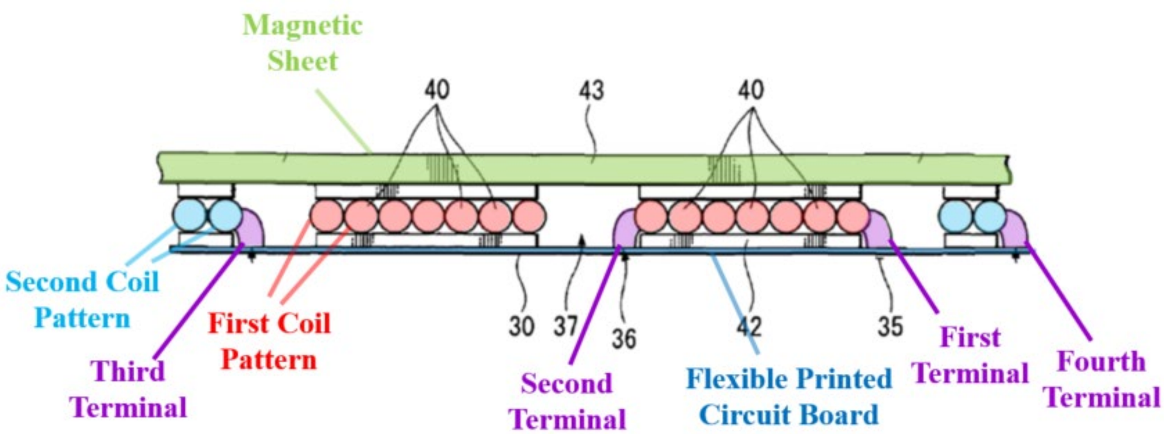
The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature for the reasons in Section IX.A.1(l). (Ex-1002, ¶140.) As shown in the non-limiting demonstrative below, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests claim element 1[m], as the terminal on the periphery of the coils that is connected to the inner end of the wireless charging coil ("second connector") is connected to another terminal that connects to the second contact terminal ("electrically connected to the second contact terminal") by a conductive line on the top surface of the flexible printed circuit board ("second connection conductive line" "disposed on the first surface of the flexible printed circuit board").



(*Id.*)

n) wherein the first antenna and the second antenna are disposed between the magnetic sheet and the flexible printed circuit board;

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶141-142.) The combination may be illustrated by the following non-limiting demonstrative:



(Ex-1002, ¶141; Section IX.A.1(f)[7].)

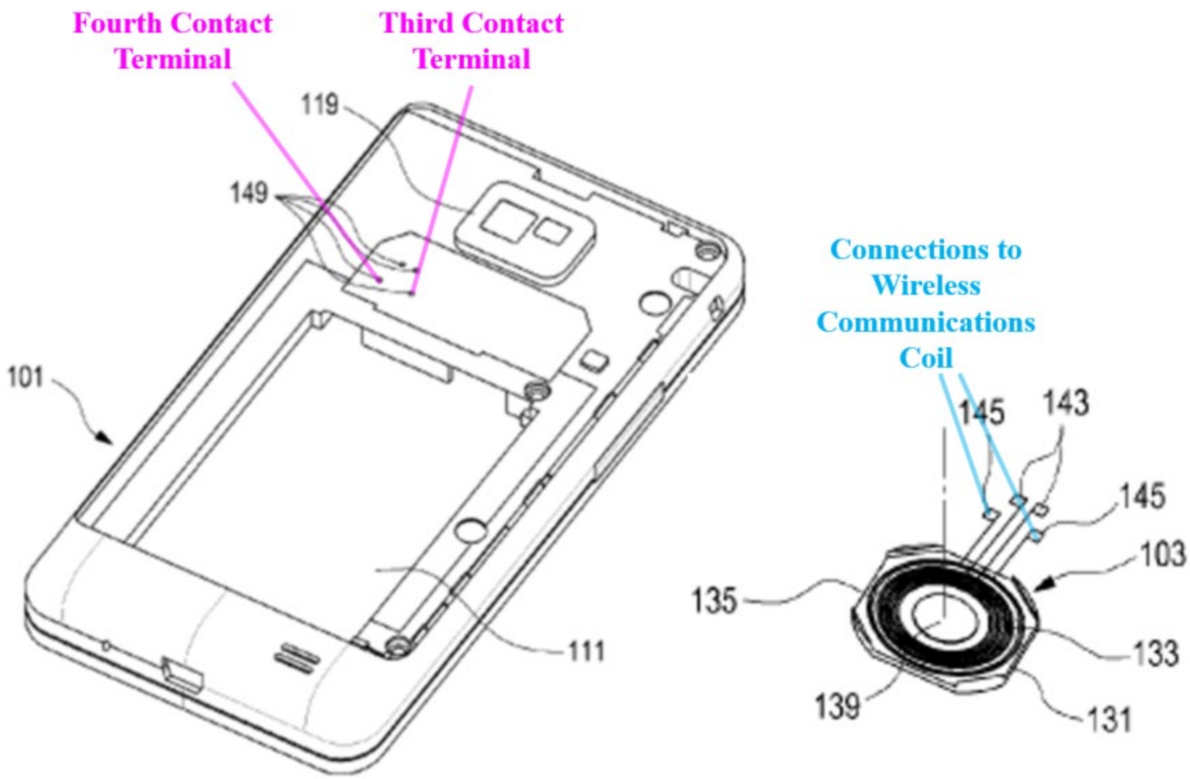
As shown above, and consistent with Kato and Chong, the first coil pattern, the second coil pattern, and the first-fourth terminals (collectively "the first antenna

[7] Combining the teachings of Hahn and Ramadan with the Kato-Park-Chong combination discussed in Section IX.A.1(f) does not change the structure shown. (Ex-1002, ¶142.)

and the second antenna") are disposed between the magnetic sheet and the flexible printed circuit board. (Section IX.A.1(f); Ex-1002, ¶142.)

o) wherein the plurality of contact terminals comprises a third contact terminal and a fourth contact terminal that connect the second antenna and the wireless communication module;

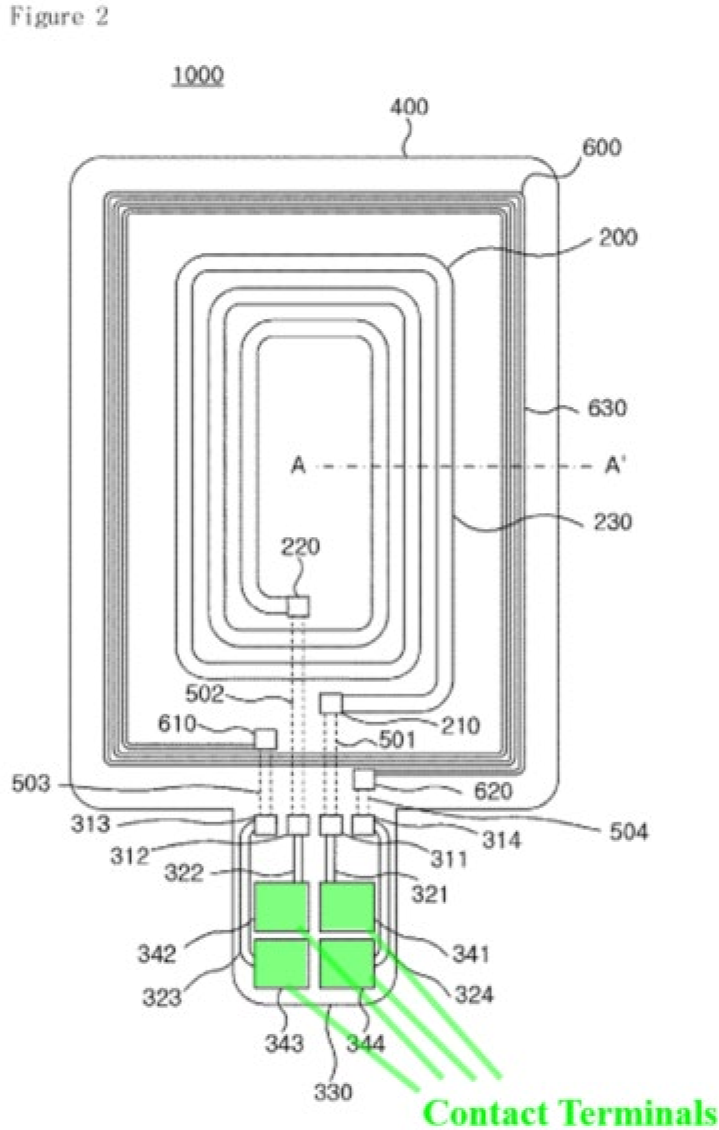
The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶143.) As discussed in Section IX.A.1(e), Park discloses terminals 149 ("plurality of contact terminals") that connect the antennas to a battery and a communication processor ("wireless communication module") of the mobile phone. (Ex-1006, 4:1-6, 5:9-26, FIGs. 1, 4-6.) As shown in the annotated excerpts of figure 1 of Park below, where the placement of the external terminals corresponds to the terminal placement in the Kato-Park-Chong-Hahn-Ramadan combination discussed above, the wireless communications coil is connected to connection ends 145 that provide connections to two of the contact terminals 149 ("third contact terminal" and "fourth contact terminal"). (Ex-1006, 4:1-6, 5:9-26, FIGs. 1, 2, 4-6; Ex-1002, ¶143.)



