

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NXP USA, INC.

Petitioner

v.

BELL SEMICONDUCTOR, LLC

Patent Owner

Patent No. 7,535,330

PETITION FOR *INTER PARTES* REVIEW

OF U.S. PATENT NO. 7,535,330

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Ex. 1007	THOMAS A. LEE, THE DESIGN OF CMOS RADIO-FREQUENCY INTEGRATED CIRCUITS (2d ed. 2004) (“Lee”)
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Ex. 1013	Plaintiff Bell Semiconductor, LLC’s Analysis of Infringement of U.S. Patent No. 7,535,330, <i>Bell Semiconductor, LLC vs. NXP USA, INC., et al.</i> 8:22-cv-02133-HDV-ADS (C.D. California) (May 17, 2023)
Ex. 1014	ANANT AGARWAL AND JEFFERY H. LANG, FOUNDATIONS OF ANALOG AND DIGITAL ELECTRONIC CIRCUITS (2005) (“Agarwal”)
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I. INTRODUCTION

NXP USA, Inc. (“Petitioner” or “NXP”) requests *inter partes* review of claims 1-20 (“the challenged claims”) of U.S. Patent No. 7,535,330 (“the ’330 Patent”) (Ex. 1001), which, according to PTO records, is assigned to Bell Semiconductor, LLC (“Patent Owner”). For the reasons discussed below, the challenged claims should be found unpatentable and canceled.

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

Real Parties-in-Interest

Petitioner identifies the following as the real parties-in-interest: NXP USA, Inc. (“Petitioner”), NXP Semiconductors N.V., NXP B.V., and Freescale Semiconductor Holdings V, Inc.

Related Matters

The ’330 Patent is at issue in *Bell Semiconductor, LLC v. NXP USA, Inc. et al* Case No. 8:22-cv-02133-HDV-ADS, pending in Federal District Court in the Central District of California.

Counsel and Service Information

Lead counsel is Patricia Healy (Reg. No. 73,072), and Backup counsel are (1) Bruce Garlick (Reg. No. 36,520), (2) Timothy Markison (Reg. No. 33,534), and (3) Timothy Taylor (Reg. No. 76,643). Service information is Garlick & Markison,

2025 Guadalupe Street, Suite 260, Austin, TX 78705, Tel.: 512-751-5682, Fax: 888-456-7824, email: GM-NXP-Bell-IPR@texaspatents.com. Petitioner consents to electronic service.

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

Fees under 37 C.F.R. § 42.15(a) will be paid at the time of filing. When necessary to further the proceeding or in the case of overages, the PTO is authorized to charge and deposit funds to and from Deposit Account No. 50-2126.

IV. GROUNDS FOR STANDING

Petitioner certifies that the '330 Patent is available for review and Petitioner is not barred/estopped from requesting review on the grounds identified herein.

V. PRECISE RELIEF REQUESTED AND GROUNDS RAISED

Claims 1-20 should be canceled as unpatentable based on the following grounds:

Ground 1: Claims 1, 2, 4-10, 17, 18, and 20 are anticipated under pre-AIA 35 U.S.C. § 102(e) based on U.S. Patent No. 7,955,886 to Marques (“Marques”) (Ex. 1005);

Ground 2: Claims 3 and 19 are obvious under pre-AIA 35 U.S.C. § 103(a) based on Marques;

Ground 3: Claims 3, 11-16, and 19 are obvious under pre-AIA 35 U.S.C. § 103(a) based on Marques in view of Thomas A. Lee, *The Design of CMOS Radio-Frequency Integrated Circuits* (2d ed. 2004) (“Lee”) (Ex. 1007);

Ground 4: Claims 1, 2, 4, 5, and 7-10 are anticipated under pre-AIA 35 U.S.C. § 102(e) based on U.S. Patent No. 7,221,251 to Menegoli et al. (“Menegoli”) (Ex. 1008);

Ground 5: Claim 3 is obvious under pre-AIA 35 U.S.C. § 103(a) based on Menegoli; and

Ground 6: Claim 3 is obvious under pre-AIA 35 U.S.C. § 103(a) based on Menegoli and Lee.

