UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.
Petitioner

v.

NUCURRENT, INC.
Patent Owner

Patent No. 10,063,100

PETITION FOR POST-GRANT REVIEW

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I. INTRODUCTION

Samsung Electronics Co., Ltd. ("Petitioner") requests post-grant review ("PGR") of claims 1-25 of U.S. Patent No. 10,063,100 ("the '100 patent") (Ex. 1001), which, according to PTO records, is assigned to NuCurrent, Inc. ("Patent Owner" or "PO"). For the reasons below and accompanying evidence, including the declaration of Dr. R. Jacob Baker (Ex. 1002), the challenged claims should be found unpatentable and canceled.

Based on Patent Owner's broadening of claim 1 just prior to allowance, none of the claims of the '100 patent have written description support. The '100 patent discloses a "single structure multimode antenna" in which two coils are positioned concentrically with an inner coil placed within an inner perimeter formed by the inner most turn of the outer coil. Every embodiment disclosed includes such an arrangement with an inner coil positioned within an outer coil. Indeed, during prosecution, Patent Owner repeatedly argued that the invention included "a multi-mode antenna having a single structure which comprises a first outer coil electrically connected in series to a second interior coil positioned within an inner perimeter formed by the first outer coil." Such an arrangement of the coils and the alleged advantages provided were used repeatedly to argue over prior art relied upon by the examiner.

However, as the end of prosecution was approaching Patent Owner amended

claim 1 in a manner that undercuts nearly all of the arguments that it had made previously in prosecution. Specifically, Patent Owner amended claim 1 such that the previous recitation of "the second coil posited on the substrate surface and within an inner perimeter formed by an innermost turn of the first coil" was changed to "the second coil deposited on the substrate surface and one of within an inner perimeter formed by an innermost turn of the first coil and adjacent the first coil." This amendment was made in an apparent attempt to cover certain accused products that did not have two coils arranged as an inner and an outer coil because the claim, as originally drafted and argued to the Examiner, was limited to an arrangement in which one coil is positioned within an inner perimeter of the other coil. (*See infra* Section IX.A.1(a).) That is, Patent Owner amended the claim such that the claim also covers a coil arrangement in which the two coils are arranged side-by-side. (*Id.*)

But such an expansive claim scope is not supported by the disclosure of the '100 patent because each and every embodiment shows one coil positioned within an inner perimeter of the other coil. Therefore, there is no written description support for the *full* scope of independent claim 1 because a POSITA would not have recognized that the inventor possessed an invention in which two coils can be positioned side-by-side. As demonstrated below, such a broad reading of the claim feature is not only unsupported by the disclosure of the '100 patent, but is also incompatible with other claim features.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

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: The specification of the '100 patent is identical to the specification of U.S. Patent No. 9,941,729 ("the '729 patent"), also assigned to Patent Owner, even though the two patents are not in the same family. Patent Owner has asserted the '729 patent against Petitioner and the other real party-in-interest in *NuCurrent, Inc. v. Samsung Elecs. Co., Ltd. et al.*, No. 1:19-cv-00798-DLC (S.D.N.Y.). Patent Owner has also asserted U.S. Patent Nos. 8,680,960 ("the '960 patent"), 9,300,046 ("the '046 patent"), 8,698,591 ("the '591 patent"), and 8,710,948 ("the '948 patent") in this action. On March 22, 2019, Petitioner filed petitions challenging certain claims of the '960, '046, '591, and '948 patents. Patent Owner is concurrently filing another petition challenging the '100 patent.

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) Paul Anderson (Reg. No. 39,896), and (3) Chetan R. Bansal (Limited Recognition No. L0667). Service information is Paul Hastings LLP, 875 15th St. N.W., Washington, D.C., 20005, Tel.: 202.551.1700, Fax: 202.551.1705, email: PH-Samsung-NuCurrent-IPR@paulhastings.com. Petitioner consents to electronic service.

III. PAYMENT OF FEES UNDER 37 C.F.R. § 42.15(a)

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. TIME FOR FILING UNDER 37 C.F.R. § 42.202

The '100 patent issued on August 28, 2018, and this Petition is being timely filed no later than the date that is nine months after the date of the grant of the '100 patent.

V. GROUNDS FOR STANDING UNDER 37 C.F.R. § 42.204(a)

The '100 patent stems from U.S. Application No. 14/821,157, filed on August 7, 2015 and therefore, the post-grant review provisions of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA") apply to it. *See* AIA §§ 3(n)(1) and 6(f)(2)(A). Petitioner certifies that the '100 patent is available for PGR and Petitioner is not barred or estopped from requesting PGR on the grounds identified herein.

VI. PRECISE RELIEF REQUESTED AND GROUNDS RAISED

A. Claims for Which Review is Requested

Petitioner respectfully requests review of claims 1-25 ("challenged claims") of the '100 patent, and cancellation of these claims as unpatentable.

B. Statutory Grounds of Challenge

The challenged claims should be canceled as unpatentable on the following grounds:

Ground 1: Claims 1-25 are unpatentable under AIA 35 U.S.C. § 112(a) as failing to satisfy the written description requirement.

Ground 2: Claims 1-25 are unpatentable under AIA 35 U.S.C. § 112(b) as failing to particularly point out and distinctly claim the subject matter which the named inventor regards as the invention.

VII. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art ("POSITA") at the time of the alleged invention of the '100 patent, which for purposes of this proceeding is the early-to-mid 2010s (including August 7, 2015) would have had a bachelor's degree in electrical engineering or a similar field, and at least two to three years of experience in integrated circuit design including power electronics. (Ex. 1002, ¶20.) More education can supplement practical experience and vice versa. (*Id.*).[1]

VIII. BACKGROUND

A. The '100 Patent

The '100 patent is entitled "Electrical System Incorporating a Single Structure Multimode Antenna for Wireless Power Transmission Using Magnetic Field Coupling." The '100 patent generally relates to an electrical system that includes

[1] Petitioner submits the declaration of R. Jacob Baker, Ph.D., P.E. (Ex. 1002), an expert in the field of the '100 patent. (Ex. 1002 at ¶¶5-14; Ex. 1003.)

"an antenna having a single coil structure in which a multitude inductor coils are electrically connected in series" "having a compact design that enables adjustment or tuning of the inductance within the antenna which results in the ability to tune multiple antenna frequencies." (Ex. 1001, 10:15-21; Ex. 1002, ¶¶26-30.)

The '100 patent acknowledges that antennas were known to be "a key building block in the construction of wireless power and/or data transmission systems." (Ex. 1001, 3:1-2.) At the time of the alleged invention of the '100 patent, devices (such as cellphones) included multi-mode antennas that could support more than one wireless charging standards (e.g., the Qi and the PMA standards). (*Id.*, 2:33-53, 3:5-10.) According to the '100 patent, however, these "multi mode" antennas had "a relatively large footprint" and were "not ideally suited for incorporation within small electronic devices . . . ." (*Id.*, 3:26-42.) An example of such a multi-mode antenna is set forth in figure 1 and according to the '100 patent, these prior art antennas had discrete antenna structures that operate independently with separate terminal connections. (*Id.*) For example, the prior art antenna of figure 1 has two coils, where each coil has separate terminals that allow for individual electrical connections to each of the two coils.

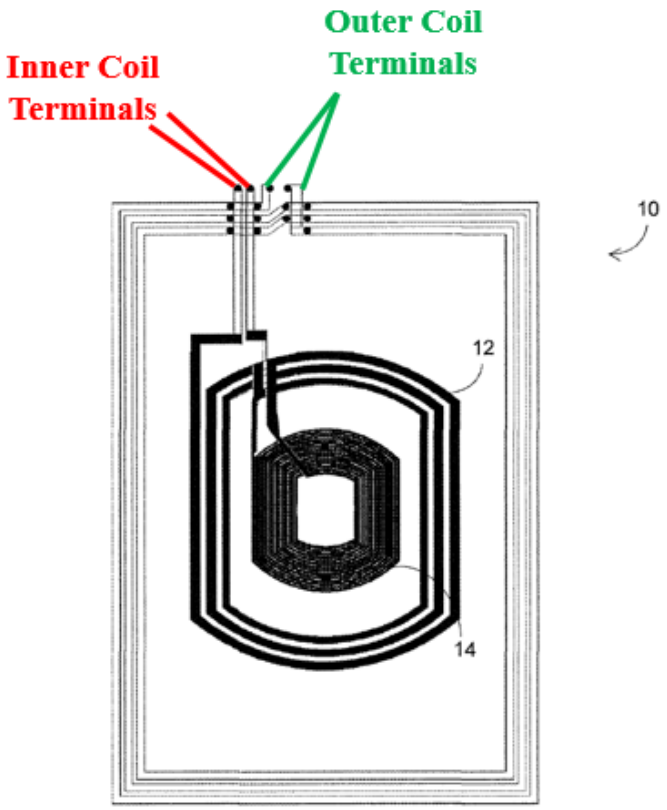


FIG. 1
PRIOR ART

(Ex. 1001, FIG. 1 (annotated); Ex. 1002, ¶27.)

The '100 patent purportedly improves upon the prior art dual mode antenna by disclosing a single structure multi-mode antenna in which an outer coil is connected to an inner coil and one of the three terminals is shared by both coils. (Ex. 1001, 3:26-32, 12:60-65.) Figure 3 of the '100 patent shows an example of such an antenna that "comprises a first outer coil 42 that is electrically connected in series to a second interior coil 44." (*Id.*, 12:60-65.)

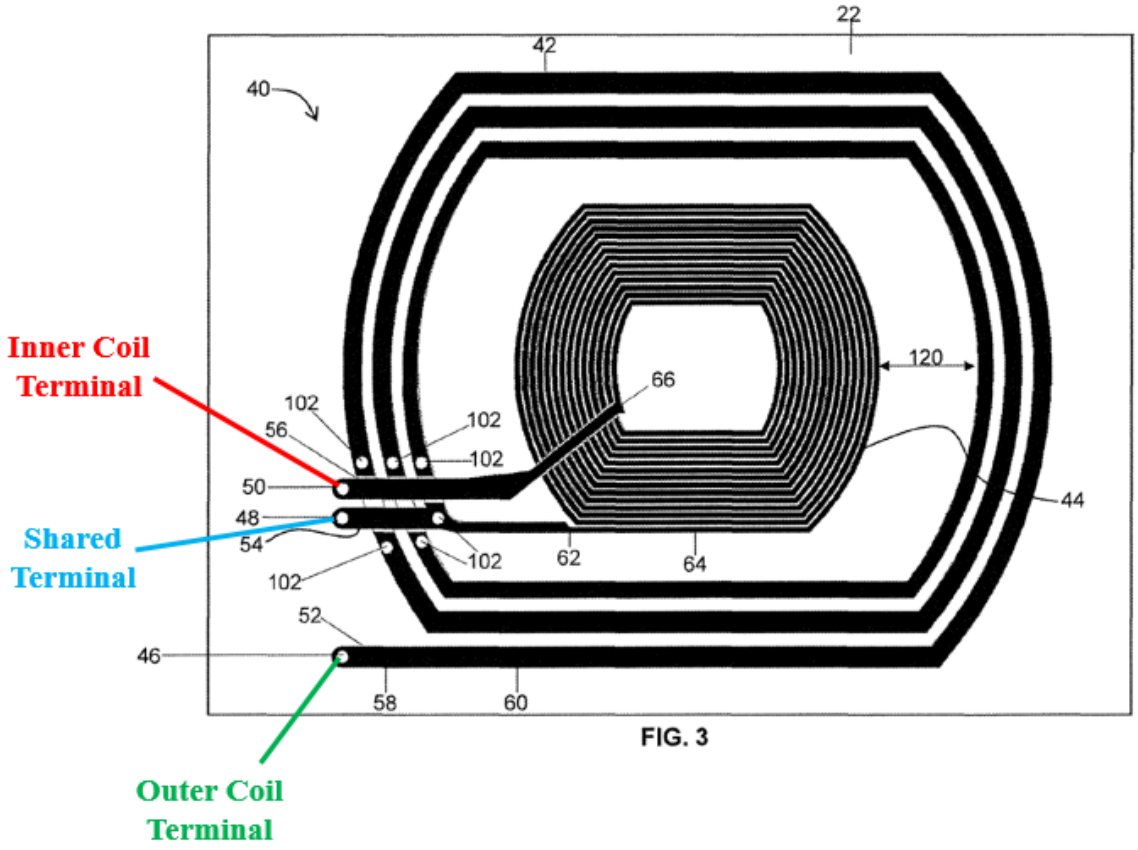


FIG. 3

(Ex. 1001, FIG. 3 (annotated); Ex. 1002, ¶28.)

As described by the '100 patent:

> The electrical connection between the two coils 42, 44 combines the inductance contributions of each of the coils 42, 44 in a reduced size and surface area. The addition of a third terminal further enables the antenna 40 to be tuned to a specific frequency or multiple frequency bands. Thus, by providing multiple connection points within and between the outer and interior inductor coils 42, 44 the inductance, and thus, the receiving or transmitting frequency bands can be instantaneously adjusted without the need to add or remove inductors. The three terminal

> antenna design enables the first and second coils 42, 44 to be strategically connected at different locations along either or both the first and second coil 42, 44. As a result, the inductance of the antenna 40 can be modified, i.e., increased or decreased, without increasing the size of the footprint of the antenna. The antenna 40 of the present disclosure efficiently utilizes space and substrate surface area to increase and/or decrease inductance therewithin and, thus, custom tune the operating frequency or frequency band of the antenna 40.

(*Id.*, 12:65-13:17.)