(Ex-1006, FIG. 1 (excerpts, annotated); Ex-1002, ¶143.)

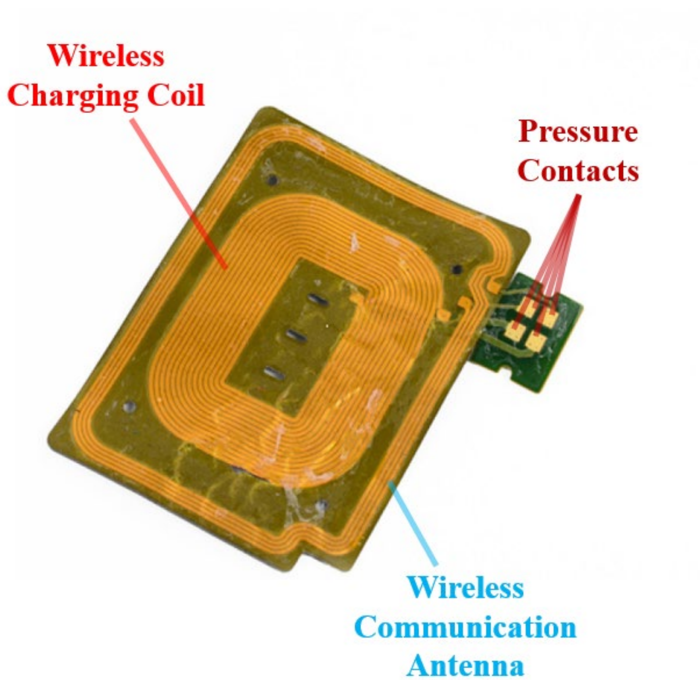
p) wherein the first, second, third, and fourth contact terminals are disposed as a 2×2 matrix;

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶144-149.) As an initial matter, the '476 patent specification does not mention a "2x2 matrix" outside of the claims, and, if anything, the only support for a "2x2 matrix" appears to be the square positioning of the contact terminals in figure 2. (Ex-1002, ¶144.)



(Ex-1001, FIG. 2 (annotated); Ex-1002, ¶144.)

A POSITA would have found it obvious to dispose the first-fourth contact terminals of the Kato-Park-Chong-Hahn-Ramadan combination in a 2x2 matrix. (Ex-1002, ¶145.) As an initial matter, such a POSITA would have understood that the relative positioning of the four contact terminals is nothing more than a design choice. (*Id.*) The ’476 patent does not mention a 2x2 matrix or provide any explanation or motivation for a 2x2 matrix arrangement. (*Id.*) As such, the '476 patent does not provide any evidence of criticality, and arranging the terminals in a 2x2 matrix would have been obvious to a POSITA. (*Id.*) Indeed, arranging such terminals in a 2x2 matrix on a circuit board in a mobile phone was a known option in use before the alleged priority date of the '476 patent. (Ex-1015, 5.)



(Ex-1015, 5 ("A number of pressure contacts power the NFC antenna and connect the induction coil needed for wireless charging to the motherboard."); Ex-1002, ¶145.)

Moreover, as shown in figures 4 and 6 of Park, the contacts 143 and 145, which provide connections to the contact terminals 149, are disposed in a 2x2 matrix, thereby disclosing or suggesting that the contact terminals 149 can also be arranged in such a 2x2 matrix in order to facilitate the connections. (Ex-1006, FIGs. 4, 6; Ex-1002, ¶146.)

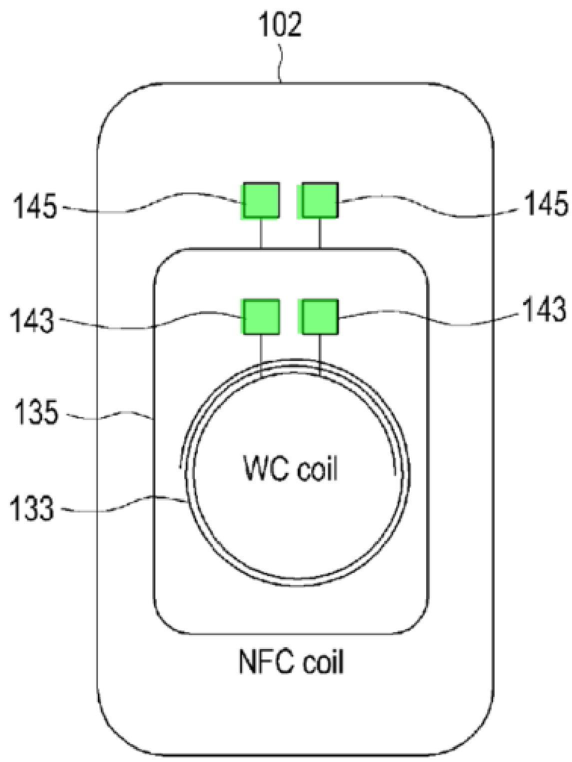


FIG.4

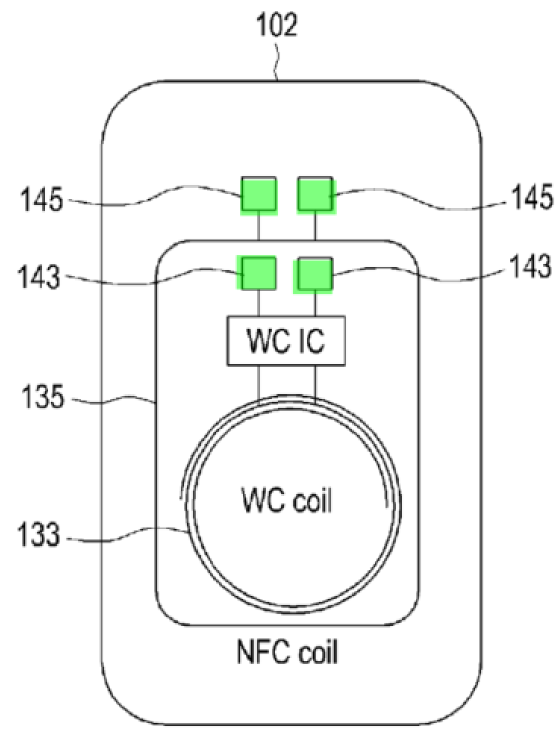


FIG.6

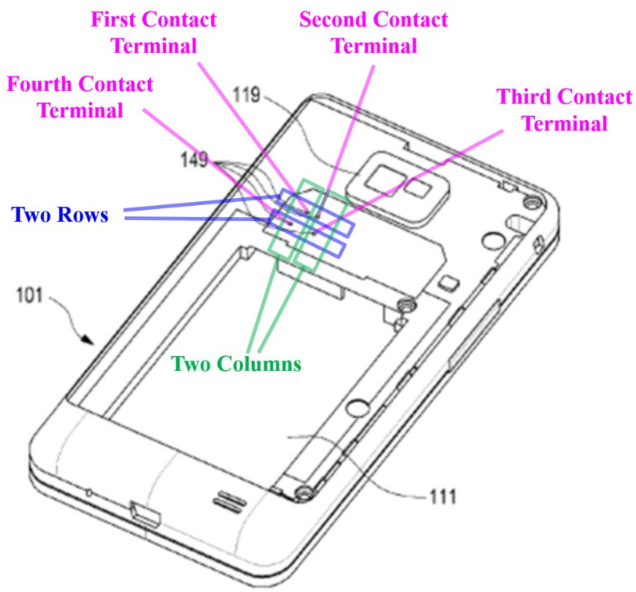
(Ex-1006, FIGs 4, 6 (annotated); Ex-1002, ¶146.)