The ’330 Patent issued on May 19, 2009, from U.S. App. No. 11/543,340 (“the ’340 Application”), filed September 22, 2006. All of the references relied on in the present Petition are prior art to the ’330 Patent.

Marques issued on June 7, 2011, based on an application filed March 30, 2005. The second edition of Lee published in 2004. Menegoli issued May 22, 2007, based on an application filed March 22, 2005. Therefore, Lee is prior art under at least pre-AIA 35 U.S.C. §102(a) and Marques and Menegoli are prior art under at least pre-AIA 35 U.S.C. §102(e).

None of these references were considered during prosecution. (See generally Ex. 1004). Lee is cited in U.S. Patent No. 7,256,646 to Eid et al. (“Eid”) and the Examiner cited to Eid during prosecution. However, Lee was not directly considered by the Examiner, and is only used as a secondary reference in combination with Marques and Menegoli.

VI. 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 ’330 Patent would have had at least the equivalent of a bachelor’s degree in electrical engineering and one to two years of experience in the field of circuit design, particularly the design of circuits operating at high frequencies. (Ex. 1002, ¶29.)¹

VII. OVERVIEW OF THE ’330 PATENT

The ’330 Patent discloses inductor structures and methods where oppositely wound inductors are positioned to cause magnetic field cancellation and reduction in parasitic mutual inductance. (Ex. 1001, Abstract; Ex. 1002, ¶¶38-44.)

¹ Petitioner submits the Declaration of Dr. Sayfe Kiaei (Ex. 1002), an expert in the field of the ’330 Patent. (Ex. 1002, ¶¶3-15, Ex. 1003.)

The '330 Patent discloses in Figure 4 below a first and second inductor coupled in series where the second inductor L2 404 is counter wound with respect to a first inductor L1 402. (Ex. 1001, 4:34-38.) The inductors 402 and 404 share a common node A 413 with current flowing in each inductor. (*Id.*, 4:38-40.) The current flows in a first direction from node A 413 to node B1 422 creating a magnetic field oriented out of the paper. (*Id.*, 4:40-47.) The current flows in a second direction from node A 413 to node B2 424 creating a magnetic field oriented into the plane of the paper. (*Id.*, 4:41-49.) The interference of opposing magnetic fields results in a cancellation effect at points of interference which reduces mutual inductance and allows for closer placement of inductors within a circuit. (*Id.*, 4:49-54.)

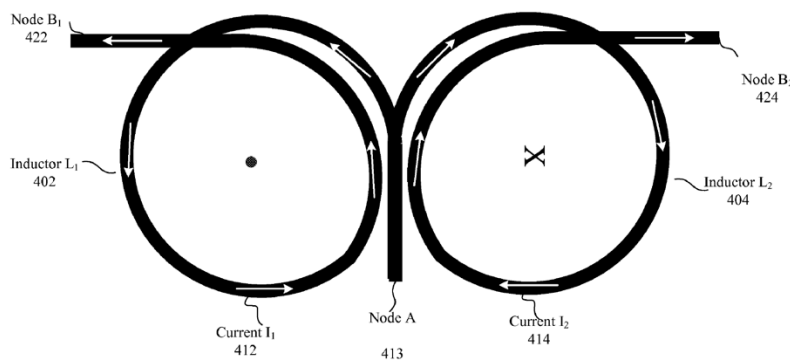


Figure 4

(*Id.*, Figure 4.)