The '100 patent states that "by electrically connecting the first terminal 46 to the second terminal 48, a first inductance may be produced that is generally suitable for operation at a first operating frequency" and "[e]lectrically connecting the first terminal 46 to the third terminal 50 produces a second inductance that is generally suitable for operation at a second operating frequency." (*Id.*, 13:35-41.) As further disclosed by the '100 patent, "[i]n general, the first outer inductor coil 24 contributes to the reception and/or transmission of higher frequencies in the MHz range whereas, the second interior inductor coil 26 contributes to the reception and/or transmission of frequencies in the kHz range." (*Id.*, 11:13-17.)

B. Prosecution History of the '100 Patent

As demonstrated below, during prosecution of U.S. Application No. 14/821,157 ("the '157 application"), which issued as the '100 patent, Patent Owner

repeatedly emphasized that the disclosed invention included a single-structure multi-mode antenna having a first outer coil electrically connected in series to *a second interior coil positioned within an inner perimeter formed by the first outer coil.* (Ex. 1004, 225, 227-228, 373, 399, 478, 482, 483.) As also detailed below, Patent Owner added numerous limitations to independent claim 1 during prosecution that are focused on the specific positioning and interconnection of the two coils in the antenna disclosed in the '100 patent. Patent Owner repeatedly relied on the specific coil positioning and interconnection in arguing over the prior art references raised by the Examiner. However, as prosecution was drawing to a close, Patent Owner added broadening language to claim 1 that divorces claim 1 from the specific antenna structure disclosed in the '100 patent that Patent Owner had repeatedly argued distinguished claim 1 over the prior art.

Claim 1, as originally filed with the '157 application, included an antenna having a first coil and a second coil, where the second coil is "positioned within an inner perimeter formed by the first coil." (Ex. 1004, 1349.) Such a two-coil antenna structure, where the second coil is within an inner perimeter of the first coil, is shown in each of figures 2, 3, 3B, 3C, and 3E. (*Id.*, 1356, 1358, 1360-61, 1363.)

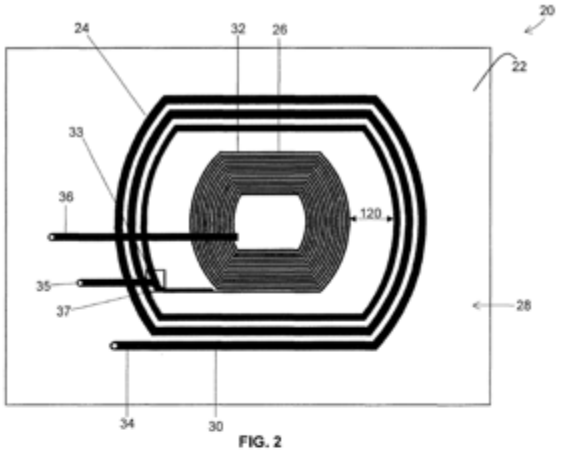


FIG. 2

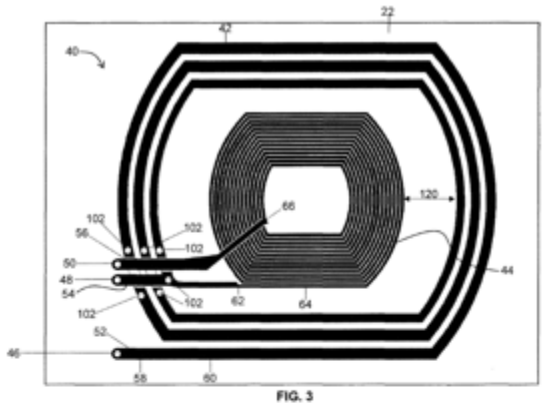


FIG. 3

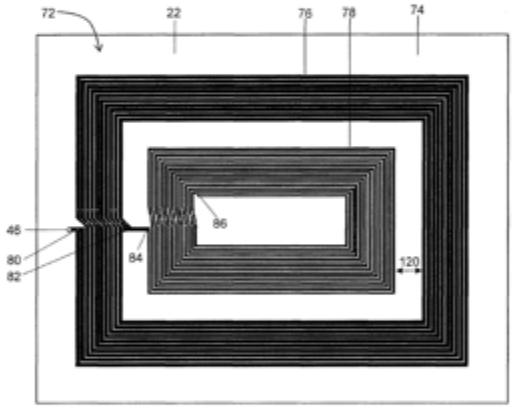


FIG. 3B

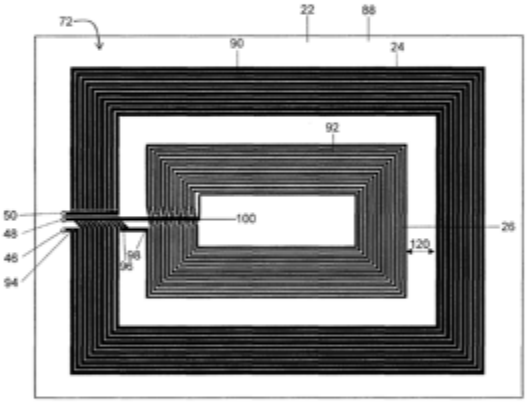


FIG. 3C

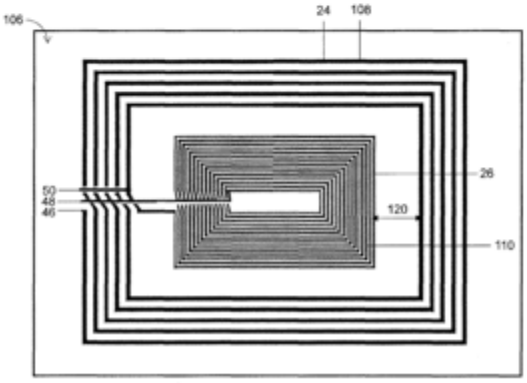


FIG. 3E

(Ex. 1004, 1356, 1358, 1360-1361, 1363 (FIGs. 2, 3, 3B, 3C, 3E).)

The Examiner rejected the originally filed claims as obvious over Kurz in view of Baarman. (*Id.*, 514-516.) In response, Patent Owner added further

limitations to claim 1 that Patent Owner argued distinguished over Kurz and Baarman. For example, Patent Owner amended claim 1 to recite:

> the second coil positioned on the substrate surface and within an inner perimeter formed by an innermost turn of the first coil, wherein a gap separates an outermost turn of the second coil from the innermost turn of the first coil, and wherein the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween

(*Id.*, 487.)

In the remarks accompanying the amendment, Patent Owner acknowledged that in Kurz "the inside end of the first coil is electrically connected to the outside end of the second coil" and that "the inside end 234 of the first coil 230 is electrically connected to the outside end 256 of the second coil 250 by a first jumper 274." (*Id.*, 477.)

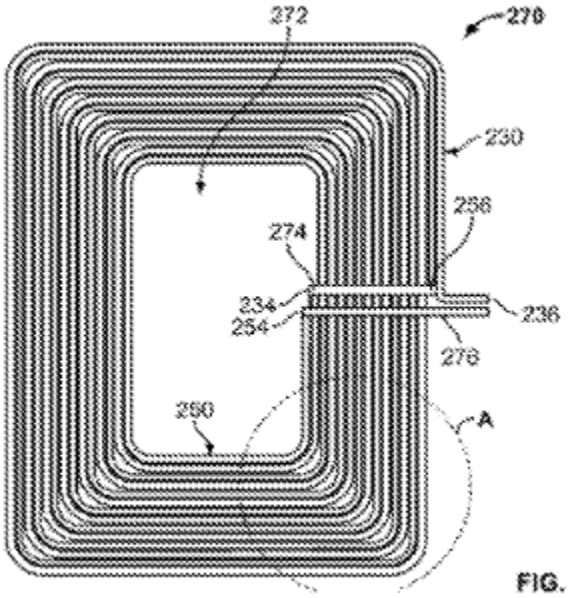


FIG. 5

FIG. 5 of Kurz that illustrates a charging coil

(*Id.*, 477.)

However, Patent Owner argued that the amendments made to claim 1 distinguished the claimed invention from Kurz:

> In contrast to the charging coil of Kurz, the presently claimed invention provides a multi-mode antenna having a single structure which comprises a first conductor coil electrically connected in series to a second conductor coil positioned within an inner perimeter formed by the first outer coil (lines 1-4, paragraph [0082]) . . . .
>
> Such a construction, namely, a single antenna structure where the first coil is physically joined to the second coil (FIG. 2), provides for an efficient antenna having a compact design . . . . Furthermore, the structure

> of the presently claimed multi-mode antenna is designed with a high quality factor to achieve efficient reception and transfer of electrical power and/or an electrical data signal in a compact structure having a reduced footprint.
>
> . . . .
>
> As illustrated in FIG. 2, shown below, the single structure multi-mode antenna of the presently claimed invention, unlike Kurz, *is constructed having a second coil that is positioned within an inner perimeter formed by an inner most turn of the first coil, where a gap separates an outermost turn of the second coil from an inner most turn of the first coil, and wherein the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween*. The Applicant respectfully submits that the charging coil of Kurz comprises a significantly different construction than the first and second coils that comprise the antenna of the present application.

(*Id.*, 478 (emphasis added).)

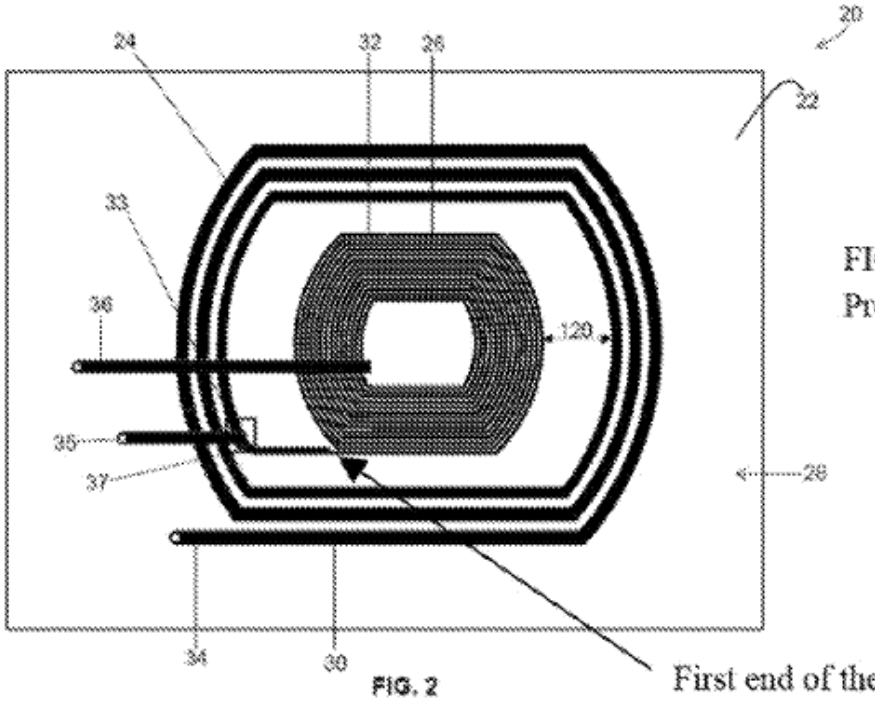


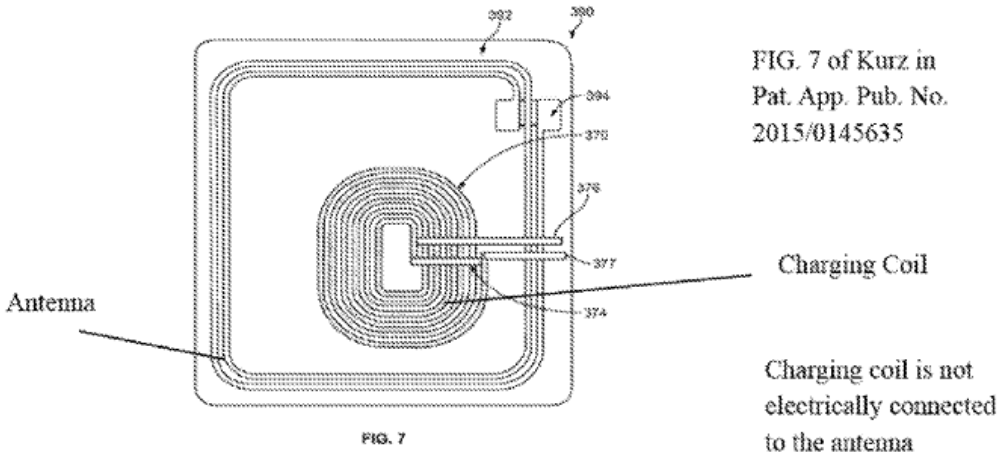
FIG. 2

FIG. 2 of the Present application

First end of the second coil joins the second end of the first coil forming a continuous junction therebetween

(*Id.*, 479.)

Patent Owner also argued that the claimed invention was distinguishable over figure 7 of Kurz because the two coils shown in figure 7 are not connected together as shown in figure 2 of the '157 application. (*Id.*, 479 ("In contrast to the presently claimed invention the charging coil 370, is not electrically connected to the outer NFC antenna 394.")



(*Id.*, 479.)

Patent Owner argued that the first and second coils in the claimed invention are connected in series such that "[i]n addition to reducing the size and foot-print of the antenna, the currently claimed invention, unlike Kurz, provides an antenna having improved electrical performance." (*Id.*, 480.) Patent Owner further argued that "[s]pecifically, as disclosed in paragraph [0082] and illustrated in FIGS. 2, 3, 3B, 3C, and 3E, the antenna of the present application is constructed such that the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween." (*Id.*, 481.)