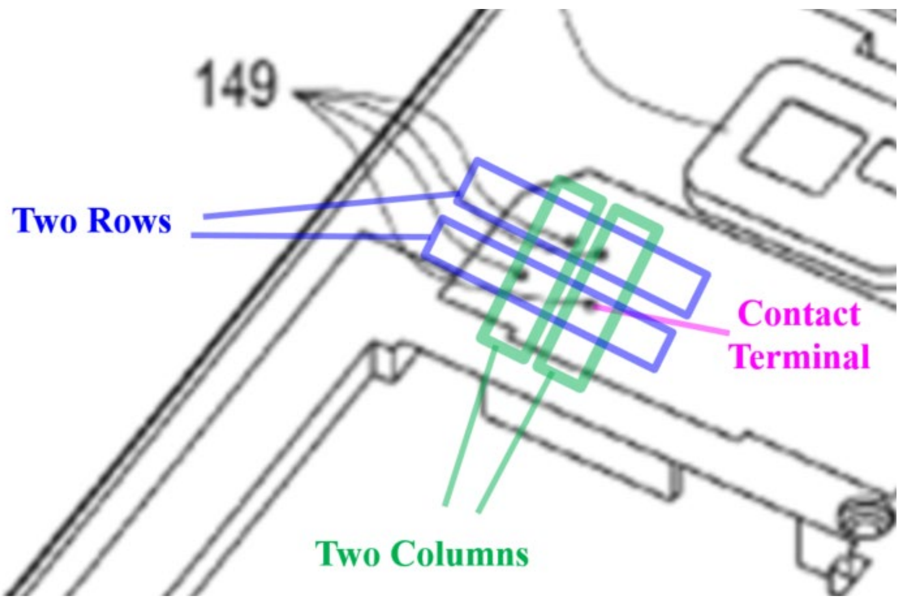
Indeed, a POSITA would have had good reason to place the terminals in a matrix, which is one of the highest density and compact arrangements of the terminals such that the area on the board for the terminals can be minimized, thereby reducing cost and component size. (Ex-1002, ¶147.) A POSITA would have had a reasonable expectation of success, as there is nothing particularly difficult or challenging about arranging the terminals in a matrix as opposed to some other configuration. (*Id*.)

Moreover, in district court, PO argues that a 2x2 matrix simply requires that the terminals are "arranged such that there are two rows and columns." (Ex-1024, 4-7.) Consistent with this broad interpretation, PO's infringement allegations contend that an arrangement of terminals with two terminals in one row and two terminals in a second row, where the terminals are not lined up in the column direction between the two rows, constitutes a 2x2 matrix. (Ex-1023, 23-24.) Without waiving any positions it may present in district court, under PO's broad interpretation, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature as shown in figure 1 of Park. (Ex-1002, ¶¶148-149.) *See 10X Genomics, Inc. v. Bio-Rad Labs., Inc.*, IPR2020-00086, Paper 8 at 21-22 (PTAB Apr. 27, 2020) (permitting petitioner to base its challenge "on claim constructions implied by Patent Owner's district court infringement contentions"); *W. Digital Corp. v. SPEX Techs., Inc.*, IPR2018-00084, Paper 14 at 11 (PTAB Apr. 25, 2018).

For example, as shown in the annotated excerpts of figure 1 of Park below, the contact terminals are arranged in two rows and two columns in a manner consistent with PO's infringement allegations.[8] (Ex-1002, ¶149.)

[8] As noted for claim element 1[e], the connectors that connect to terminals 149 also constitute "contact terminals." Those connectors, which, based on the teachings of Ramadan, can be implemented with larger outer bonding pads, are arranged in a 2x2 array according to PO's mapping. (Ex-1002, ¶149.)





(Ex-1006, FIG. 1 (excerpts, annotated); Ex-1002, ¶149.)

q) wherein the first contact terminal and the second contact terminal are disposed on a first line in the 2×2 matrix and the third contact terminal and the fourth contact terminal are disposed on a second line in the 2×2 matrix;

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶150-153.) As discussed above, arranging the terminals in a 2x2 array is nothing more than an obvious design choice. (Section IX.A.1(p).) Therefore, for the same reasons, disposing the first and second contact terminals on a first line of the matrix and disposing the third and fourth contact terminals on a second line of the matrix is also nothing more than an obvious design choice. (*Id*.; Ex-1002, ¶150.) A POSITA would have had a reasonable expectation of success, because there is nothing particularly difficult or challenging about arranging the terminals for wireless charging in one line and the terminals for wireless communication in another line. (Ex-1002, ¶150.) The ’476 patent does not describe the contact terminals being grouped in this manner, and provides no indication that such a grouping is important. (*Id*.)

Moreover, as shown in figures 4 and 6 of Park, the contacts 143 for wireless charging are in a first line, and the contacts 145 for wireless communication are in a second line, thereby disclosing or suggesting that the contact terminals are arranged in such a manner. (Ex-1006, FIGs. 4, 6; Ex-1002, ¶151.) Indeed, a POSITA would have been motivated to group the terminals corresponding to the wireless function they facilitate. (Ex-1002, ¶152.)

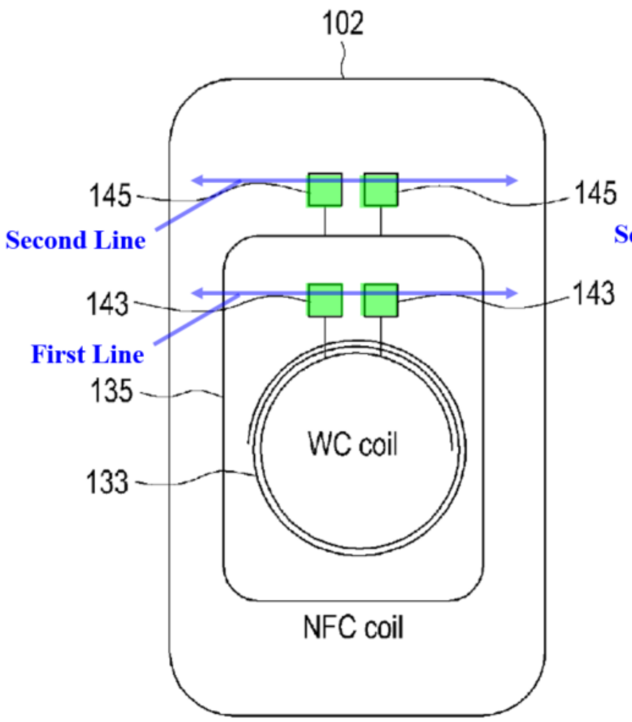


FIG.4

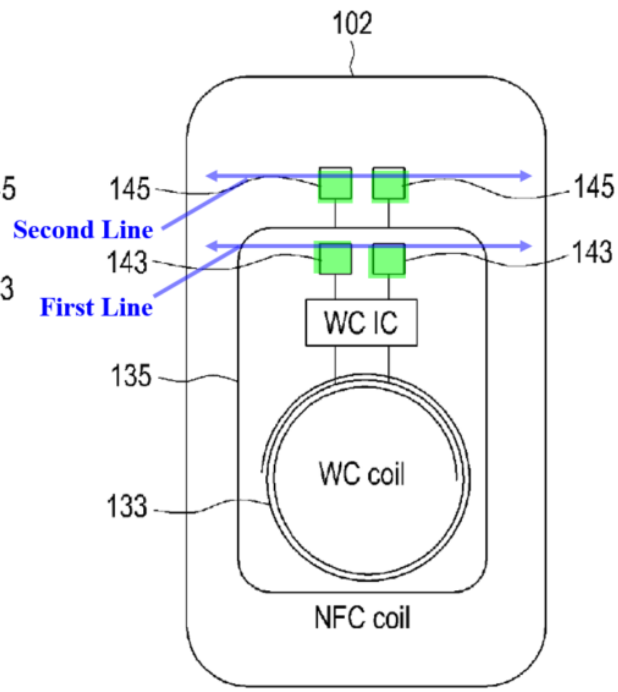
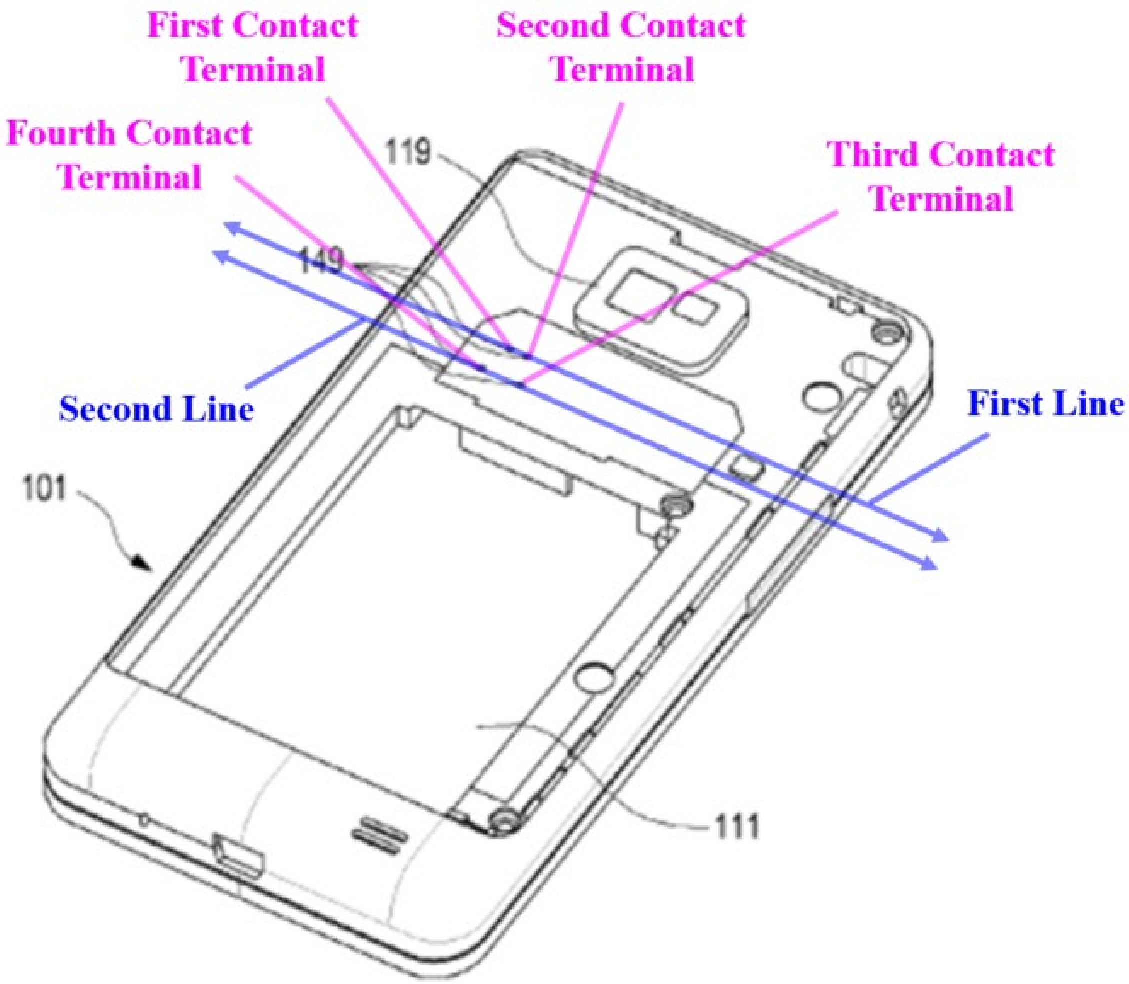