The '330 Patent further discloses in Figure 5 below, an octagonal spiral inductor structure which is like the embodiment of Figure 4 except for the shape of

the inductors. (*Id.*, 5:18-24.) The '330 Patent further discloses that the octagonal spiral structure may reduce the complexity of manufacturing. (*Id.*)

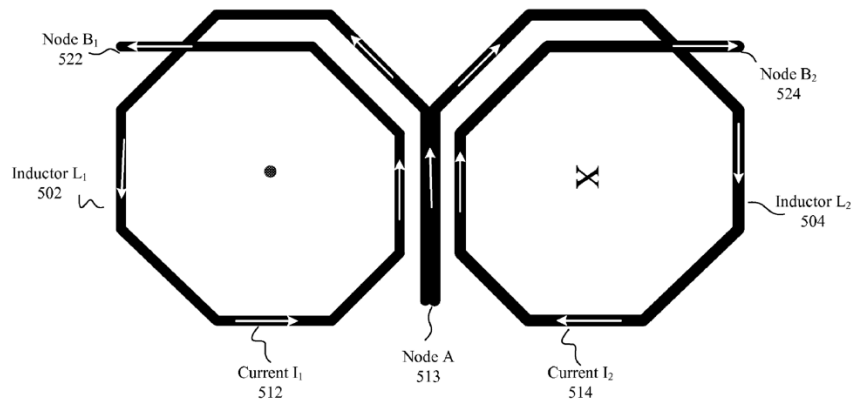


Figure 5

(*Id.*, Figure 5.)

The '330 Patent discloses that inductor interference is a potential issue in circuits requiring multiple inductors such as differential low noise amplifiers (“DLNAs”). (*Id.*, 1:58-63.) Figure 2 below depicts a prior art DLNA where inductor interference can potentially be an issue. (*Id.*, 1:60-63.) Parallel drain inductors L_{d1} 202 and L_{d2} 204 are required to be separated by a distance to minimize interference. (*Id.*, 1:63-65.) Further, series source inductors L_{s1} 207a and L_{s2} 207b share a common node and are required to be kept close to the differential FET 209a and 209b, which makes placement of inductors difficult to implement. (*Id.*, 1:67-2:3.)

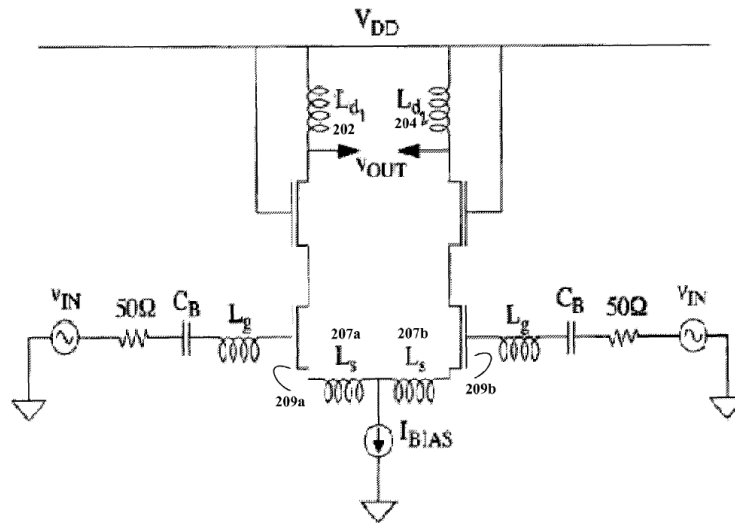


Figure 2

(*Id.*, Figure 2.)

As a solution, the '330 Patent discloses “[m]ultiple inductors structures and methods for providing low mutual inductance between inductors” where “the polarities of the inductors are positioned such that parasitic mutual inductance is reduced by causing electro-magnetic fields to at least partially cancel resulting in a reduction in interference between the inductors.” (*Id.*, 2:16-22.)

As explained below (*infra*-Section IX), the above features were all known in the prior art. (See Ex. 1002, ¶¶54-149; see also *id.*, ¶¶30-37 (describing the state of the art).)

VIII. CLAIM CONSTRUCTION

For IPR proceedings, the Board applies the claim construction standard according to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). See

83 Fed. Reg. 51, 340-59 (Oct. 11, 2018). Under *Phillips*, claim terms are typically given their ordinary and customary meanings, as would have been understood by a POSITA at the time of the invention. *Phillips*, 415 F.3d at 1313; *see also id.*, 1312-16. The Board, however, 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) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Petitioner believes that no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims. (Ex. 1002, ¶45.)