Patent Owner also noted that claim 1 was specifically amended to require the coils to be arranged such that the second coil is positioned inside the innermost turn of the first coil, where there is a gap between the coils. (*Id.*, 482.) Evidently attempting to distinguish over the "jumper" that connects the inside end 234 of the first coil 230 to the outside end 256 of the second coil 250, Patent Owner emphasized

that the outer end of the interior coil "meets and joins" the inner end of the outer coil "forming a continuous junction" between the coils:

> Thus, the Applicant has amended independent claim 1 to recite, "a second conductive wire forming a second coil having N2 number of turns with spaced apart first and second, second coil ends configured to generate a second inductance, the second coil positioned on the substrate surface and within an inner perimeter formed by an innermost turn of the first coil, wherein *a gap separates an outermost turn of the second coil from the innermost turn of the first coil, and wherein the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween.*"

(*Id*. (emphasis added).)

Patent Owner emphasized the gap between the two coils, arguing that "the optimal dimension of the gap between the first and second coils was discovered through considerable experimentation and design effort." (*Id*., 481, citing '157 application ¶¶[0102],[0103].) The paragraphs cited by Patent Owner indicate that while increasing the gap reduces the "proximity effect" between the coils, a larger gap increases the footprint of the antenna, which is undesirable. (*Id*.) Patent Owner contended that determining the optimal width of the gap between the coils was non-trivial. (*Id*., ("extensive experimentation was performed to create a balance between

the strength of the proximity effect and its effect on the quality factor in constructing an antenna of minimal size with a small footprint ….").)

With respect to Baarman, which was the other reference cited by the Examiner, Patent Owner could not dispute that Baarman disclosed first and second coils with a gap between the coils.

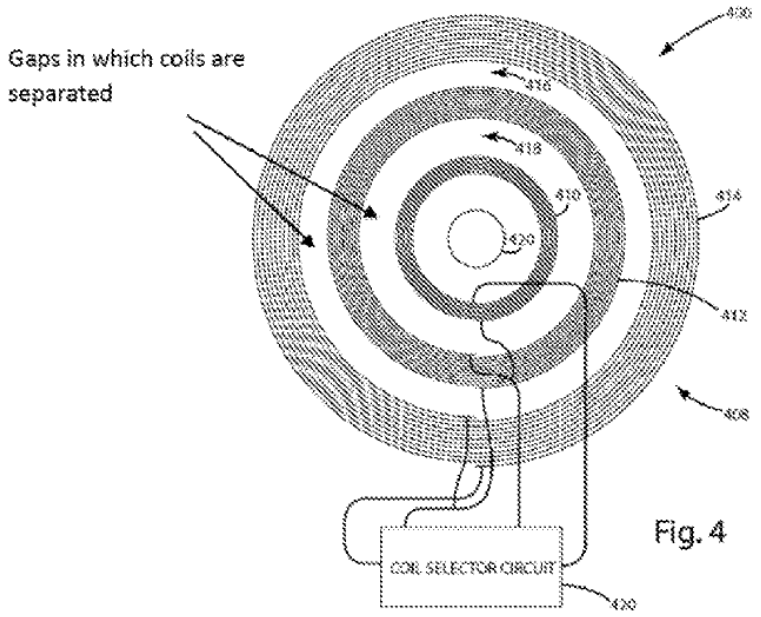


Fig. 4

FIG. 4 of Baarman in 2013/0076154

(*Id.*, 482 (citing Baarman FIG. 4).)

Instead, Patent Owner argued that Baarman discloses multiple separate coils that do not "meet and join" such that Baarman does not disclose a "continuous junction" between the coils:

> In contrast to Baarman, the Applicant discloses and currently claims an antenna that comprises a second coil positioned within an inner perimeter formed by the first

> coil on a substrate surface, wherein the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween. The Applicant respectfully submits that the coil assembly of Baarman does not have the same or similar structure as the presently claimed invention. In contrast to the present invention, none of the coils that comprise the Baarman primary coil assembly 408 are joined together, but rather comprises separate coils. Furthermore as stated by Baarman, "some of the coils share an electrical connection to the coil selector circuit" (line 7-8, paragraph [0049]). (*Emphasis added*.) The Applicant respectfully submits that a shared electrical connection to the coil selector circuit, as disclosed by Baarman, is a distinctly different construction than a continuous junction formed by the meeting and joining of the first end of the second coil and the second end of the first coil, as disclosed and currently claimed by Applicant.

(Ex. 1004, 483 (emphasis in original).)

Patent Owner included the following annotated figure to demonstrate a "continuous junction" where the two coils are joined.

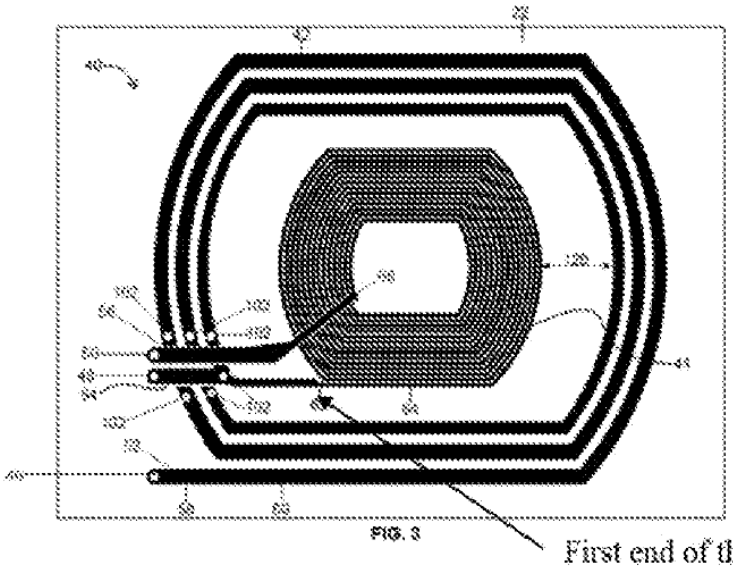


FIG. 3 of
Present Application

First end of the second coil joins the second end of the first coil forming a continuous junction therebetween

(Ex. 1004, 483.)

Thus, Patent Owner argued that not only is the inner coil within the inner perimeter of the outer coil, but the outer coil and the inner coil are required to "meet and join" directly, and form a "continuous junction." Patent Owner contended that such a connection where the coils "meet and join" to form a "continuous junction" was different from the connection shown in figure 4 of Baarman highlighted in green below. Even though Baarman illustrates the second coil positioned within the inner perimeter of the first coil and further illustrates a connection between the innermost turn of the first coil with the outmost turn of the second coil, Patent Owner argued that such a connection does not disclose the first end of the second coil "meets and

joins" the second end of the first coil "forming a continuous junction therebetween." (*Id.*, 483-484)

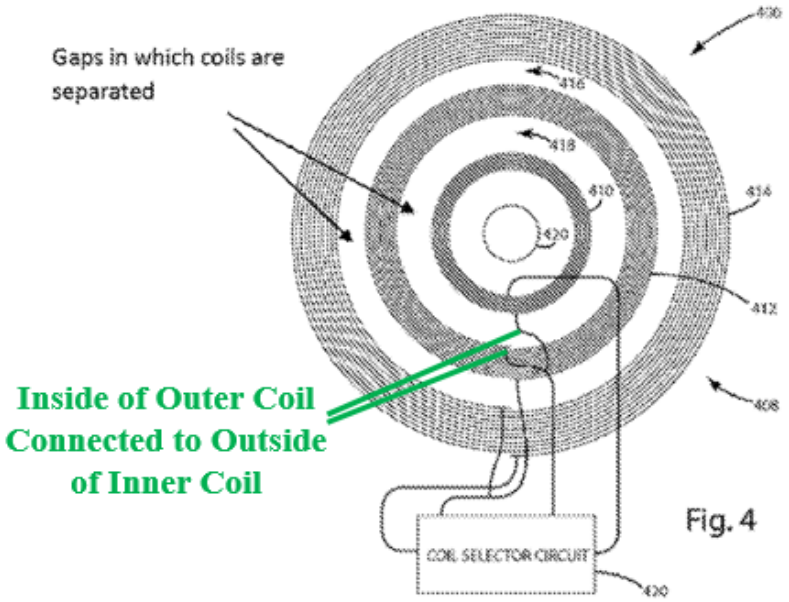


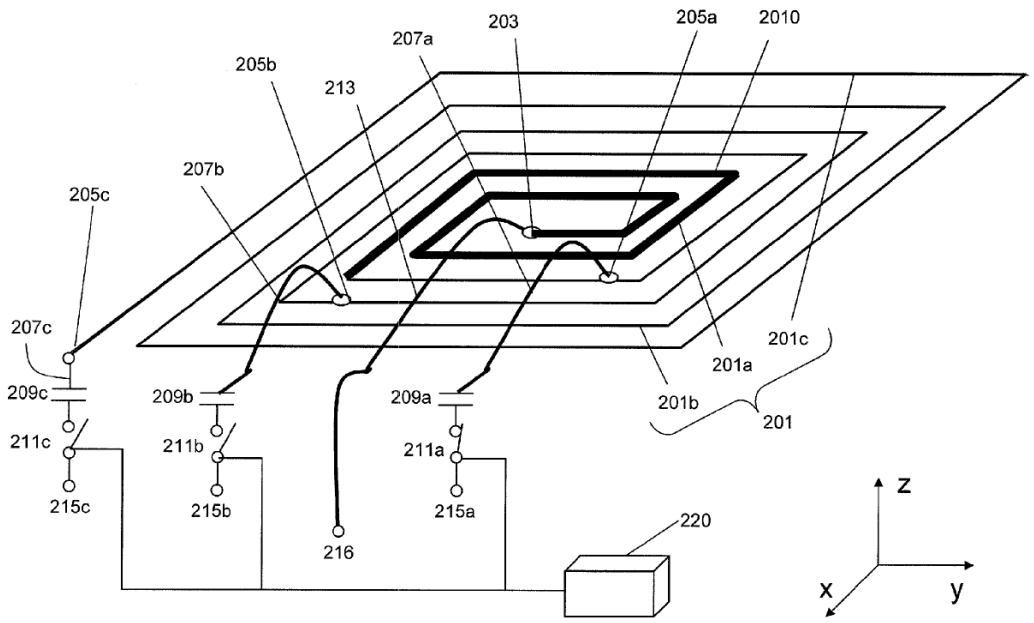
FIG. 4 of
Baarman in 2013/0076154

(Ex. 1004, 482-483, (citing Baarman FIG. 4) (annotated).)

Therefore, in order to argue claim 1 was different from Baarman and Kurz, Patent Owner amended claim 1 to require an antenna where "the second coil [is] positioned . . . within an inner perimeter formed by an innermost turn of the coil, where a gap separates an outermost turn of the second coil from the innermost turn of the first coil, and wherein the first end of the second coil meets and joins the second end of the first coil forming a continuous junction therebetween." (*Id.*, 487 (emphasis added).)

Subsequently, the Examiner issued a final office action that rejected the pending claims using Kanno as the primary reference. (*Id.*, 439-441.) The Examiner demonstrated that Kanno disclosed all of the features related to the second coil, including the second coil being within the inner perimeter of the innermost turn of the first coil, a gap between the coils, and the first end of the second coil meeting an joining the second end of the first coil to form a continuous junction. (*Id.*)

FIG.3



(Ex. 1007, FIG. 3.)

In response to the rejection, Patent Owner filed an After Final Consideration Pilot request ("AFCP request") that included an amendment adding features to claim 1 that specify a first gap between turns in the first coil, a second gap between turns in the second coil, and a third gap that corresponds to the gap separating the

outermost turn of the second coil from the innermost turn of the first coil. (*Id.*, 392-393.) The proposed amendment also specified that the third gap is greater than the first and second gaps. (*Id.*, 393.)

In the AFCP request, Patent Owner also argued that in the claimed antenna has a "compact design" where the first and second coils are "physically joined" and that the third gap supported a "high quality factor":

> In contrast to Kanno, the presently claimed invention provides a multi-mode antenna having a single structure which comprises a first conductor coil electrically connected in series to a second interior coil positioned within an inner perimeter formed by the first outer coil …. In addition, a gap 120 separates an outermost turn of the second coil from an inner most turn of the first coil.
>
> Such a construction, namely, a single antenna structure where the *first coil is physically joined to the second coil* (FIG. 2), provides for an efficient antenna having a *compact design* that enables adjustment or tuning of the inductance within the antenna which results in the ability to tune multiple antenna frequencies (lines 1-7, paragraph [0057]). Furthermore, the structure of the presently claimed multi-mode antenna having *the gap between the first and second coils provides an antenna designed to exhibit a high quality factor* to achieve

> efficient reception and transfer of electrical power and/or an electrical data signal in a *compact structure* having a reduced footprint.
>
> As illustrated in FIG. 2 of the present application, shown below, the single structure multi-mode antenna of the presently claimed invention, unlike Kanno, is constructed having a second coil with a first gap between adjacent turns of the second coil positioned within an inner perimeter formed by an inner most turn of the first coil having a second gap between adjacent turns of the first coil, wherein, a third gap 120 greater than the first and second gaps.

(*Id.,* 373-374 (emphasis added).)