FIG.6

(Ex-1006, FIGs 4, 6 (annotated); Ex-1002, ¶151.)

Moreover, when applying PO's 2x2 matrix interpretation, the annotated excerpt of figure 1 of Park below shows the first and second contact terminals disposed along a first line and the third and fourth contact terminals disposed along a second line. (Ex-1006, FIG. 1; Ex-1002, ¶153.)



(Ex-1006, FIG. 1 (excerpt, annotated); Ex-1002, ¶153.)

r) wherein the third terminal is electrically connected to the third contact terminal by a third sub-connection part physically insulated from the second coil pattern;

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶154-155.) As discussed in Section IX.A.1(i), the Kato-Park-Chong-Hahn combination discloses or suggests conductor patterns ("sub-connection parts") on the bottom side of the circuit board to provide connections between the coil contact portions and the terminals on the outer periphery of the coils. As shown in the non-limiting demonstrative below, in the Kato-Park-Chong-Hahn-Ramadan combination,[9] a conductor pattern ("third sub-connection part") electrically connects the third terminal at the interior end of the wireless communications coil pattern ("third terminal") to a third connector at the periphery of the coils. The conductor pattern ("third sub-connection part") is physically insulated from the wireless communications coil ("second coil pattern") by the insulative circuit board. (Ex-1002, ¶154.)

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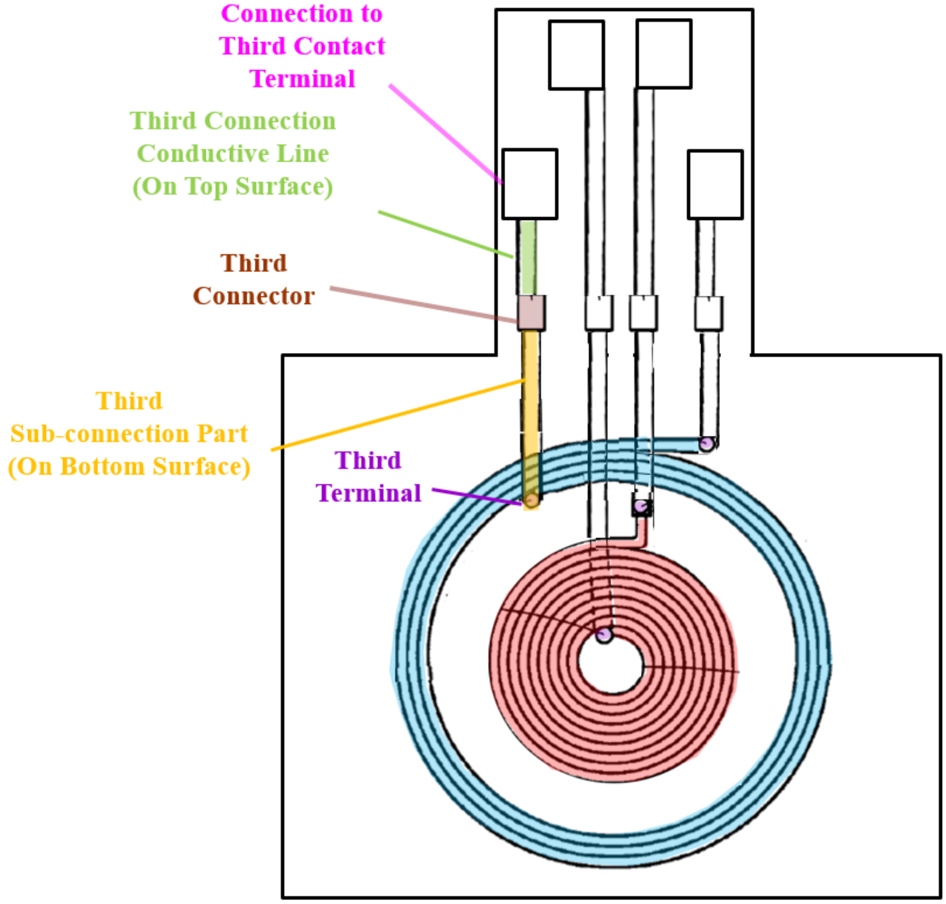
[9] Combining Ramadan with the Kato-Park-Chong-Hahn combination does not impact the analysis in Section IX.A.1(i). (Ex-1002, ¶154.)

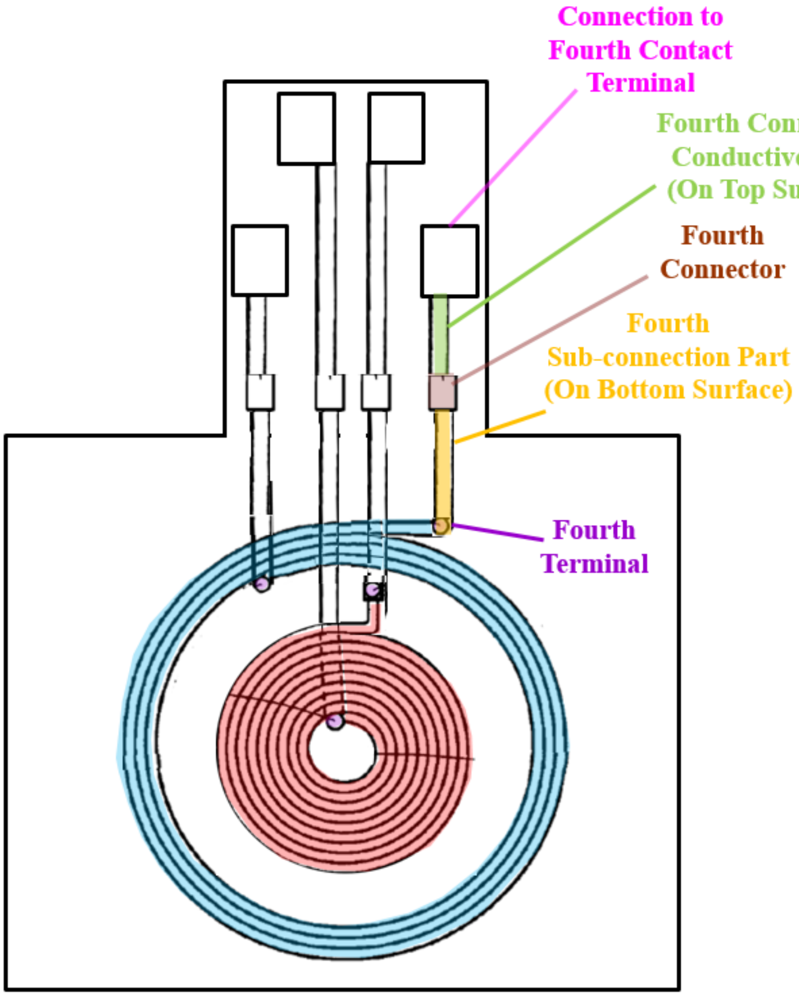


(*Id.*)