IX. DETAILED EXPLANATION OF UNPATENTABILITY

A. Ground 1 –Marques Anticipates Claims 1, 2, 4-10, 17, 18, and 20

As shown in detail below, Marques discloses all of the features recited in claims 1, 2, 4-10, 17, 18, and 20 of the '330 Patent. (Ex. 1002, ¶¶54-84.)

1. Claim 1

(a) “A multiple inductor array comprising:”

To the extent that the preamble is limiting, Marques discloses “a multiple inductor array.” (Ex. 1002, ¶55.) Marques discloses an inductive structure that may take the form of two or more inductors. (Ex. 1005, Abstract, 3:25-27; 4:54-55 (“any desired number of loops can be used”); Ex. 1002, ¶55.)

(b) “a first node that receives a first current and a second current;”

Marques discloses this claim feature. (Ex. 1002, ¶¶56-60.) As shown in annotated Figure 5 below, Marques discloses a series connection between inductors 10E and 10F. (Ex. 1005, 5:11-12.) The inductors are counter wound such that the current in inductor 10E is going one direction (current I1) and the current in inductor 10F is going the opposite direction (current I2). (Id., 5:21-25.)

In the Special Master Report and Recommendation on Claim Construction, the Special Master tentatively construes “node” to mean “a point of connection or intersection in an electrical circuit.” (Ex. 1015, 27.) A series connection is defined by two circuit branches joined by a common node. (Ex. 1002, ¶57.) As such, Marques discloses a common node (“first node”) between series connected inductors 10E and 10F. (Ex. 1005, 5:11-12.) The common node can therefore be viewed as the intersection of where I1 and I2 meet (i.e., the first node receives a first and second current). (Ex. 1002, ¶58.)

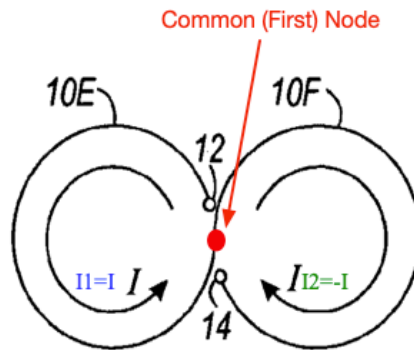


FIG. 5

(Ex. 1005, FIG. 5 (annotated).)

Additionally, Marques discloses a parallel connected inductor structure as shown Figure 7 below. (*Id.*, 5:49-53.) Figure 8 below discloses the equivalent circuit diagram for the inductor structure of Figure 7 which clearly shows a first node receiving a first current I_1 and a second current I_2 . (Ex. 1005, 5:49-53; Ex. 1002, ¶59.)

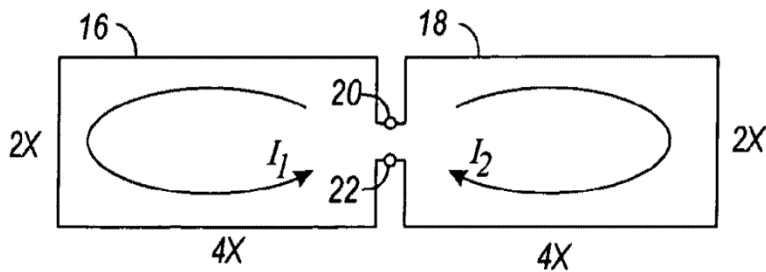


FIG. 7

(Ex. 1005, FIG. 7.)

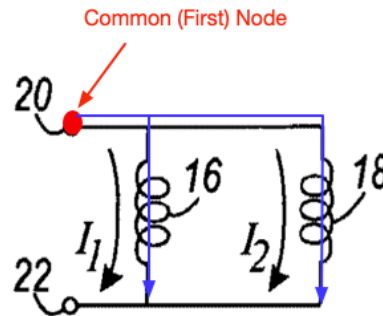


FIG. 8

(*Id.*, FIG. 8 (annotated).)