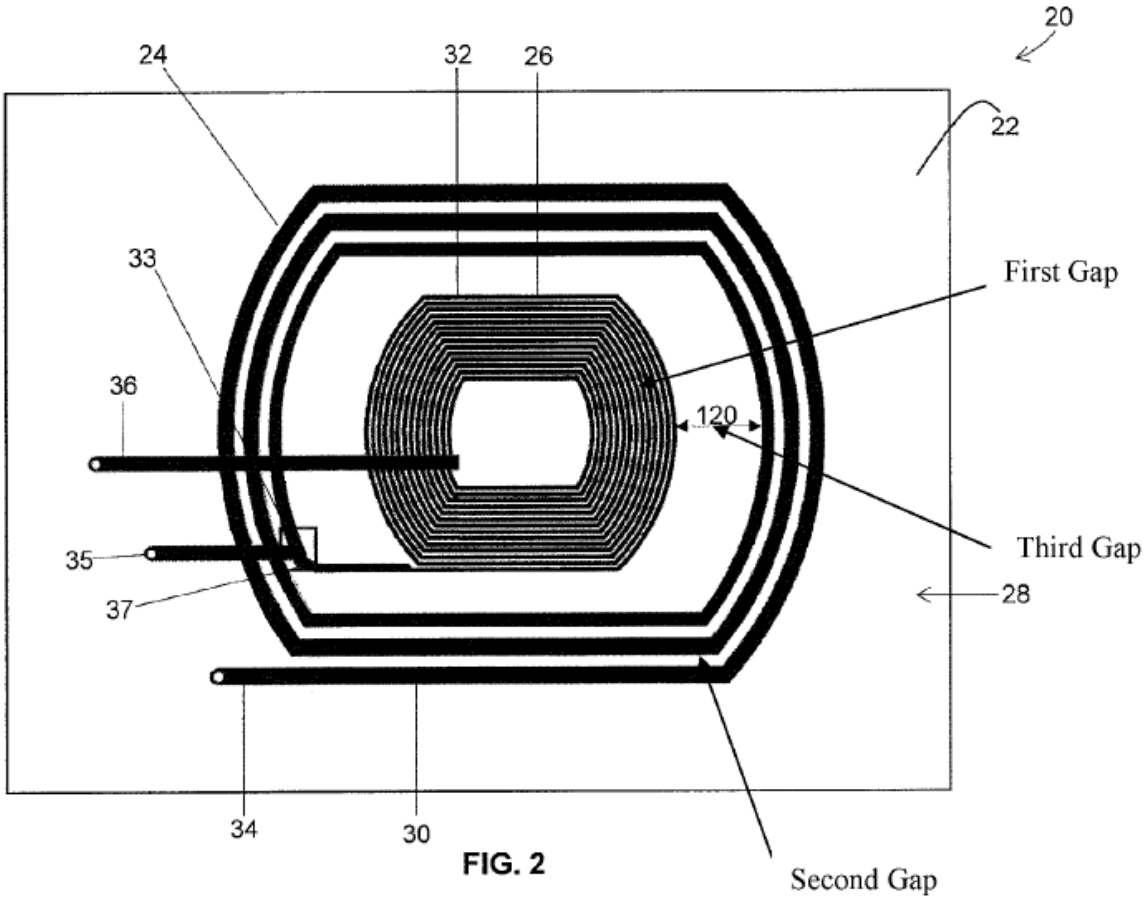


FIG. 2

FIG. 2 of the present application

(*Id.*, 400.)

Patent Owner argued that Kanno did not disclose a third gap between the first and second coils, where the third gap is greater than the first and second gaps. Patent Owner stressed the importance of the third gap in the claimed antenna structure. (*Id.*, 401 ("Furthermore, the third gap 120 positioned between the inmost [sic] turn of the first coil and the outermost turn of the second coil is specifically designed to enable the structure of the multi-mode antenna of the present invention to exhibit a high quality factor and achieve an efficient reception and transfer of electrical power

and/or an electrical data signal in a compact structure having a reduced footprint.") Patent Owner noted how the specification described the third gap 120 as reducing the proximity effect between the coils while also noting that a larger footprint results from a larger the third gap. (*Id.*)

The Examiner was unpersuaded by the amendments and arguments presented in the AFCP request and issued an advisory action indicating the proposed amendments would not be entered. (*Id.*, 342.) Applicant submitted a request for continued examination (RCE) with an accompanying amendment that proposed more limited amendments to claim 1 than those that accompanied the AFCP request. (*Id.*, 365.) Most notably, the amendment presented with the RCE did not specify that the third gap is greater than the first and second gaps as had been recited in the AFCP request amendment. (*Id.*, 365.) Patent Owner's remarks that accompanied the RCE amendment mistakenly argued that the amended independent claim required the third gap to be greater than the first and second gaps. (*See, e.g.*, Ex. 1004, 374.)

In response to the amendment filed with the RCE, the Examiner again rejected claim 1, noting that Patent Owner's argument that Kanno did not disclose a third gap that is greater than the first and second gaps was unsupported as no such feature was included in the amended claim. (*Id.*, 319.) Indeed, the Examiner noted that even if such a feature were included in the claim, it would be obvious. (*Id.*)

Patent Owner then amended claim 1 again to recite that the third gap is greater than the first and second gaps (*id.*, 218) and repeated its arguments that that the specific structure of the claimed invention was not disclosed by Kanno:

> In contrast to Kanno, as shown in annotated FIG. 2 below, the presently claimed invention provides an electrical system with a multi-mode antenna having a *single structure which comprises a first outer coil electrically connected in series to a second interior coil positioned within an inner perimeter formed by the first outer coil* (lines 1-4, paragraph [0083]). … In addition, a *gap 120 separates an outermost turn of the second coil from an inner most turn of the first coil*.

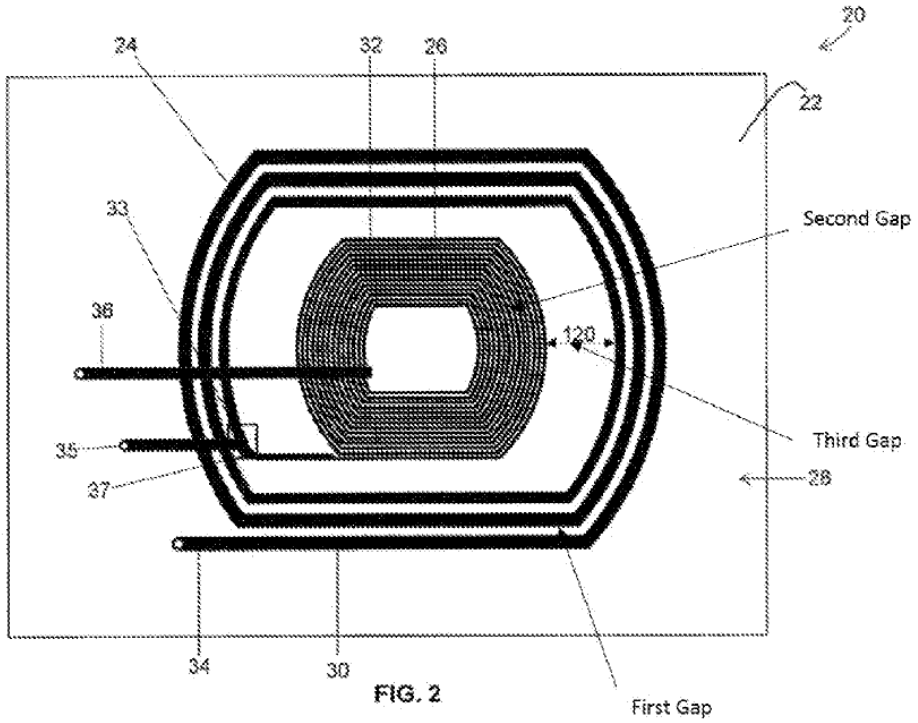


FIG. 2

FIG. 2 of the present application (annotated)

> Such a construction, namely, a single multi mode antenna structure where *the first coil is physically joined to the second coil* (FIG. 2), provides for an efficient antenna having a compact design …. In addition, the structure of the presently claimed multi-mode antenna having the gap between the first and second coils provides an antenna designed to exhibit a high quality factor to achieve efficient reception and transfer of electrical power and/or an electrical data signal in a compact structure having a reduced footprint.

(Ex. 1004, 225-226 (emphasis added); *see also id.*, 227-228 ("In contrast to Kanno, the single structure multi-mode antenna of the presently claimed electrical system

is constructed having a second coil . . . positioned within an inner perimeter formed by an inner most turn of the first coil . . . .").)

A subsequent Examiner interview was held where the Examiner proposed additional limitations that the Examiner believed would overcome the prior art. (Ex. 1004, 174.) Specifically, as described in the interview summary:

> Examiner proposed amendments to claim 1 to overcome the current grounds of rejection. Applicant's representative counter proposed amendments which were found to be allowable. The amendments to the claims are detailed in the attached Notice of Allowance.

(*Id.*)

In the amendments to claim 1, Patent Owner added language, which, on its face, expands the claim to cover a scenario where the antenna includes a second coil that is merely "adjacent the first coil" and not necessarily "within an inner perimeter formed by an innermost turn of the first coil":

> the second coil positioned on the substrate surface and <u>one of</u> within an inner perimeter formed by an innermost turn of the first coil <u>and adjacent the first coil</u>"

(Ex. 1004, 168-169, underlining in original.)

The Examiner's Amendment also included the following limiting features:

d) wherein the first resonant frequency of the first coil differs from the second resonant frequency of the second coil by at least 100kHz; and

e) wherein at least one of the first coil and the second coil operates at about 100 kHz to about 500 kHz.

(*Id.*, 169.) In the "examiner's statement of reasons for allowance," the Examiner indicated that Kanno did not teach newly-added limiting features d) and e). (*Id.*, 171-172.)[2]

IX. CLAIM CONSTRUCTION

In a post grant review, claims are construed in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.200(b). In particular, claim terms are generally given their "ordinary and customary meaning,"

[2] It is apparent that the *broadening* language regarding the second coil being adjacent the first coil was presented by Applicant and not the Examiner because an Examiner would not propose broadening claim language in exchange for allowing an application. Notably, additional amendments made to pending claims 25, 26, and 27 in the Examiner's Amendment (*id.*, 170) also lack written description support. (*See infra* Sections X.A(6)-(8).)

that is, "the meaning that the term would have to a POSITA in question at the time of the invention, i.e., as the effective filing date of the patent application." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (*en banc*). In the case that "the specification . . . reveal[s] a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess . . . the inventor's lexicography governs." *Id.* at 1316 (internal citation omitted).

The Board only construes the claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport Systems*, Inc., IPR2015-00633, Paper 11 at 16 (August 14, 2015). Petitioner submits that for purposes of this proceeding, no term requires construction. (Ex. 1002, ¶31.)

X. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: Claims 1-25 Fail to Satisfy the Written Description Requirement

A patent specification must "contain a written description of the invention." 35 U.S.C. § 112(a). The written description requirement serves "to ensure that the patent applicant was in full possession of the claimed subject matter on the application filing date." *Turbocare Div. of Demag Delaval Turbomachinery Corp. v. General Electric Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001). "This requirement protects the quid pro quo between inventors and the public, whereby the public receives 'meaningful disclosure in exchange for being excluded from practicing

the invention for a limited period of time.'" *ICU Medical, Inc. v. Alaris Medical Systems, Inc.*, 558 F.3d 1368, 1377 (Fed. Cir. 2009) (internal citation omitted).

To comply with the written description requirement, the specification or earlier-filed application "must describe the invention sufficiently to convey to a person of skill in the art that the patentee had possession of the claimed invention at the time of the application, i.e., that the patentee invented what is claimed." *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed Cir. 2005); *see also Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997); *Allergan, Inc. v. Sandoz Inc*., 796 F.3d 1293, 1308-09 (Fed. Cir. 2015). While the specification "description need not recite the claimed invention in haec verba" it "must do more than merely disclose that which would render the claimed invention obvious." *ICU Medical, Inc*., 558 F.3d at 1377 (internal citations omitted); *Lockwood*, 107 F.3d at 1572.

As discussed below, claims 1-25 include features not disclosed in the specification such that a POSITA would not have understood that the named inventor had possession of the claimed invention at the time the '157 application was filed on August 7, 2015. (Ex. 1002, ¶¶32-66.) Numerous limitations recited in claim 1, which is the only independent claim, are not supported, and therefore, claim 1, and each of claims 2-25 that depend from claim 1, lacks written description

support. In addition, certain dependent claims include additional features that are invalid for lack of written description support.

1. Claims 1-25

A POSITA would not have understood that the named inventor of the '100 patent possessed an invention with all of the features recited in claim 1 at the time of the alleged invention. (Ex. 1002, ¶32.)

a) "the second coil positioned on the substrate surface and one of within an inner perimeter formed by an innermost turn of the first coil and adjacent the first coil"

Claim 1 recites, *inter alia*, "the second coil positioned on the substrate surface and one of within an inner perimeter formed by an innermost turn of the first coil and adjacent the first coil," where the underlined language was added just prior to allowance as discussed above in section VIII.B. (Ex. 1001, 32:55-58; *see supra* section VIII.B.) Prior to the amendment, the claim was limited to a coil configuration in which one coil was inside the inner perimeter of the other; specifically, the second coil was inside the inner perimeter of the first coil. But patentee's amendment broadened the scope of the claim such that it encompasses a coil arrangement where the two coils can be side-by-side, i.e., one coil need not be within the inner perimeter of the other coil. (*See* Ex. 1009, 10-11 ("Claim 1 then recites two alternatives for each coil's position with respect to the other: one coil is

positioned inside of the other, or the two are positioned adjacent to one another.")[3].) It is clear that this last-minute amendment to the claims was made to cover products (such as Samsung's) in which the two coils are placed side-by-side (not one inside the other).