As discussed in Section IX.A.1(l), the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests connection conductive lines on the top side of the circuit board between the connectors on the periphery of the coils and the contact terminals. As shown above, the third connector is electrically connected to the third contact terminal by a third connection conductive line. (*Id.*, ¶155.) Therefore, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests claim element 1[r], as the third sub-connection part provides a portion of the electrical path between the third terminal and the third contact terminal. (*Id.*) Such an understanding is consistent with the'476 patent. (Ex-1001, 7:15-23, 7:29-31, FIG. 2; Ex-1002, ¶155.)

s) wherein the fourth terminal is electrically connected to the fourth contact terminal by a fourth sub-connection part physically insulated from the second coil pattern; and

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature for similar reasons to those discussed in Section IX.A.1(r). (Ex-1002, ¶¶156-157.) As shown in the non-limiting demonstrative below, in the combination, a conductor pattern on the backside of the board ("fourth sub-connection part") electrically connects the fourth terminal at the outer end of the wireless communications coil pattern to the fourth connector at the periphery of the coils. The conductor pattern ("fourth sub-connection part") is physically insulated from the wireless communications coil ("second coil pattern") by the insulative board. (*Id.*, ¶156.)

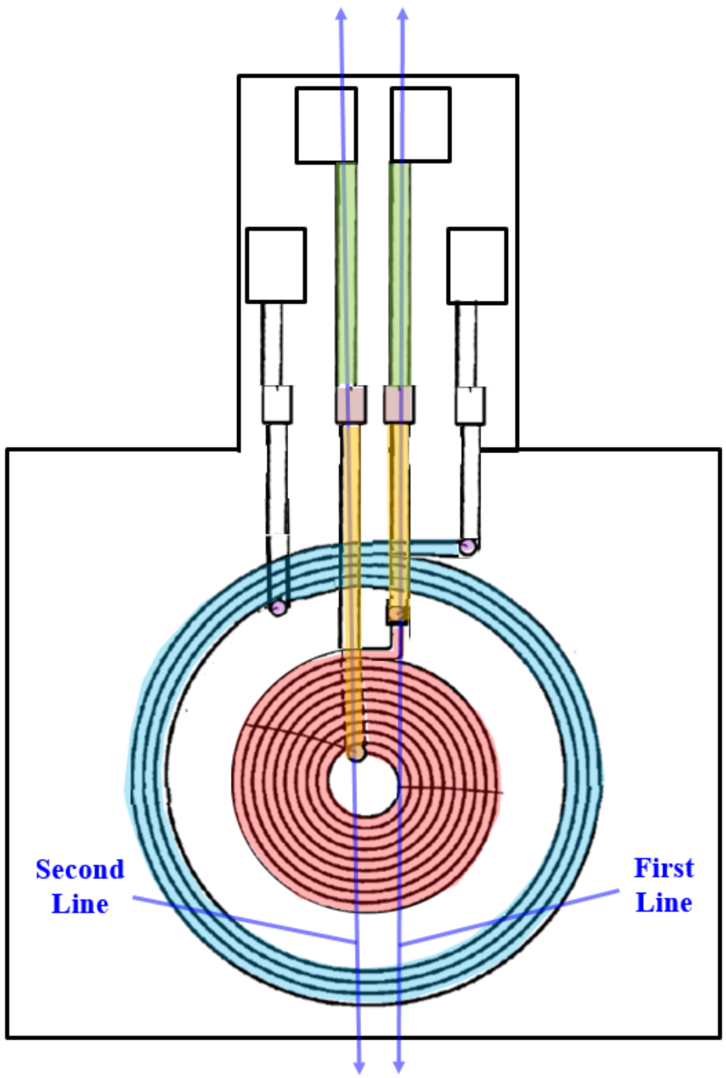


(*Id.*)

As shown above, the fourth connector is electrically connected to the fourth contact terminal by a fourth connection conductive line. (*Id.*, ¶157.) Therefore, the combination discloses or suggests claim element 1[s], as the fourth sub-connection part provides a portion of the electrical path between the fourth terminal and the fourth contact terminal. (*Id.*; Ex-1001, 7:15-23, 7:31-34, FIG. 2.)

t) wherein a first line connecting the first terminal and the first contact terminal through the first sub-connection part, the first connector and the first connection conductive line, and a second line connecting the second terminal and the second contact terminal through the second sub-connection part, the second connector and the second connection conductive line are disposed between the third terminal and the fourth terminal.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶158-159.) For example, as shown below, a "first line" that runs between the first terminal and the first contact terminal, which overlies the first sub-connection part, the first connector, and the first connection line, is disposed between the third terminal and the fourth terminal. Similarly, a "second line" that runs between the second terminal and the second contact terminal, which overlies the second sub-connection part, the second connector, and the second connection line, is disposed between the third terminal and the fourth terminal. A POSITA would have understood that such linear routing is efficient in comparison to a less-direct path between the terminals that would add complexity, cost, and electrical resistance. (*Id.*, ¶158.)



(Ex-1002, ¶158.)

As discussed above, a POSITA would have known that various connectors could have been used to provide electrical connections between the antennas and the associated wireless charging and communication circuitry. Because the '476 patent does not provide any indication as to why particular types of interconnection are used, reasons for the relative positioning of the conductors with respect to each other, or any criticality of any aspects of the interconnect, a POSITA would have understood that the choice of connection techniques and the relative positioning of the connectors is nothing more than an obvious design choice. (*Id*., ¶159.)

2. Claims 2-4

a) 2: The wireless power receiver of claim 1, wherein the first sub-connection part is disposed under the second coil pattern.

b) 3: The wireless power receiver of claim 1, wherein the second sub-connection part is disposed under the first coil pattern and the second coil pattern.

c) 4: The wireless power receiver of claim 1, wherein the third sub-connection part is disposed under the second coil pattern.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests these features to the extent they can be understood. (Ex-1002, ¶¶160-162.) As discussed in Sections IX.A.1(i), (j), (r), the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests the claimed first, second, and third "sub-connection parts," which are formed on the bottom ("second surface") of the circuit board, while the first and second coil patterns are formed on the top ("first surface") of the board. Assuming that the first surface of the circuit board is oriented such that the first surface is "above" the second surface, the first, second, and third sub-connection parts on the second surface are "disposed under" the second coil pattern, and the second sub-connection part is also disposed under the first coil pattern. (Ex-1002, ¶¶160-162.)

3. Claims 5-10

a) 5: The wireless power receiver of claim 1, wherein the first terminal is electrically connected to the first sub-connection part through a first via hole.

b) 6: The wireless power receiver of claim 1, wherein the first connector is electrically connected to the first sub-connection part through a second via hole.

c) 7: The wireless power receiver of claim 1, wherein the second terminal is electrically connected to the second sub-connection part through a third via hole.