Therefore, whether considering Marques' series connected inductor structure or the parallel connected inductor structure, Marques discloses a first node receiving a first and second current. (Ex. 1002, ¶60.)

- (c) **“a first inductor coil, coupled to the first node and to a second node, that communicates the first current in a clockwise direction and generates a first magnetic field;”**

Marques discloses this claim feature. (Ex. 1002, ¶¶61-65.) With the current in inductor 10F of annotated Figure 5 below flowing in a clockwise direction, inductor 10F will be referred to as the first inductor and the current flowing in inductor 10F will be referred to as the first current I_1 for ease of comparison. As

shown in annotated Figure 5 below, the first inductor 10F is coupled to a first node (e.g., as discussed above, there is a common node between the first and second inductors) and a second node (i.e., terminal 14, highlighted in green). (Ex. 1005, 5:11-14; Ex. 1002, ¶61.)

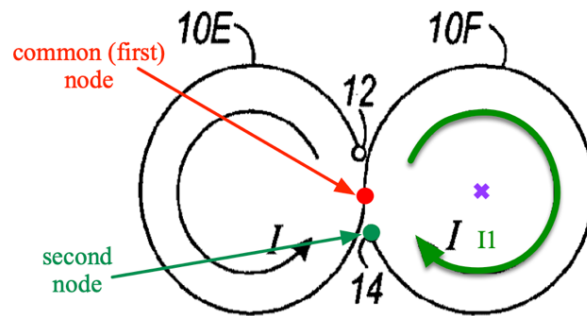


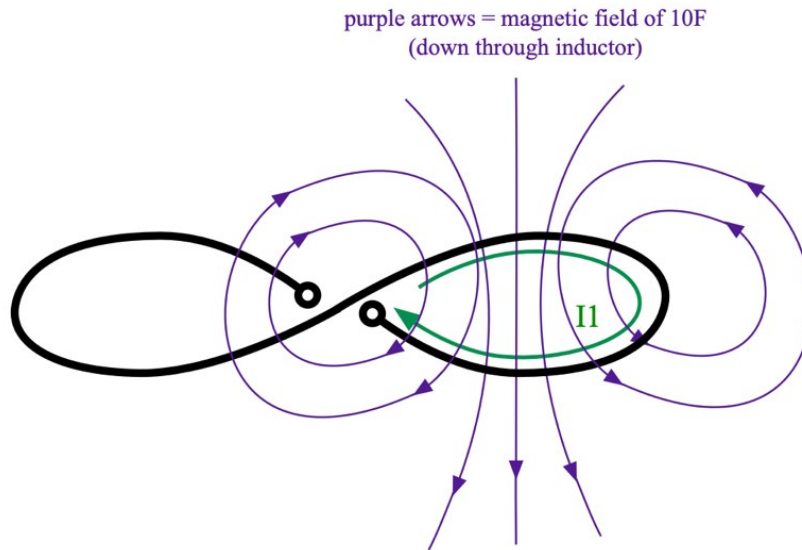
FIG. 5

(Ex. 1005, FIG. 5 (annotated).)

The magnetic field induced by the current flowing through the first inductor (current I_{II} above) in a clockwise direction will generate a magnetic field directed into the plane of the paper as indicated by the purple "x" in the center of first inductor 10F (in accordance with the right-hand rule). (Ex. 1005, 4:20-22, 5:21-25, 5:25-29; Ex. 1002, ¶62.)

Below is a redrawn, annotated version of Marques' Figure 5. (Ex. 1002, ¶62.) Redrawn, annotated Figure 5 below shows the inductor structure at an angle to

illustrate the magnetic field lines of the first inductor flowing downwards through the first inductor when current I1 is flowing in a clockwise direction. (*Id.*)



(Ex. 1005, FIG. 5 (redrawn, annotated); Ex. 1002, ¶62.)