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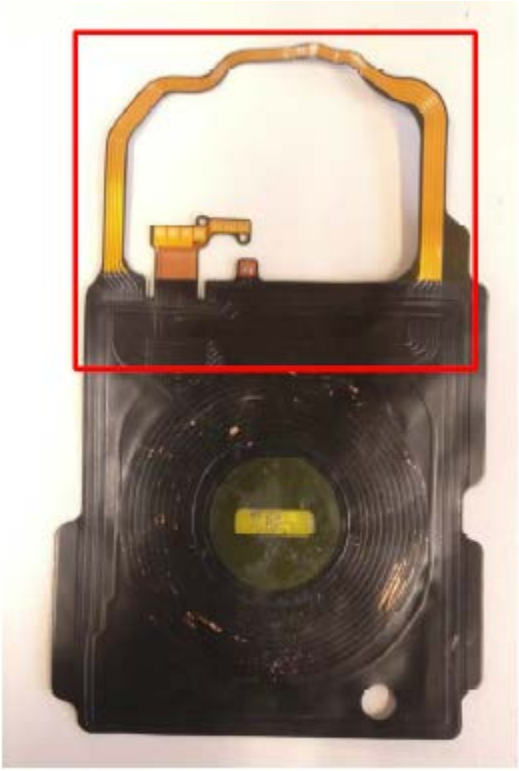
[3] These allegations are from the NuCurrent's Opening Claim Construction Brief for the '729 patent, not the instant '100 patent. But the '729 patent has claim language very similar to the limitation at issue. (*See* Ex. 1005, 32:56-59 ("wherein the second coil is disposed on the substrate surface positioned one of within an inner perimeter formed by the innermost turn of the first coil and adjacent the first coil").) Just like in the '100 patent file history, patentee added the broadening language to claim 1 of the '729 after repeatedly emphasizing to the Examiner that its invention was to a coil arrangement in which the second coil is positioned within an inner perimeter of the first coil. (*See* Ex. 1006, 367-368 (emphasizing that the invention is a coil configuration in which the second coil is inside the inner perimeter of the first coil), 297-299 (same), 273-275 (same), 142-43 (same), 73-85 (applicant proposed amendments to broaden the claim scope when the Examiner was willing to allow the claims if applicant added the last two frequency limitations).)



Flex Printed Circuit Extracted from Samsung Galaxy S8
(Magnetic Secure Transmission ("MST") coil identified)

(Ex. 1008 at 53-55 (alleging that the Samsung products include a "first coil").[4])

[4] These allegations are from the complaint alleging infringement of the '729 patent. But as discussed above in footnote 3, the '729 patent has claim language very similar to the limitation at issue.

Flex Printed Circuit Extracted from Samsung Galaxy S8 (wireless power coil identified)

(*Id.* (alleging that the Samsung products include a "second coil").)

But the broadened claim language renders claim 1 unpatentable for lack of written description support because there is no support for the broadened claim 1 in the original application (including the original claims). *Synthes USA, LLC v. Spinal Kinetics, Inc.*, 734 F.3d 1332, 1341-42 (Fed. Cir. 2013). Specifically, as confirmed by NuCurrent's arguments in the '729 patent claim construction brief (*see* Ex 1009, 10-11), the issued claim encompasses within its scope a coil arrangement in which two coils can be positioned side-by-side (like in the Samsung products), an arrangement that has no support in the '157 application that led to the '100 patent. As such, claim 1 is unpatentable under 35 U.S.C. § 112(a) because the full scope of

claim 1 is not supported by the specification. *See ICU Medical, Inc. v. Alaris Medical Sys., Inc.*, 558 F.3d 1368 (Fed. Cir. 2009) (finding a claim invalid for lack of written description support when the full claim scope covered valves with and without spikes but the specification only disclosed valves with spikes). As discussed below, a POSITA would not have recognized that the inventor possessed an invention in which two coils can be placed side-by-side (i.e., one coil is not within the inner perimeter of the other coil). (Ex. 1002, ¶33.)

i. The '157 Application Only Discloses an Antenna in Which One Coil Is Placed Within the Inner Perimeter of Another Coil

Each and every embodiment in the '157 application (the application from which the '100 patent issued) that includes a two-coil antenna is limited to a configuration in which one coil is positioned within the inner perimeter formed by the innermost turn of the other coil. (Ex. 1002, ¶34.) Every figure that illustrates a two-coil antenna shows an inner coil that lies within the innermost turn of an outer coil. (*See* Ex. 1004, 1356, 1358, 1360-1361, 1363 (FIGs. 2, 3, 3B, 3C, 3E).)

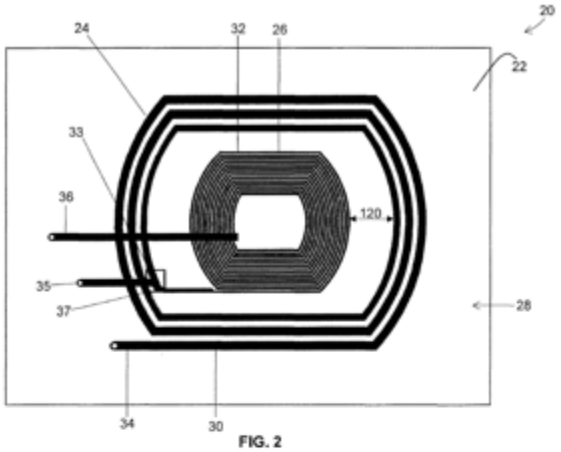


FIG. 2

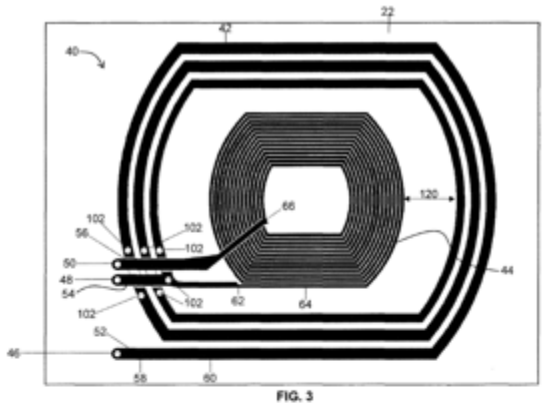


FIG. 3

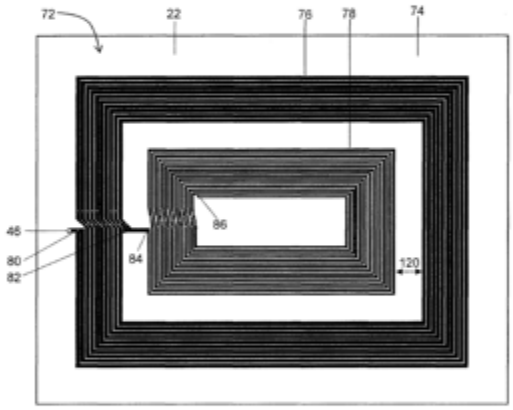


FIG. 3B

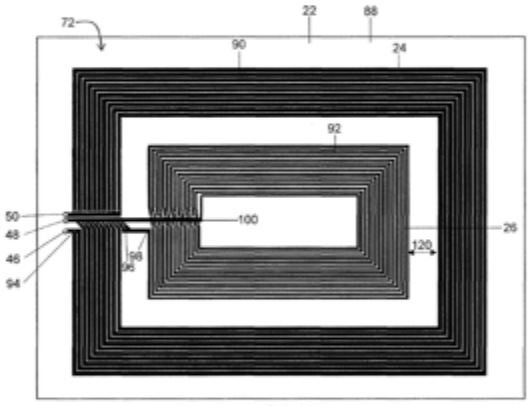


FIG. 3C

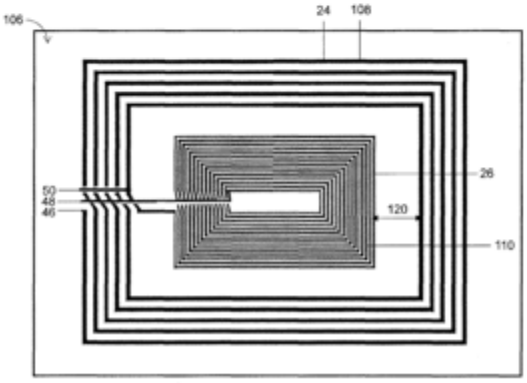


FIG. 3E

(Ex. 1004, 1356, 1358, 1360-1361, 1363 (FIGs. 2, 3, 3B, 3C, 3E).[5]) As such, there is no disclosure in the '157 application of two coils that are arranged side-by-side.

Nor does the use of the term "adjacent" in the specification show that the inventor possessed a coil arrangement in which the coils are arranged side-by-side.

(Ex. 1002, ¶35; Ex. 1004, 1322-1323 (¶[0097]) ("adjacent first and second inductor coils").) A POSITA would have recognized that in the context of the positioning of the two coils the word "adjacent" is only used in describing the gap 120 between the outermost turn of the *inner* coil and the innermost turn of the "adjacent" *outer* coil. (Ex. 1002, ¶35; Ex. 1004, 1322-1323.) In other words, each time "adjacent" is used to describe the coils, it is in the specific context of an inner coil that lies within the innermost turn of an outer coil. (Ex. 1002, ¶¶35-38.)

For example, with respect to figures 3B and 3C, the specification states that "the quality factor of the single structure multiple mode antenna of the present disclosure can be significantly affected by the length and position of a gap 120 of space disposed between adjacent first and second inductor coils such as the first and second inductor coils 76, 78 and/or the third and fourth inductor coils 90, 92." (Ex. 1004, 1322-1323 (¶[0097]).)

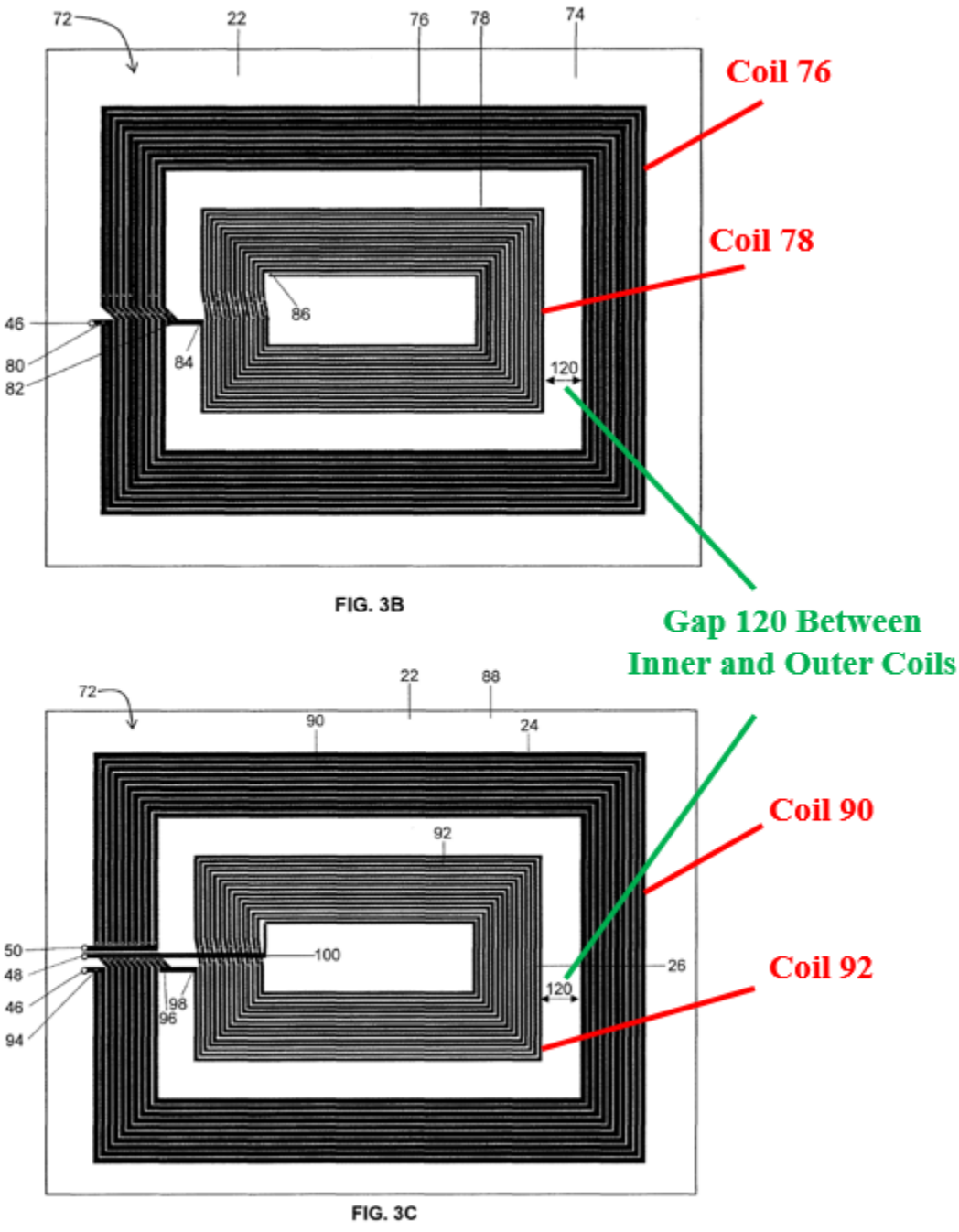


FIG. 3B

FIG. 3C

(Ex. 1004, 1360-61 (FIGs. 3B, 3C) (annotated); Ex. 1002, ¶36.)

Similarly, with respect to the antenna structure shown in figures 2, 3B, and 3C, the '157 application states:

> Specifically, the single structure multiple mode antenna of the present disclosure is designed with a gap of space 120 posited between adjacently positioned inductor coils such as the first and second inductor coils 24, 26. This gap 120 preferably reduces the proximity effect between *adjacently positioned inner and outer coils*, such as 76, 78 (FIG. 3B) and 90, 92 (FIG. 3C).