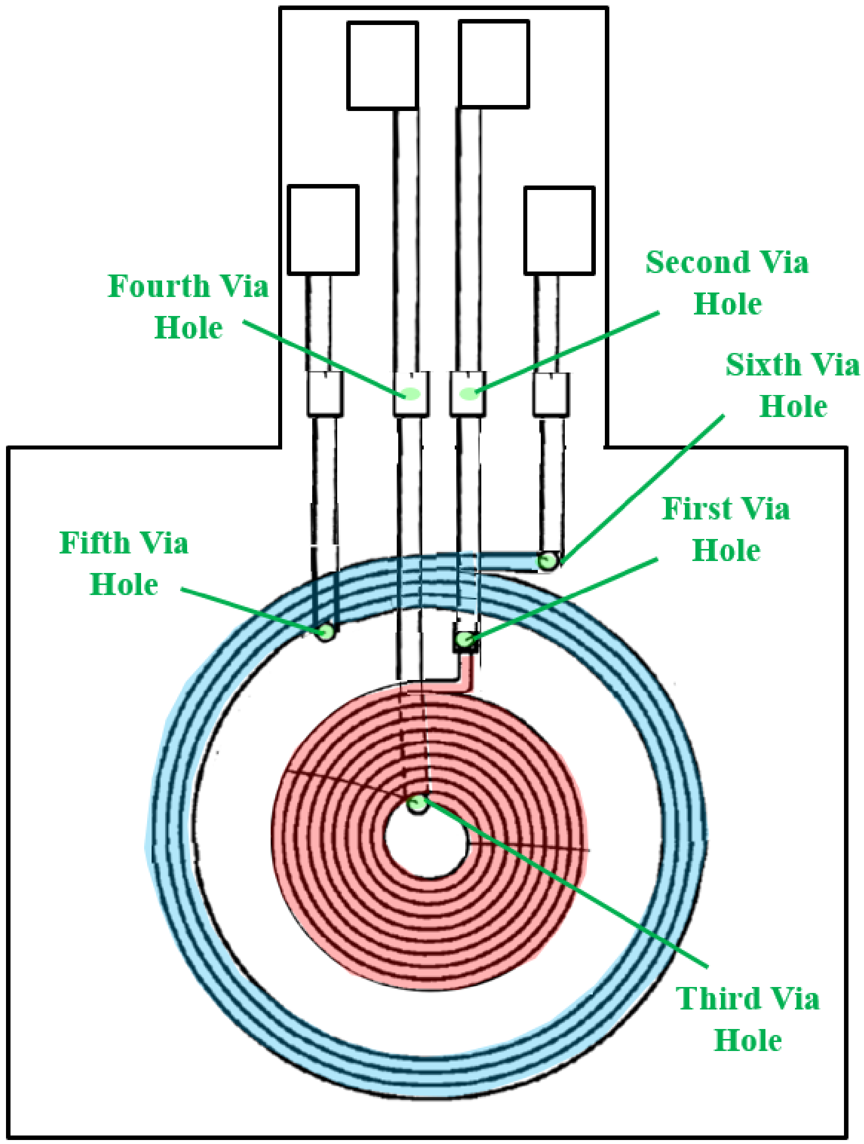
d) 8: The wireless power receiver of claim 1, wherein the second connector is electrically connected to the second sub-connection part through a fourth via hole.

e) 9: The wireless power receiver of claim 1, wherein the third terminal is electrically connected to the third sub-connection part through a fifth via hole.

f) 10: The wireless power receiver of claim 1, wherein the fourth terminal is electrically connected to the fourth sub-connection part through a sixth via hole.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests these features. (Ex-1002, ¶¶163-165.) For example, as discussed in Section IX.A.1(i), the combination discloses or suggests that each of the coil contact portions corresponding to the wireless charging coil ("first terminal" and "second terminal") and the wireless communication coil ("third terminal" and "fourth terminal") is electrically connected to a corresponding connector at the periphery of the coils (first-fourth "connectors") with a conductor pattern (first-fourth "sub-connection parts") that is disposed on the bottom ("second surface") of the flexible printed circuit board. (*Id*., ¶163.)

As also discussed in Section IX.A.1(i), a POSITA would have understood that connections between conductors on the first surface (e.g. coil ends and connectors at periphery of the coils) and the conductor patterns on the second surface ("sub-connection parts") would have been realized using holes in the substrate filled with conductive material, which are commonly referred to as "vias." (*Id*., ¶¶164-165.) Therefore, a POSITA would have found it obvious to use vias to provide the connections between the sub-connection parts on the backside of the circuit board with the conductive features on the front side in the Kato-Park-Chong-Hahn-Ramadan combination. (*Id*., ¶165.) A POSITA would have had good reason to use vias, as they were well-known and efficient for making direct connections between layers. (*Id*.) Indeed, an alternative like a jumper that goes around the board from the top to the bottom is inefficient and would add cost, complexity, and a higher likelihood of failure due to the longer distance. (*Id*.) Vias have been used in printed circuit boards for decades, and, as evidenced by Hahn and Kato, a POSITA would have known how to implement such vias with a reasonable expectation of success. (*Id*.) Therefore, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests the first-sixth "via holes" recited in claims 5-10, where those via holes are highlighted in the non-limiting demonstrative below. (*Id.*)



(*Id.*)

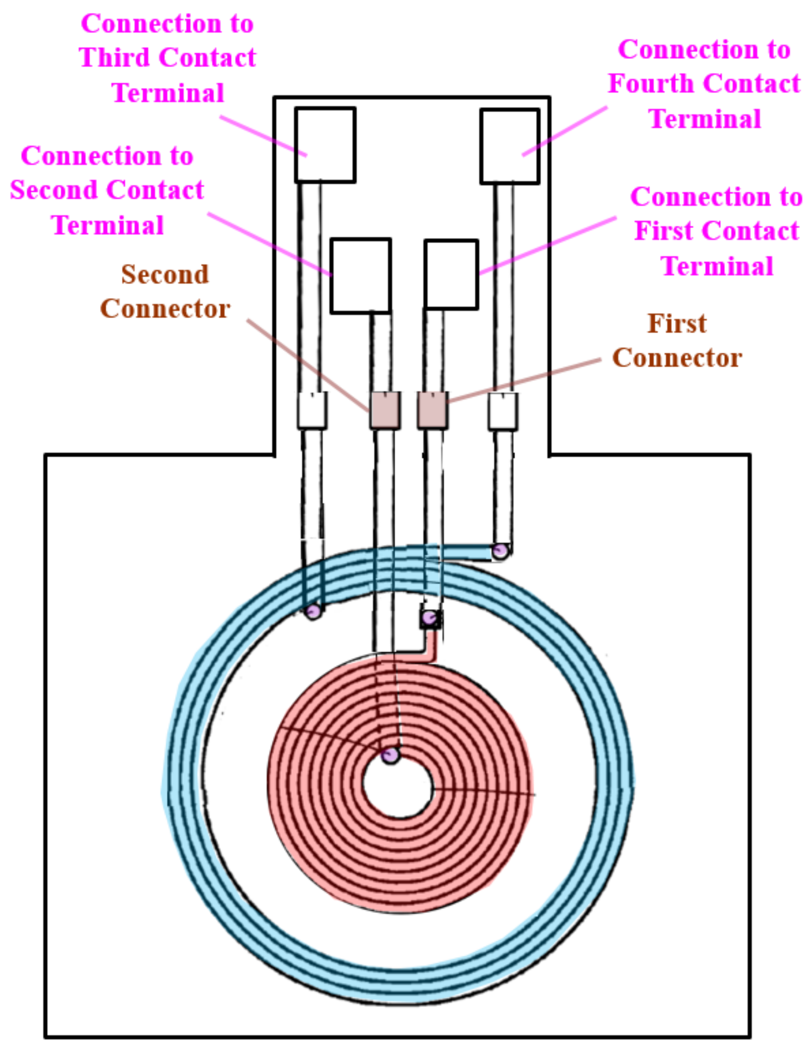
4. Claims 11-12

a) 11: The wireless power receiver of claim 1, wherein the first contact terminal is disposed closer to the first connector than is the third contact terminal.

b) 12: The wireless power receiver of claim 1, wherein the second contact terminal is disposed closer to the second connector than is the fourth contact terminal.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests these features. (Ex-1002, ¶¶166-167.) The '476 patent does not provide any explanation or rationale for having the first/second contact terminal disposed closer to the first/second connector than the third/fourth contact terminal, and a POSITA would have understood that the relative placement of those elements is nothing more than a simple design choice. (*Id*., ¶166.) As such, a POSITA would have found it obvious to position the first/second contact terminal closer to the first/second connector than the third/fourth contact terminal in the Kato-Park-Chong-Hahn-Ramadan combination. (*Id*.)

Moreover, while the demonstratives above do not show the first/second contact terminal disposed closer to the first/second connector than the third/fourth contact terminal, a POSITA would have been motivated to alter the positioning of the pairs of contact terminals such that the length of the conductors corresponding to the wireless charging are shorter than those for wireless communication. (*Id*., ¶167.) Such a POSITA would have had good reason to use shorter conductors for wireless charging in order to reduce the resistance through the conductive path for the power transferred by wireless charging, as a lower resistance will result in less power loss. (*Id*.) The much smaller currents associated with wireless communication relative to wireless charging are less impacted by longer conductive paths that have higher resistance, and therefore using the shorter paths for wireless charging instead of wireless communication provides an overall benefit. (*Id*.) As shown in the non-limiting demonstrative below, changing the positioning of the pairs of contact terminals to make the pair with the shorter connections correspond to wireless charging results in the first/second contact terminal being disposed closer to the first/second connector than the third/fourth contact terminal. (*Id*.)