- (d) “a second inductor coil, coupled to the first node and to a third node, that communicates the second current in a counter clockwise direction and generates a second magnetic field having an opposing orientation to the first magnetic field; and”

Marques discloses this claim feature. (Ex. 1002, ¶¶63-65.) Because the current in inductor 10E of annotated Figure 5 below is flowing in a counterclockwise direction, the inductor 10E will be referred to as the second inductor and the current flowing in inductor 10E as the second current I2 for ease of comparison. As shown

in annotated Figure 5 below, the second inductor 10E is coupled to a first node (e.g., as discussed above, there is a common node between the first and second inductors) and a third node (i.e., terminal 14, highlighted in blue). (Ex. 1005, 5:11-14; Ex. 1002, ¶63.)

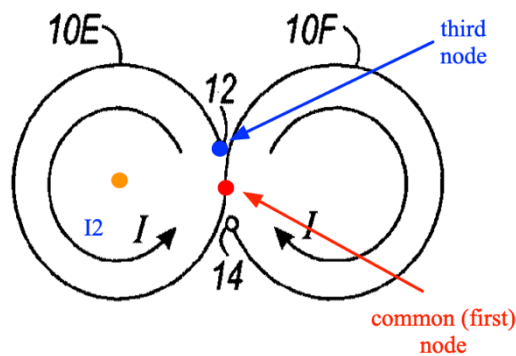


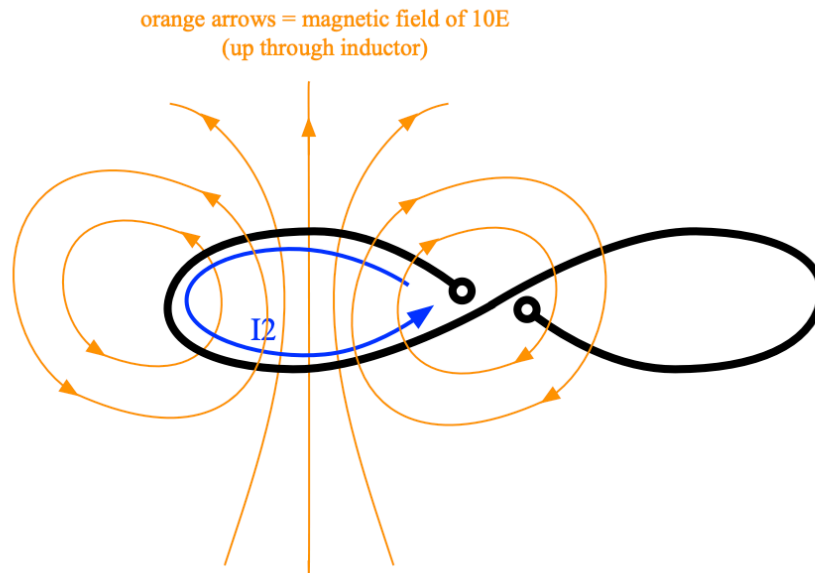
FIG. 5

(Ex. 1005, FIG. 5 (annotated).)

The magnetic field induced by the current flowing through the second inductor in a counterclockwise direction generates a magnetic field directed out of the plane of the paper as indicated by the orange dot in the center of second inductor 10E (in accordance with the right-hand rule) which is the opposite orientation of the magnetic field generated by the current in the first inductor. (Ex. 1005, 4:20-22, 5:21-25, 5:25-29; Ex. 1002, ¶64.)

Below is a redrawn, annotated version of Marques' Figure 5. (Ex. 1002, ¶65.) Redrawn, annotated Figure 5 below shows the inductor structure at an angle to

illustrate the magnetic field lines of the second inductor flowing upwards through the second inductor when current I_2 is flowing in a counterclockwise direction. (Ex. 1002, ¶65)