(*Id.*, 1324 (¶[0101]) (emphasis added).)

Therefore, as seen from the description above, the term "adjacent" refers to a coil arrangement in which one coil is within the inner perimeter of the other coil. (Ex. 1002, ¶38.)

The above understanding—that the inventor only possessed a coil arrangement in which one coil is positioned within the inner perimeter of the other coil—is confirmed by Patent Owner's statements during prosecution where Patent Owner repeatedly noted that the invention disclosed in the '157 application includes an antenna with a very specific structure that hinges on a second coil being positioned *inside* of a first coil. (*See supra* section VIII.A; Ex. 1004, 225, 227-228, 373, 399, 478, 482, 483.) Indeed, in characterizing the claimed invention during prosecution, Patent Owner repeatedly relied upon the following passage, which clearly states that one coil is placed within the inner perimeter of the other coil. (Ex. 1004, 225, 373, 399, 478.)

> As shown in FIG. 3B, the first inductor coil 76 is electrically connected in series to the second interior inductor coil 78 that is posited within an inner perimeter formed by the first inductor coil.

(*Id.*, 1314 (¶[0082]).)

For instance, Patent Owner represented to the Patent Office that its invention was an antenna in which one coil is positioned within an inner perimeter of the other coil:

> As illustrated in FIG. 2 of the present application, shown below, the single structure multi-mode antenna of the presently claimed invention, unlike Kanno, is constructed having a second coil with a first gap between adjacent turns of the second coil positioned within an inner perimeter formed by an inner most turn of the first coil having a second gap between adjacent turns of the first coil, wherein, a third gap 120 greater than the first and second gaps.

(*Id.,* 373-374 (emphasis added).)

Patent Owner's representations and the disclosure in the '157 application should leave no doubt that the inventor did not have possession of the full claim scope of claim 1. Several on-point Federal Circuit cases further confirm this conclusion.

For example, in *ICU Medical,* the specification only described medical valves that operate with a spike. *ICU Medical,* 558 F. 3d at 1378. The application thus included claims where the valves had spikes. *Id.* at 1372-73. But during prosecution, patentee added spike-optional claims, i.e., claims that covered *both alternatives* (valves with and without spikes). *Id.* at 1377-78. The Federal Circuit concluded that the spike-optional claims lacked written description support as there was no disclosure in the specification of a spikeless valve. *Id*. at 1379. That is, the Federal Circuit found that the full claim scope was not supported by the specification. The same reasoning should apply here because Patent Owner amended claim 1 to cover two coil arrangements—one where the coils must be placed one inside the other, and one where the coils need not be placed one inside the other (i.e., they can be placed side-by-side). But like in *ICU Medical*, only one of those coil arrangements is disclosed in the original specification.

In *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336 (Fed. Cir. 2005), the patent dealt with compressing digital images using a mathematical technique known as discrete wavelet transforms ("DWTs"). *Id*. at 1337-39. The written description disclosed a single method for creating a "seamless" DWT without edge distortions by maintaining updated sums of DWT coefficients. *Id*. at 1339, 1344. The disputed claim was directed to creating a seamless DWT, but it lacked the "maintain[] updated sums" concept used by the only technique disclosed

in the specification. *Id*. at 1343. The Federal Circuit concluded that such a generic claim was too broad compared to the written description and affirmed summary judgment of invalidity. *Id.* at 1344. Similarly, nothing in the '157 application supports a "generic" claim that covers two coil arrangements—one where the coils are placed one inside the other, and one where the coils are not placed one inside the other (i.e., they are placed side-by-side).

Indeed, patentee's amendment has reduced the limitation at issue to a claim reciting two options: one of A and B, where A is a coil arrangement in which one coil is placed inside the other and B is a coil arrangement in which no coils are placed inside the other. (Ex. 1009, 10.) For such a claim to be supported, both options (A and B) necessarily must be disclosed but here, only option A is disclosed in the specification. Hence, the full breadth of the claim is not disclosed and therefore, the claim lacks written description support.

ii. The "Third Gap" of Claim 1 Shows that the Inventor Was Not In Possession of a Coil Arrangement in Which the Two Coils Are Placed Side-by-Side

Claim 1 recites, *inter alia*, "a third gap separating an outermost turn of the second coil from the innermost turn of the first coil, wherein the third gap is greater than the first and second gaps." (Ex. 1001, 32:60-62.) Such a gap only makes sense if two coils are arranged such that one coil is within the inner perimeter of the other.

(Ex. 1002, ¶39; *see infra* Section IX.B.1.) In fact, the '157 application explains this "third gap" in the context of an inner and outer coil (not side-by-side coils) and discloses how the "third gap" controls the proximity effect and thus, the quality factor of the antenna design. (Ex. 1004, 1324-1326 (¶¶[0101]-[0103]).) Indeed, Patent Owner explained during prosecution that the purpose of the third gap is to specify the separation between two coils and the value of the third gap has "a significant effect on the quality factor of the antenna design." (*Id.*, 401.)

But when two coils are placed side-by-side, the third gap does not define the distance between two coils because in such an arrangement the distance between the "an outermost turn of the second coil from the innermost turn of the first coil" (the definition of the "third gap") necessarily includes a portion of one of the coils itself. (Ex. 1002, ¶40-41.) Therefore, two coils could be extremely close to each other but the "third gap" could be extremely large if one of the coils is extremely wide. (*Id.*)

Accordingly, for this additional reason, the inventor did not possess the full scope of claim 1.

b) "wherein the first resonant frequency of the first coil differs from the second resonant frequency of the second coil by at least 100 kHz"

Claim 1 recites in relevant part "wherein the first resonant frequency of the first coil differs from the second resonant frequency of the second coil by at least 100 kHz." (Ex. 1001, 33:11-13.) The '157 application lacks written description

support for the claimed "at least 100 kHz" resonant frequency difference between the first and second coils. As explained below, there is no mention of the "at least 100 kHz" resonant frequency difference in the '157 application. (Ex. 1002, ¶42.)

The '157 application in its entirety provides limited disclosures related to the coils' resonant frequencies. (Ex. 1002, ¶¶43-44.) For example, the '157 application states "[t]he single structure antenna of the present application is capable of self resonant frequencies that range from about 1 kHz to about 500 GHz." (Ex. 1004, 1292 (¶[0019]).) But it does not distinguish the first coil from the second and instead describes the resonant frequency of the entire structure. (*See id.*) In a later example, while describing the operation of a particular selection circuit, the '157 application lists example conditions where the first coil has a resonant frequency at least ten times greater than the resonant frequency of the second coil (*see* excerpt below), but never explains what those two resonant frequencies are. (*Id.* at 1320-21 (¶¶[0093]-[0094]).)

Example conditions:

A. $f_1 \geq 10f_2$,
B. $\Delta f_2 \leq 0.5f_2$
C. $\Delta f_1 \leq f_1/50$

(*Id.*, 1320.)

Limited description of the two coils' resonant frequencies appears in a section

discussing ferrite permeability, and in that example, the resonant frequency of one coil is 6.78 MHz and the resonant frequency of the other is 100 kHz to about 500 kHz—a difference of not less than about 6.28 MHz—far greater than the 100 kHz differential claimed. (*Id.* at 1332-1333 (¶[0117]).)

Nor do the original claims specify the claimed "at least 100 kHz" range. (Ex. 1004, 1349-1353.) In fact, the claim limitation specifying the difference in resonant frequencies was added just prior to allowance. (*Id.*, 168-170.)

Thus, there is simply no support in the original disclosure for the claimed "at least 100 kHz" frequency differential range because, *inter alia*, the lower bound of a 100 kHz frequency difference is not disclosed, let alone the entire range. Similarly, there is no upper bound to the claimed range, and a POSITA would not have understood that the inventor was in possession of an invention where the first and second coils have differing frequencies where the difference has no upper bound. (Ex. 1002, ¶¶45-46.) Hence, the claim is unpatentable because (1) the lower bound is not disclosed, and (2) a range with no upper bound is unsupported. *Application of Wertheim*, 541 F.2d 257, 263-64 (C.C.P.A. 1976); *Smith & Nephew, Inc. v. Anthrex, Inc.*, IPR2016-00483, Paper No. 7 at 14-23 (July 27, 2016).

Accordingly, claim 1 does not comply with the requirements of 35 U.S.C. § 112(a) for this additional reason.

2. Claim 10

Claim 1 of the '100 patent recites "a first terminal electrically connected to the first end of the first coil, a second terminal electrically connected to the second end of the second coil and a third terminal electrically connected to either of the first or second coils." (Ex. 1001, 32:66-33:3.) Claim 10 states that "each terminal of the antenna has a terminal lead portion that extends between a coil connection point and a terminal end, the coil connection point electrically connected to one of either of the first and second conductive wires of the first and second coils, respectively, wherein the terminal lead portion extends over at least a portion of either of the first and second conductive wires of the first and second coils, respectively." (*Id.*, 33:52-60.) A POSITA at the time of the alleged invention would not have understood that the inventor of the '100 patent possessed an invention with all of the features recited in claim 10. (Ex. 1002, ¶47.)

Claim 10 requires that each of the three terminals recited in claim 1 has a "terminal lead portion" that "extends over at least a portion of either of the first and second conductive wires of the first and second coils." However, none of the embodiments described or depicted in the '157 application discloses such a feature. (*Id.*, ¶48.)

In each of the embodiments disclosed in the '157 application that include two coils, one of the terminals corresponds to the end of the outer coil ("first coil")

that is located on the outermost turn of the first coil. For example, annotated figure 2 below shows the first terminal is coupled to the first end of the first coil.

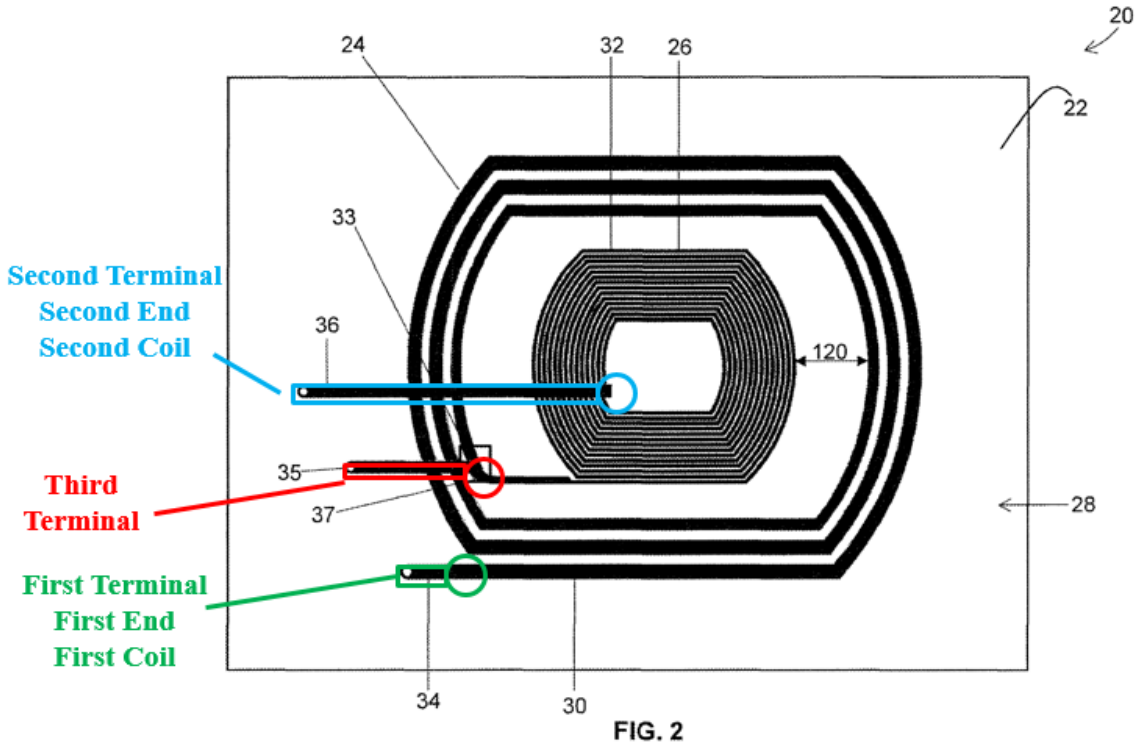


FIG. 2

(Ex. 1004, 1356 (FIG. 2) (annotated); Ex. 1002, ¶49.)

As is apparent from annotated figure 2 above, the first terminal lies on the outer-most point of the two coils, and therefore, any terminal lead corresponding to the first terminal is at the outside of the coil structure and the terminal lead portion is not disclosed *as extending over at least a portion of either of the first and second conductive wires of the first and second coils*. Because claim 10 requires that *all* of the three terminals include a terminal lead that extends over at least a portion of either of the first and second coils and no such disclosure is present in the '157

application, claim 10 does not comply with the requirements of 35 U.S.C. § 112(a). (Ex. 1002, ¶50.)

While claim 10 is an original claim, that fact "does not necessarily end all inquiry as to the satisfaction of the written description requirement." *Univ. of Rochester v. G.D. Searle & Co.*, 375 F.3d 1303, 1307 (Fed. Cir. 2004); *Enzo Biochem, Inc. v. Gen-Probe Inc.,* 323 F.3d 956, 968-69 (Fed. Cir. 2002) ("If a purported description of an invention does not meet the requirements of the statute, the fact that it appears as an original claim or in the specification does not save it. A claim does not become more descriptive by its repetition, or its longevity."). This is especially true because every embodiment of the '157 application shows an outer and an inner coil (*supra* Section X.A.1(a)(1)(i)), and in such an arrangement it would make no sense for the terminal at the end of the outer coil to extend over any portion of the first or the second coils, as discussed above. (Ex. 1002, ¶51.)