(*Id.*)

5. Claim 13

a) The wireless power receiver of claim 1, wherein a width of the first coil pattern is wider than a width of the second coil pattern.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature to the extent it can be understood. (Ex-1002, ¶¶168-171.) It is unclear whether "width" refers to the "line width" of the conductor used to form the coil pattern or some other "width." For purposes of this proceeding, it is assumed that "width" refers to the "line width" discussed in the '476 patent. (Ex-1001, 6:43-45; Ex-1002, ¶168.)

The '476 patent does not provide any explanation or rationale as to why one of the coil patterns has a greater line width than the other, and a POSITA would have understood that selecting the line width for a coil pattern is nothing more than a design choice. (Ex-1002, ¶168; Ex-1001, 6:43-45.) For example, a POSITA would have known that trace-width is one of many variables that can be manipulated to configure the performance of the coil by, for example, adjusting the inductance, resistance, and quality factor (Q) of the coil. (Ex-1002, ¶169; Ex-1011, ¶[0046]; Ex-1013, 1276, 1281, 1279; Ex-1014, 871, 872, FIGs. 6-9.) Therefore, a POSITA would have found it obvious to make the width of the first coil pattern wider than that of the second coil pattern for applications in which the resulting coil characteristics provide the desired performance. (Ex-1002, ¶170.)

Indeed, a POSITA would have found it obvious to make the first coil pattern wider than the second coil pattern, because having a wider first coil pattern is one of only three possible alternatives, all of which would have worked and a POSITA would have been encouraged to try: first coil pattern is wider, second coil pattern is wider, or the two coil patterns have the same width. (*Id*.) A POSITA would have understood that a wider coil pattern reduces the resistance of the coil pattern and produces a higher quality (Q) factor, which is desirable in some applications. (*Id*.,

¶171; Ex-1014, 871, 872, FIG. 8.) In addition, making the trace width of the first coil pattern wider may result in the desired coil characteristics for a coil configuration in which other variables for the coil (e.g., trace spacing, coil dimensions, trace thickness) are constrained. (Ex-1002, ¶171.)

6. Claim 14

a) The wireless power receiver of claim 1, wherein a spacing of the first coil pattern is greater than a spacing of the second coil pattern.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests this feature. (Ex-1002, ¶¶172-175.) The '476 patent does not provide any explanation or rationale as to why one of the coil patterns has a greater spacing than the other, and a POSITA would have understood that selecting the spacing for a coil pattern is nothing more than a design choice. (*Id.*, ¶172; Ex-1001, 6:45-47.) For example, a POSITA would have known that the spacing of the traces for the coil is one of a number of variables that can be manipulated to configure the performance of the coil. (Ex-1014, 871, 872, FIGs. 6-9; Ex-1002, ¶173.) Therefore, a POSITA would have found it obvious to make the spacing of the first coil pattern greater than that of the second coil pattern when the resulting coil characteristics provide the desired performance. (Ex-1002, ¶174.)

Indeed, a POSITA would have found it obvious to make the spacing of the first coil pattern greater than the second coil pattern because having a first coil pattern with greater spacing is one of only three possible alternatives, all of which would have worked and a POSITA would have been encouraged to try: greater first coil spacing, greater second coil spacing, or the coils have same spacing. (*Id.*) Selecting the spacing of the first coil pattern to be greater can result in a desired coil configuration when other variables for the coils (e.g., trace width, coil dimensions, trace thickness) are constrained. (*Id.*, ¶175.)

7. Claim 15

a) The wireless power receiver of claim 1, wherein the second antenna is a Near Field Communication (NFC) antenna.

The Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests these features. (Ex-1002, ¶176.) For example, as discussed in Sections IX.A.1(d) and (f), both Park and Chong disclose that the wireless communication antenna is an NFC antenna. (Ex-1006, 1:27-36, 1:54-58, 4:16-24; Ex-1007, 1:28-35, 3:6-10, 3:25-33, 11:33-46, 12:43-44.)

B. Ground 2: Claims 13 and 14 Are Obvious over Kato, Park, Chong, Hahn, Ramadan, and Yu

1. Claim 13[10]

Kato, Park, Chong, Hahn, Ramadan, and Yu disclose or suggest claim 13. (Ex-1002, ¶177-185.) As discussed in Section IX.A.5, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests the features of claim 13, as selecting a

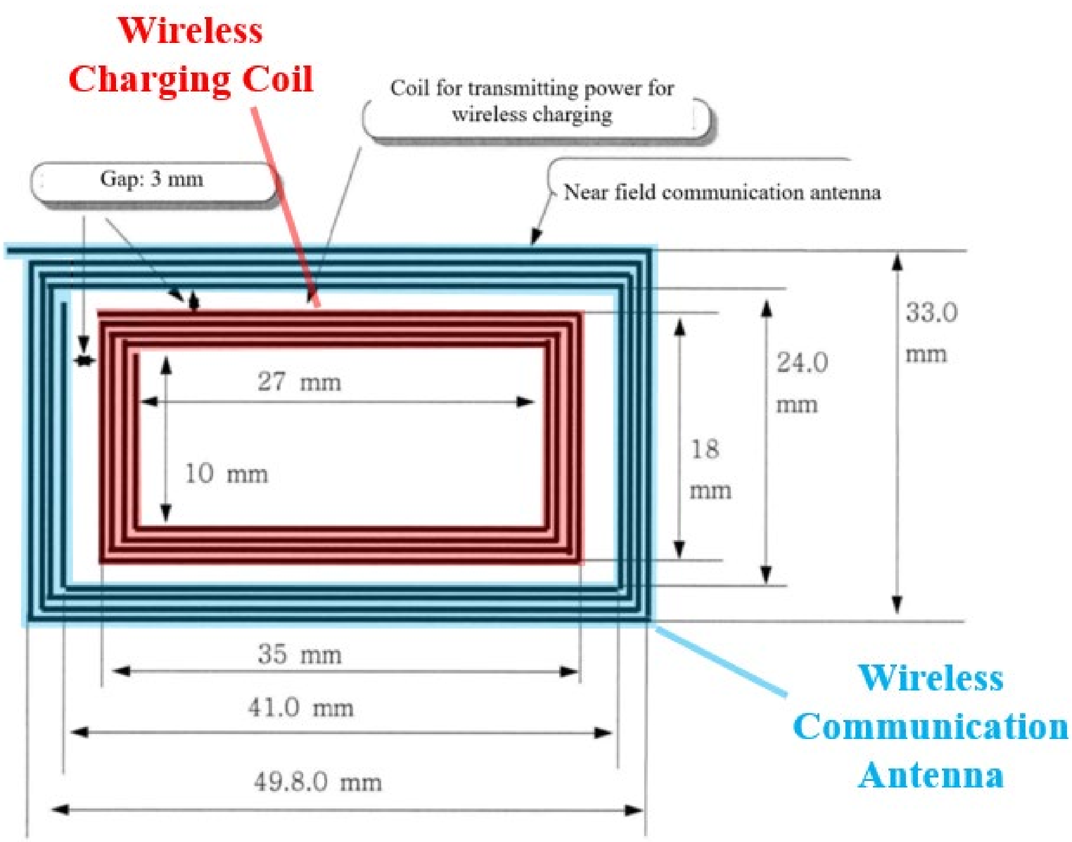
[10] The claim language recited in Section IX.A is not repeated.

width for the first coil pattern greater than that of the second coil pattern is nothing more than an obvious design choice. (Section IX.A.5.) However, none of these references expressly disclose the features of claim 13. Yu, however, discloses coil patterns with the claimed features, and, in view of Yu, a POSITA would have found it obvious to implement the coil patterns in the Kato-Park-Chong-Hahn-Ramadan combination such that width for the first coil pattern is greater than that of the second coil pattern. (Ex-1002, ¶178.)

Yu, like Kato, Park, Chong, Hahn, and Ramadan is directed to coils, where the coils are used for transmitting power and wireless communication. Indeed, Yu, like Park and Chong, discloses an NFC coil on a substrate with a wireless charging coil. (Ex-1010, Title, Abstract, ¶¶[0001], [0009]-[0010]; (Ex-1002, ¶179.) For example, as shown in annotated figure 6 below, Yu discloses an NFC antenna surrounding a coil used for wireless charging:

Fig. 6

An embodiment in which a small coil for wireless charging is mounted inside a near field communication (NFC) antenna



(Ex-1010, FIG. 6 (annotated); Ex-1002, ¶179.)

Yu further discloses different example coil combinations that have, among other varying parameters, varying "pattern line widths" (i.e., width of the traces) and a varying "gap between antenna lines" (i.e., spacing of the traces). (Ex-1010, ¶¶[0133]-[0148], [0169]-[0182].) Yu also discloses a conventional wireless charging coil that has a pattern line width of 1.0 mm, which is greater than the pattern line width of the disclosed conventional NFC antenna of 0.9 mm. (Ex-1010,

¶¶[0024]-[0037].) A POSITA reading Yu would have understood that the width of the traces in a coil pattern is a variable that can be selected to achieve the desired performance characteristics, where, in some applications it is desirable to have the line width of a particular coil wider than another coil in order to achieve the desired performance of both coils. (Ex-1002, ¶180; Section IX.A.7.)