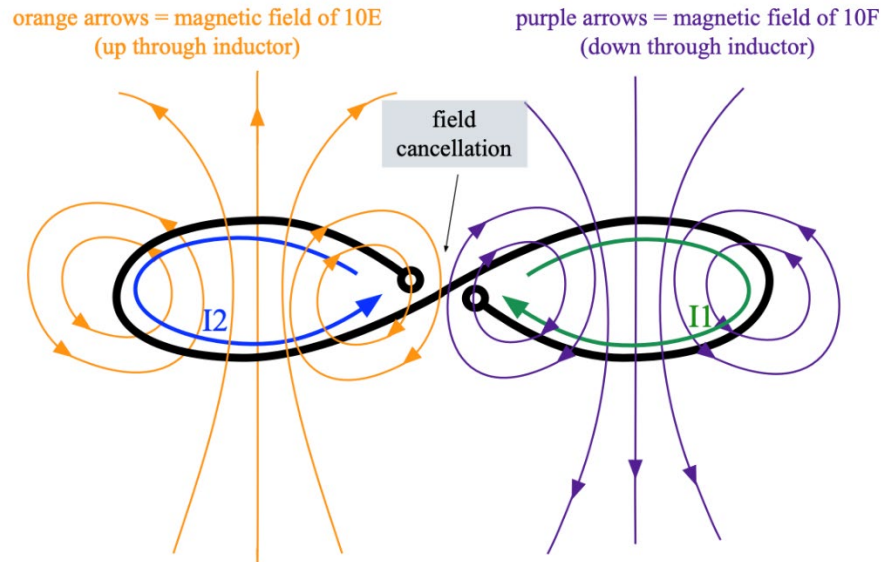


(Ex. 1005, FIG. 5 (redrawn, annotated); Ex. 1002, ¶65.)

(e) “wherein the first magnetic field and the second magnetic field at least partially cancel at an interference point.”

Marques discloses this claim feature. (Ex. 1002, ¶¶66-67.) Marques discloses that since the magnetic field induced by the current flowing through the first inductor will be opposite to the magnetic field induced by the current flowing through the second inductor, the total magnetic field will at least partially cancel out. (Ex. 1005,

4:20-24.) As illustrated in redrawn, annotated Figure 5 below, at least a portion of the opposing magnetic fields in inductors 10E and 10F will cancel based on the interference of the oppositely oriented fields. (Ex. 1002, ¶66.)



(Ex. 1005, FIG. 5 (redrawn, annotated); Ex. 1002, ¶66.)

Marques further discloses in Figure 12 below that magnetic field cancellation is optimal at axis 38 where the distance to each inductor 50 and 52 is equal. (Ex. 1005, 9:11-14.) As such, Marques discloses a first and second magnetic field that cancel at an interference point (e.g., as illustrated by optimal magnetic field cancellation axis 38). (Ex. 1002, ¶67.)

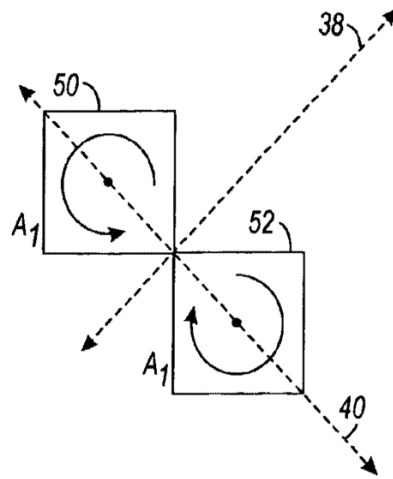


FIG. 12

(Ex. 1005, FIG. 12.)

2. Claim 2

- (a) “The array of claim 1 wherein the first inductor coil and the second inductor coil are spiral structures.”**

Marques discloses this claim feature. (Ex. 1002, ¶68.) Marques discloses in Figure 5 below first and second inductors having a spiral (round) shape. (Ex. 1005, 5:14-15.) Therefore, Marques discloses that first and second inductor coils are spiral structures. (Ex. 1002, ¶68.)

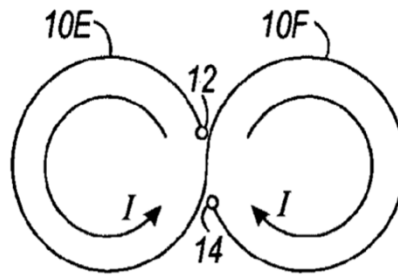


FIG. 5

(Ex. 1005, FIG. 5.)