3. Claim 13

Claim 13 recites "[t]he electrical system of claim 1, wherein the antenna is capable of exhibiting a quality factor greater than 10 at an antenna operating frequency of at least 10 kHz." (Ex. 1001, 34:12-14.) While original claim 15 states that the antenna can have a quality factor greater than 10, the '157 application lacks support for the claimed range of quality factors for an antenna operating *in the claimed range of frequencies* ("at least 10 kHz"). Original claim 15 simply stated

"[t]he antenna of claim 1, the antenna having a quality factor greater than 10." (Ex. 1004, 1352.) A frequency of "10 kHz" or "at least 10 kHz" is not mentioned anywhere in the '157 application, and, while such a frequency may be included in the broader range of "the 1 kHz range to about 10 GHz range," (Ex. 1004, 1305 (¶65)) the broader range is not disclosed in combination with any quality factor calculation, let alone a quality factor with a lower bound of 10 and no upper bound.[6] Moreover, a POSITA would have understood that the "the 1 kHz range to about 10 GHz range" is an *extremely* broad range. (Ex. 1002, ¶53.) The inventor did not attribute any significance to the "10 kHz" number, and selecting the value of "at least 10 kHz" from this broad range would be akin to selecting a tree out of a forest. Indeed, "[t]he disclosure of a broad range of values does not by itself provide written description support for a particular value within that range. Instead, where a

[6] The first occurrence of 10 kHz in the '157 application is in amended claims 19 and 20 filed February 27, 2017 in which Patent Owner changed the recited "100 kHz" to "10 kHz" but provided no justification or specific support for extending the claimed range of frequencies. (Ex. 1004, 490 (claims 19, 20); *see also id.*, 476 ("Support for the amendments and new claims is found in the original disclosure. No new matter is introduced by this paper.").)

specification discloses a broad range of values and a value within that range is claimed, the disclosure must allow one skilled in the art to 'immediately discern the limitation at issue in the claims.'" *Gen. Hosp. Corp. v. Sienna Biopharmaceuticals, Inc.*, 888 F.3d 1368, 1372 (Fed. Cir. 2018) (internal citation omitted).

Therefore, a POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes the features recited in claim 13, and claim 13 does not comply with the requirements of 35 U.S.C. § 112(a). (Ex. 1002, ¶53.)

4. Claim 17

Claim 17 recites "wherein the antenna is capable of receiving or transmitting within a frequency band selected from the group consisting of about 10 kHz to about 250 kHz, about 250 kHz to about 500 kHz, 6.78 MHz, 13.56 MHz, and combinations thereof." Claim 17 is derived from original claim 19, which was amended on February 27, 2017 as follows:

> 19. (Currently Amended) The ~~antenna~~ electrical system of claim 1, wherein the antenna is capable of receiving or transmitting within a frequency band selected from the group consisting of about [[100]] 10 kHz to about 250 kHz, about 250 kHz to about 500 kHz, 6.78 MHz, 13.56 MHz, and combinations thereof.

(Ex. 1004, 490.)

As noted above with respect to claim 13, a frequency of 10 kHz is not mentioned anywhere in the '157 application as filed. Table 1 that was included with the '157 application includes the "100 – 250 kHz" range as well as the other ranges recited in original claim 19, but does not include a "10 kHz to 250 kHz range" added by amendment during prosecution of the '157 application. (Ex. 1002, ¶¶54-55.)

Table I

Mode	Operating Frequency	Terminal Connections
1	100 - 250 kHz (Qi and/or PMA)	1 and 2
1	6.78 MHz (A4WP)	1 and 3
2	13.56 MHz (NFC/RFID/ Proprietary power and data)	1 and 3
2	100 - 250 kHz (Qi and/or PMA)	2 and 3
3	250 - 500 kHz (PMA and/or, proprietary power and data)	2 and 3

(Ex. 1004, 1311.)

While the '157 application discloses a broad range of "1 kHz range to about 10 GHz range," (Ex. 1004, 1305 (¶65)), a POSITA would have understood that this is an *extremely* broad range. (Ex. 1002, ¶56.) In fact, examples provided in the specification disclose a maximum frequency of 6.78 MHz (*see, e.g., id.*, 1311 (Table III)), which is three orders of magnitude lower than the upper bound of the "1 kHz

range to about 10 GHz range." Therefore, a POSITA would not have understood that the inventor had possession of an antenna that operated in the *entire* "1 kHz range to about 10 GHz range" where any particular frequency within the range can be selected. The inventor did not attribute any significance to the "10 kHz" number, and selecting the value of "at least 10 kHz" from this broad range would be akin to selecting a tree out of a forest.

A POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes a frequency range with a lower limit of 10 kHz, and therefore, would not have understood the inventor to have possession of an invention with the features recited in claim 17. (Ex. 1002, ¶57.) Therefore, claim 17 does not comply with the requirements of 35 U.S.C. § 112(a).

5. Claim 18

Claim 18 recites "[t]he electrical system of claim 1, wherein the antenna is capable of receiving or transmitting frequencies of at least 10 kHz." (Ex. 1001, 34:37-39.) As discussed above with respect to claims 13 and 17, a frequency of 10 kHz is not mentioned anywhere in the '157 application, and the first occurrence of 10 kHz in the '157 application is in amended claims 19 and 20 filed February 27, 2017. In that amendment, Patent Owner changed pending claim 20, which issued as claim 18, as follows:

20. (Currently Amended) The ~~antenna~~ electrical system of claim 1, wherein the antenna is capable of receiving or transmitting frequencies of at least [[100]] 10 kHz.

(Ex. 1004, 490.)

For reasons similar to those discussed above with respect to claims 13 and 17, a POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes a frequency range with a lower limit of 10 kHz and no upper bound, and therefore would not have understood the inventor to have possession of an invention with the features recited in claim 18. (Ex. 1002, ¶¶58-59.) Therefore, claim 18 does not comply with the requirements of 35 U.S.C. § 112(a).

6. Claim 23

Claim 23 recites "at least one of the first and second coils has an unshielded inductance of between about 4.2 μH to about 8.2 μH when operating at about 100 kHz to about 500 kHz." (Ex. 1001, 34:54-57.) Claim 23 issued from pending claim 25 which was amended in the February 7, 2018 examiner's amendment that accompanied the notice of allowance. (Ex. 1004, 170.) Prior to that amendment, the recited inductance range within the recited frequency range was not disclosed anywhere in the '157 application. (Ex. 1002, ¶60.)

The '157 application discloses:

> The increased perimeter size and typically fewer number of filar turns that comprise the first outer inductor coil 24, generally create first coil inductances in the 4.2μH range, which, thus, provides reception and/or transmission in the MHz operating frequency range. In contrast, the increased number of filar turns and smaller coil diameter of the second interior inductor coil 26 generally create inductances in the 8.2μH range, which provides reception and/or transmission in the kHz operating frequency range.

(Ex. 1004, 1304-1305 (¶0064).)

The only other mention of 4.2 μH and 8.4 μH in the '157 application is in the context of two different inductors, where one inductor has "13 turns and a constant gap width of about 0.2 mm between adjacent traces of the coil" and the other inductor has "a variable trace width that ranged from 0.55 mm to about 0.2 mm in the interior of the coil." (*Id.*, 1329-1330 (¶111).) In the context of those two inductors, the '157 application discloses that "[t]he inductance of the antenna of design 1 having a constant trace width was measured to be about 4.2 μH," whereas "the inductance of design 2 with the variable trace width was measured to be about 8.2 μH …." (*Id.*) Nothing in the specification supports the range of "unshielded inductance" of between 4.2μH and 8.2μH when operating at 100 kHz to about 500 kHz as recited in issued claim 23. Disclosure of one inductor with an inductance of 4.2 μH and another inductor with an inductance of 8.2 μH does not constitute

disclosure of inductors having a *range* of inductances between those values, let alone such a range "when operating at 100 kHz to about 500 kHz." (Ex. 1002, ¶¶61-62.)

For at least these reasons, a POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes the features recited in claim 23. (*Id.*, ¶63.) Therefore, claim 23 does not comply with the requirements of 35 U.S.C. § 112(a).

7. Claim 24

Claim 24 recites "wherein at least one of the first and second coils has a surface area exceeding 120 mm." (Ex. 1001, 34:58-59.) Claim 24 issued from pending claim 26 which was amended in the February 7, 2018 examiner's amendment that accompanied the notice of allowance. (Ex. 1004, 170.) Prior to that amendment, there was no mention of "120 mm" or disclosure of a range with a lower bound of "120" mm (or mm^2) anywhere in the '157 application. (Ex. 1002, ¶64.)

Notably, claim 24 is indefinite as it is unclear how "surface area" is to be measured with respect to the coils, and claim 24 is also deficient as area is measured in square units (e.g. mm^2) and one-dimensional units (e.g. mm) cannot convey a measure of area. (*See infra* section X.B.2.) However, even assuming for the sake of argument that a POSITA would be able to overcome the lack of clarity of claim 24, the claimed surface area range is not disclosed in the '157 application. (Ex. 1002,

¶65.) For at least these reasons, a POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes the features recited in claim 24. (*Id.*) Therefore, claim 24 does not comply with the requirements of 35 U.S.C. § 112(a).

8. Claim 25

Claim 25 recites "wherein at least one of the first and second coils operates at a current exceeding 500 mA." (Ex. 1001, 34:58-59.) Claim 25 issued from pending claim 27 which was amended in the February 7, 2018 examiner's amendment that accompanied the notice of allowance. (Ex. 1004, 170.) Prior to that amendment, there was no mention of "500 mA" or disclosure of a current range with a lower bound of 500 mA anywhere in the '157 application. For at least these reasons, a POSITA would not have understood that the alleged inventor of the '100 patent had possession of an invention that includes the features recited in claim 25. (Ex. 1002, ¶66.) Therefore, claim 25 does not comply with the requirements of 35 U.S.C. § 112(a).

B. Ground 2: Claims 1-25 Are Indefinite

To avoid indefiniteness under 35 U.S.C. § 112(b), "a patent's claims, viewed in light of the specification and prosecution history, [must] inform those skilled in

the art about the scope of the invention with reasonable certainty." *Nautilus, Inc. v. Biosig Instr., Inc.*, 134 S. Ct. 2120, 2129 (2014).[7]

Claims 1-25 of the '100 patent fail to meet this requirement for several reasons, as discussed below. (Ex. 1002, ¶¶67-78.)

1. Claim 1

Claim 1 recites "a third gap separating an outermost turn of the second coil from the innermost turn of the first coil, wherein the third gap is greater than the first and second gaps." (Ex. 1001, 32:60-62.) This claim limitation is indefinite under the full scope of claim 1. (Ex. 1002, ¶68.)

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[7] Prior to the rule change applying the *Phillips* claim construction standard (*supra* Section X), the Board has also applied the *In re Packard* standard where a claim is held to be indefinite when it contains words or phrases whose meaning is unclear in describing and defining the claimed invention. *See Nippon Suisan Kaisha Ltd. v. Pronova Biopharma Norge AS*, PGR2017-00033, Paper 37 at 11-12, 14 (January 16, 2019), citing *In re Packard* 751 F.3d 1307, 1311 (Fed. Cir. 2014). The claims are indefinite even under the *In re Packard* standard because, as discussed below, the claims include words or phrases whose meaning is unclear. (*See infra* Sections XII.A.1-3.)

As discussed above in Section IX.A.1(a), the full scope of claim 1 (notwithstanding the lack of written description support) is not limited to one coil positioned within an inner perimeter of another coil. Instead, the plain language of claim 1 (as issued) encompasses an antenna in which the two coils are arranged side-by-side. But in such a side-by-side arrangement, the "third gap" limitation is rendered indefinite because a POSITA would not have known *where* the "third gap" would be measured in such an arrangement. (Ex. 1002, ¶69.)

In every two-coil embodiment described in the specification, the "third gap" is described as being between "inner and outer coils." For example, with respect to figures 3B and 3C, the specification states that "the quality factor of the single structure multiple mode antenna of the present disclosure can be significantly affected by the length and position of a gap 120 of space disposed between adjacent first and second inductor coils such as the first and second inductor coils 76, 78 and/or the third and fourth inductor coils 90, 92." (Ex. 1004, 1322-1323 (¶[0097]).)