A POSITA would have looked to Yu for guidance regarding implementing a mobile phone like that disclosed or suggested by the Kato-Park-Chong-Hahn-Ramadan discussed for claim 1 in Section IX.A, particularly because all of these references are in the same field. (Ex-1002, ¶181.) Having looked to Yu, such a POSITA would have had good reason to make the width of the wireless charging coil ("first coil pattern") wider than that of the wireless communication coil ("second coil pattern") in the Kato-Park-Chong-Hahn-Ramadan-Yu combination in order to achieve the desired performance for both the antennas. (*Id*.)

As Yu discloses, wireless charging coils that were wider than wireless communications coils were known in the art and therefore a known option for a POSITA implementing the antennas for a mobile phone according to the Kato-Park-Chong-Hahn-Ramadan-Yu combination. (Ex-1010, ¶¶[0024]-[0037]; Ex-1002, ¶182.) Similarly, as discussed in Section IX.A.5, a POSITA would have known that the width of the traces for the coil is one of a number of variables that can be manipulated to configure the performance of the coil by, for example, adjusting the inductance, resistance, and quality factor (Q) of the coil. (Ex-1002, ¶182.) Therefore, based on the disclosure of Yu and for the same reasons discussed in Section IX.A.5, a POSITA would have found it obvious to make the width of the first coil pattern wider than the width of the second coil pattern for applications in which the resulting coil characteristics provide the desired performance. (*Id.*, ¶¶182-185.)

Indeed, in the examples given by Yu, the wireless charging coil is always at least as wide as the NFC coil, and, in the conventional coil examples, the wireless charging coil is wider. (*Id.*, ¶183; Ex-1010, ¶¶[0024]-[0037], [0133]-[0148], [0169]-[0182].)

2. Claim 14

Kato, Park, Chong, Hahn, Ramadan, and Yu disclose or suggest claim 14. (Ex-1002, ¶¶186-190.) As discussed in Section IX.A.6, the Kato-Park-Chong-Hahn-Ramadan combination discloses or suggests the features of claim 14, as selecting a spacing for the first coil pattern greater than that of the second coil pattern is nothing more than an obvious design choice. However, none of Kato, Park, Chong, Hahn, or Ramadan expressly disclose the features of claim 14. Yu, however, discloses coil patterns with the claimed features, and, in view of Yu, a POSITA would have found it obvious to implement the coil patterns in the Kato-Park-Chong-Hahn-Ramadan combination such that spacing for the first coil pattern is greater than that of the second coil pattern. (Ex-1002, ¶186.)

As discussed in Section IX.B.1, a POSITA would have looked to Yu for guidance regarding implementing a mobile phone like that disclosed or suggested by the Kato-Park-Chong-Hahn-Ramadan discussed for claim 1 in Section IX.A.1. Having looked to Yu, such a POSITA would have had good reason to make the spacing of the wireless charging coil ("first coil pattern") wider than that of the wireless communication coil ("second coil pattern") in the Kato-Park-Chong-Hahn-Ramadan-Yu combination in order to achieve the desired performance for both the antennas. (Ex-1002, ¶187.)

Yu explicitly discloses an example where an NFC and wireless charging coil are placed on the same printed circuit board, where the spacing of the wireless charging coil is greater than the space of the NFC coil. For example, Yu discloses a wireless charging coil that has a gap between the antenna lines of 0.3 mm when the wireless communication coil has a gap of 0.1 mm ("a spacing of the first coil pattern is greater than a spacing of the second coil pattern"). (Ex-1010, ¶¶[0169]-[0182]; Ex-1002, ¶188.) Similarly, as discussed in Section IX.A.6, a POSITA would have known that the spacing of the traces for the coil is one of a number of variables that can be manipulated to configure the performance of the coil by, for example, adjusting the resistance and quality factor (Q) of the coil. Therefore, based on the disclosure of Yu and the reasons in Section IX.A.6, a POSITA would have found it obvious to make the spacing of the first coil pattern wider than the width of the second coil pattern for applications in which the resulting coil characteristics provide the desired performance. (Ex-1002, ¶¶188-190.)

X. THE BOARD SHOULD NOT USE ITS DISCRETION TO DENY INSTITUTION UNDER *FINTIV*

The six *Fintiv* factors do not justify denying institution under 35 U.S.C. § 314(a). *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential).

The **first factor** is neutral because Samsung has not yet moved to stay the district court proceeding. *See Hulu LLC v. SITO Mobile R&D IP, LLC et al.*, IPR2021-00298, Paper 11 at 10-11 (PTAB May 19, 2021).

The **second factor** is neutral. No trial date has been set, and Petitioner has moved to transfer. (Ex-1026.) Even if a trial date were set, statistics show that a vast majority of trial dates are delayed. (Ex-1027.) Moreover, the trial date is "non-dispositive" and simply means that "the decision whether to institute will likely implicate other factors," which, as explained, favor institution. *Fintiv*, IPR2020-00019, Paper 11 at 5, 9; *Samsung Elecs. Co., Ltd., v. Acorn Semi, LLC*, IPR2020-01183, Paper 17 at 38-39, 47 (Feb. 10, 2021) (instituting IPR despite trial occurring over ten months before anticipated FWD); *Consentino S.A.U. v. Cambria Co. LLC*, IPR2021-00010, Paper 11 at 10-11, 16 (May 18, 2021) (same by seven months);

Roku, Inc., v. Flexiworld Tech., Inc., IPR2021-00715, Paper 18 at 11, 15 (Oct. 26, 2021) (same by six months).

The **third factor** weighs against denial. First, the district court case is in the early stages. Fact discovery is ongoing. The parties have not taken any depositions. The *Markman* hearing will not occur until after Samsung's motion to transfer in district court is decided. (Ex-1028.) Expert discovery has not yet begun. And there have been no substantive orders. Additionally, Petitioner filed its petition before the statutory deadline to do so, and less than eight months after being served with preliminary infringement contentions on September 7, 2021, which identified the asserted claims. (Ex-1029.) In its complaint against Samsung, PO asserted six patents containing over 100 claims. Samsung has since filed petitions against five of those patents, and has worked diligently to file the instant Petition against the remaining '476 patent, which includes an independent claim spanning well over a column of text. Therefore, Petitioner filed the instant Petition in a reasonably timely fashion. *Apple Inc. v. Seven Networks, LLC*, IPR2020-00180, Paper 12 at 12 (Aug. 14, 2020).

The **fourth factor** weighs strongly against denial. There is no overlap with arguments made in the district court, because Petitioner has stipulated to counsel for PO that, if the IPR is instituted, Petitioner will cease pursing in district court all obviousness grounds that include the primary reference in the instant Petition. (Ex-

1030.) Thus, this factor "weighs strongly in favor of not exercising discretion to deny institution." *Samsung Electronics Co., Ltd. v. Power2B Inc.*, IPR2021-01239, Paper 12 at 12-13 (January 20, 2022).

Regarding the **fifth factor**, the Board should give no weight to the fact that Petitioner and PO are the same parties as in district court. *See Weatherford U.S., L.P., v. Enventure Global Tech., Inc.*, Paper 16 at 11-13 (April 14, 2021).

"Other circumstances" under the **sixth factor** further weigh against discretionary denial. The merits of the Petition are especially strong, because, as discussed above, all of the challenged claims are disclosed by the prior art cited herein. *See Align Technology, Inc. v. 3Shape A/S,* IPR2020-01087, Paper 15 at 42-43 (PTAB Jan 20, 2021). Sections VII.A and IX.

Taken together holistically, the *Fintiv* factors strongly weigh against denial.

XI. CONCLUSION

For the reasons given above, Petitioner requests institution of IPR for claims 1-15 of the '476 patent based on the grounds specified in this petition.

Respectfully submitted,

Dated: April 29, 2022 By: /Naveen Modi/
Naveen Modi (Reg. No. 46,224)
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(b)(1), the undersigned certifies that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 9,553,476 contains, as measured by the word-processing system used to prepare this paper, 13,322 words. This word count excludes the Table of Contents, Table of Authorities, List of Exhibits, Certificate of Compliance, and Certificate of Service.

Respectfully submitted,

Dated: April 29, 2022

By: /Naveen Modi/
Naveen Modi (Reg. No. 46,224)
Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify that on April 29, 2022, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 9,553,476 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

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Washington, DC 20006-1152

A courtesy copy was also sent via electronic mail to Patent Owner's litigation counsel listed below:

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