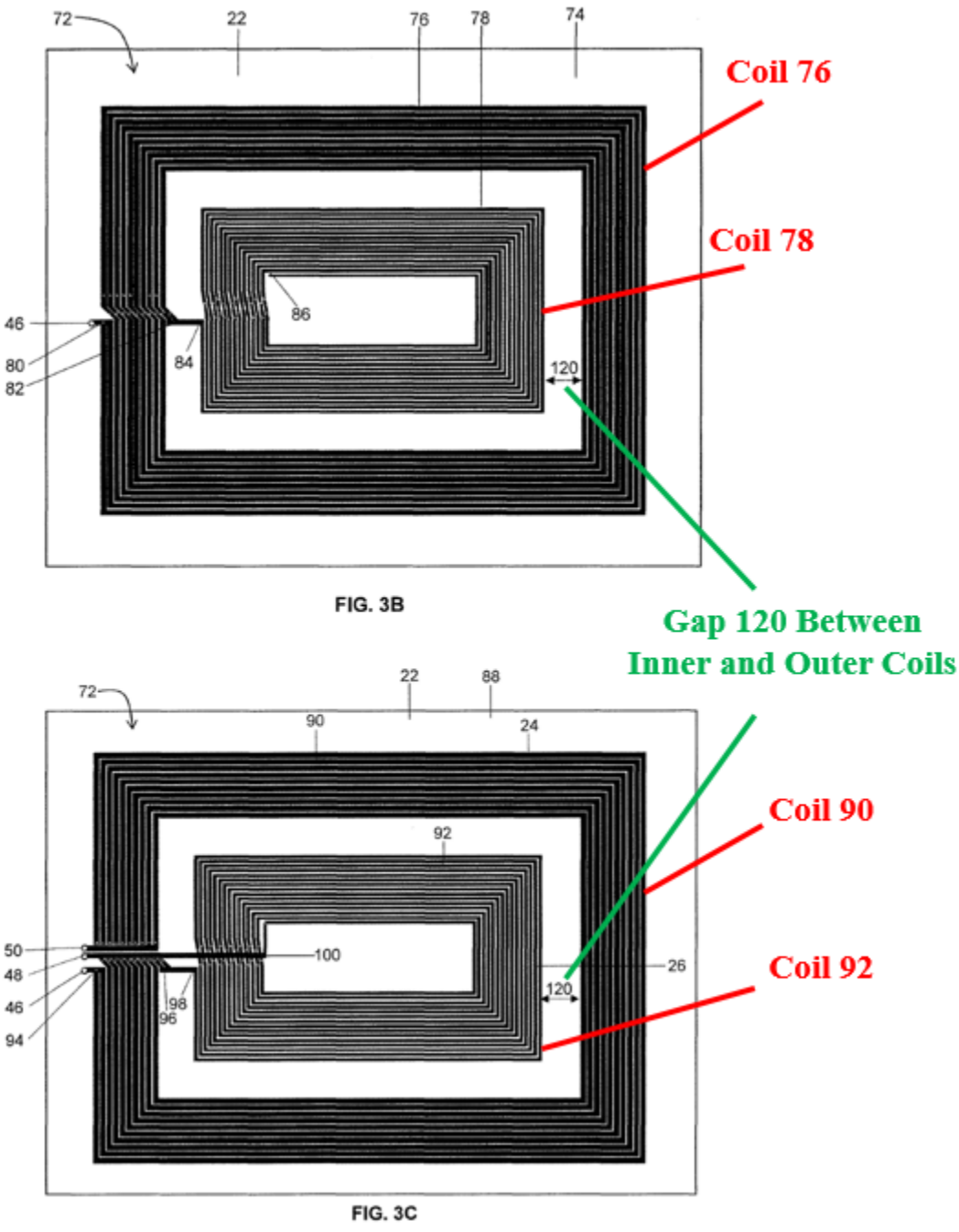


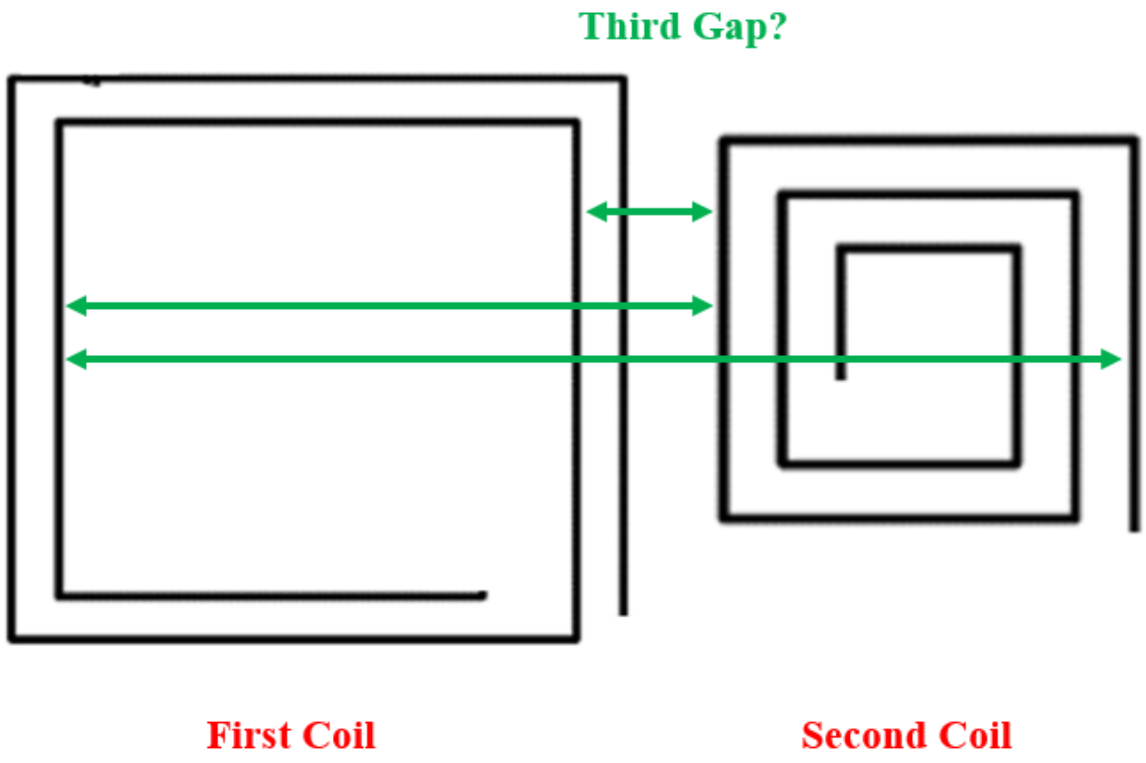
FIG. 3B

FIG. 3C

(Ex. 1004, 1360-61 (FIGs. 3B, 3C) (annotated); Ex. 1002, ¶70.)

But if the coil arrangement is such that the two coils are side-by-side, a POSITA would not be able to ascertain the scope of claim 1 with reasonable

certainty. The "third gap" is defined to be the gap "separating an outermost turn of the second coil from the innermost turn of the first coil." Therefore, if the two coils are positioned side-by-side, it is unclear where the "third gap" would be measured. (Ex. 1002, ¶71.) As shown in the demonstrative below, a POSITA would not know whether the relevant measurement for the "third gap" is between the nearest two points on the outermost turn of the second coil and the innermost turn on the first coil, the two furthest points on those turns of the respective coils, or some other points on the respective coils.



(*Id.*)

Moreover, in a side-by-side coil arrangement, a POSITA could not have determined with reasonable certainty whether the claim requires the third gap to be greater than the first and second gaps for all points on one coil with respect to all of the points on the other coil or if such a condition need only be true for some subset of the points on the coils. (Ex. 1002, ¶72.) Because the '100 patent does not include any examples or disclosure of an antenna with two coils where the second coil is *not* within the innermost turn of the first coil, the '100 patent does not provide any guidance to a POSITA attempting to understand the scope of claim 1 (and particularly, the "third gap" limitation) when the coils are positioned side-by-side. (*Id.*)

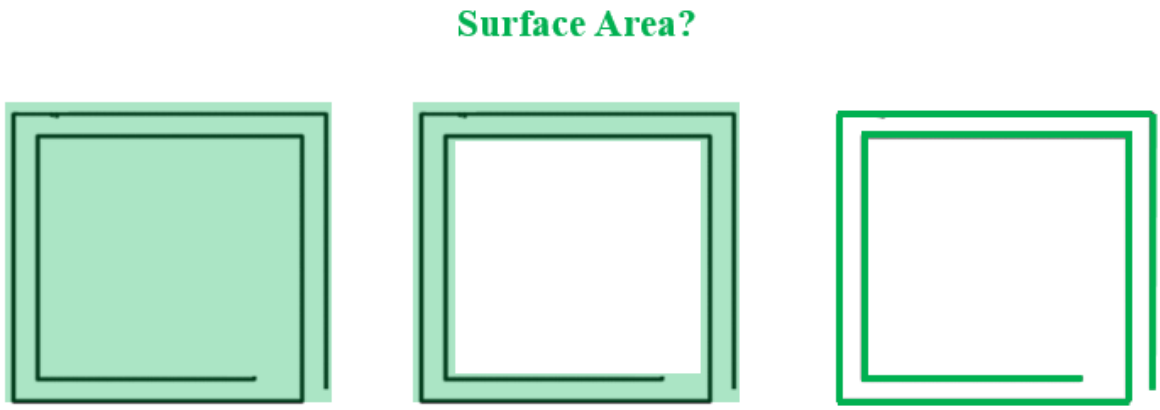
Therefore, claim 1 is indefinite. (Ex. 1002, ¶73.) Because each of claims 2-24 depend from claim 1, each of those claims is also indefinite for the reasons presented above with respect to claim 1.

2. Claim 24

After reviewing claim 24 in light of the specification, drawings, and prosecution history of the '157 application, a POSITA would not have been able to determine the scope of claim 24 with reasonable certainty. (Ex. 1002, ¶¶74-78.) Claim 24 recites "wherein at least one of the first and second coils has a surface area exceeding 120 mm." (Ex. 1001, 34:58-59.) As noted above in section X.A.7, the specification does not disclose a coil having a "surface area exceeding 120 mm."

Claim 24 is indefinite as it is unclear how "surface area" is to be measured with respect to the coils. A POSITA would not have understood whether the surface area of the coil is restricted to the surface area of only the conductive traces or wires making up the coil or whether the surface area is the entire footprint of the coil, including the gaps between the traces or wires making up the coil. (Ex. 1002, ¶75.) Moreover, with respect to the former scenario, it is unclear whether the entire surface area of a three-dimensional wire would be included in the "surface area" recited in claim 1, or only the surface area in a single plane (e.g. where the coil is "disposed on the substrate surface") is included. (*Id.*) With respect to the latter, it is also unclear whether, for example, the gap inside of an innermost turn of the coil would be included in the surface area of the coil or not. (*Id.*)

For example, a POSITA would not be able to determine with reasonably certainty if the "surface area" of the coil shown in the demonstrative below is limited to the two-dimensional area covered by the traces that make up the coil (as highlighted in green on the right), whether the gaps between the traces should also be included in the surface area (as highlighted for the coil in the middle), or whether the surface area corresponding to the interior of coil should also be included the surface area of the coil (the coil on the left showing the interior area included in the surface area). (*Id.*, ¶76.)



(*Id.*)

Similarly, when the two coils "meet and join" to form a "continuous junction," it is unclear where the first coil ends and the second coil begins. For example, as shown in figure 3 below, it would be unclear to a POSITA whether the conductive trace connecting the outer coil to the inner coil should be included as part of the surface area of the inner coil, the outer coil, both of the coils, or neither of the coils. (*Id.*, ¶77.)

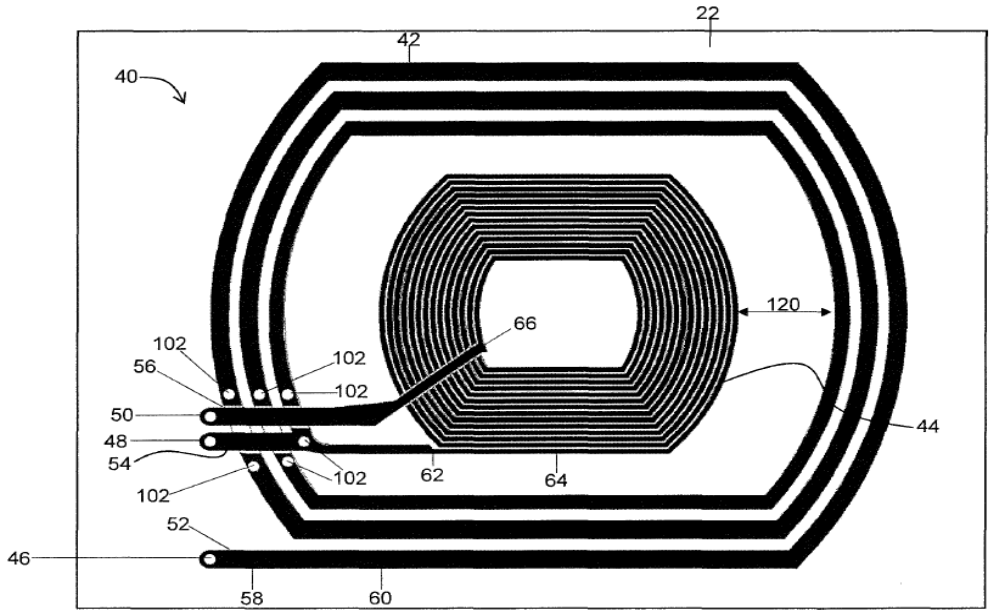


FIG. 3

(Ex. 1001, FIG. 3.)

Claim 24 is also deficient as area is measured in square units (e.g., mm^2) and single-dimension units (e.g. mm) cannot represent a measure of area. Notably, the specification does not provide any concrete examples demonstrating what constitutes the "surface area" of a coil or how it is to be represented. Therefore a POSITA reading the specification would not have found any disclosure that would clarify the meaning of this claim. (Ex. 1002, ¶78.) For at least these reasons, a POSITA would not have been able to determine the scope of claim 24 with reasonable certainty. (*Id.*)

XI. CONCLUSION

For the reasons given above, Petitioner requests institution of PGR for claims 1-25 of the '100 patent, and a finding that the claims are unpatentable based on the above grounds.

Respectfully submitted,

Dated: May 28, 2019

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

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petition for Post-Grant Review of U.S. Patent No. 10,063,100 contains, as measured by the word processing system used to prepare this paper, 11,501 words. This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Respectfully submitted,

Dated: May 28, 2019

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

CERTIFICATE OF SERVICE

I hereby certify that on May 28, 2019, I caused a true and correct copy of the foregoing Petition for Post-Grant Review of U.S. Patent No. 10,063,100 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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Respectfully submitted,

Dated: May 28, 2019

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