3. Claim 4

- (a) “The array of claim 1 wherein a change in magnitude of the first magnetic field causes a change in magnitude of the second magnetic field.”**

Marques inherently discloses this claim feature. (Ex. 1002, ¶69.) Dr. Kiaei discusses in the technical background section of the Declaration, that when a current flows through an inductor, a magnetic field proportional to the current is produced. (Id., ¶32.) Therefore, because current *I* flows through inductors 10E and 10F (as shown in Figure 5 above), a change in current *I* would change the magnetic fields produced by both inductors. (Id., ¶69.) To cause a change in the first magnetic field, a change in current *I* would need to occur which would cause a change in the second magnetic field as well. (Id.)

4. Claim 5

- (a) “The array of claim 1 wherein a change in magnitude of the second magnetic field causes a change in magnitude of the first magnetic field.”**

Marques inherently discloses this claim feature. (*Id.*, ¶70.) As discussed above, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Therefore, because current I flows through inductors 10E and 10F (as shown in Figure 5 above), a change in current I would change the magnetic fields produced by both inductors. (*Id.*, ¶70.) To cause a change in the second magnetic field, a change in current I would need to occur which would cause a change in the first magnetic field as well. (*Id.*)

5. Claim 6

- (a) “The array of claim 1 wherein the first and second currents flow within the same direction.”**

Marques discloses this claim feature. (*Id.*, ¶¶71-72.) In Marques, as in the ’330 Patent, the inductor configuration dictates the way that current flows within the structure. (Ex. 1005, 5:21-25; Ex. 1002, ¶71.) Marques discloses a parallel inductor structure in Figure 8 below. (*Id.*, 5:41-56.) The currents I_1 and I_2 are shown to flow in the same direction through inductors 16 and 18. (*Id.*) As such, Marques discloses first and second currents flowing in the same direction. (Ex. 1002, ¶72.)

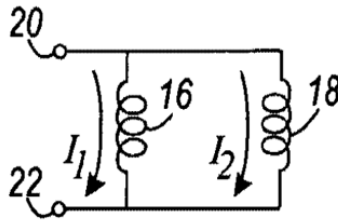


FIG. 8

(Ex. 1005, FIG. 8.)

6. Claim 7

- (a) “The array of claim 1 wherein the first and second currents flow in opposing directions.”**

Marques discloses this claim feature. (Ex. 1002, ¶73.) As discussed above, in Marques, as in the '330 Patent, the inductor configuration dictates the way that current flows within the structure. (Ex. 1005, 5:21-25; Ex. 1002, ¶73.) The inductors in the Marques structure are configured “such that current flows in opposite directions through the loops.” (*Id.*, 1:52-54.) Therefore, regardless of the direction of current is flowing upon entering the inductor structure, the configuration of the inductors results in first and second currents flowing in opposing directions. (Ex. 1002, ¶73.) As such, Marques discloses first and second currents flowing in opposing directions. (*Id.*)

7. Claim 8

- (a) “The array of claim 1 wherein the magnitudes of the first and second currents are related so that a change in the first current causes a corresponding change in the second current in order to cause a reactionary interference cancellation.”**

Marques inherently discloses this claim feature. (*Id.*, ¶74.) As discussed above, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Because current I flows through inductors 10E and 10F (as currents I1 and I2 in annotated Figure 5 above), a change in current I would change both the first and second currents through the inductors. (*Id.*, ¶74.) Therefore, to change the current through one inductor, a change in current I needs to occur which ultimately changes the current in the other inductor and produces opposing magnetic fields proportional to the new current (i.e., reactionary interference cancellation). (*Id.*, ¶74.)

8. Claim 9

- (a) “The array of claim 1 further comprising a third inductor coil that generates a third magnetic field that cancels at least a portion of the first magnetic field.”**

Marques discloses this claim feature. (Ex. 1002, ¶75.) Marques discloses in Figure 4B below, four inductors 10C, 10D, 10E, and 10F coupled in series between terminals 12 and 14. (Ex. 1005, 4:61-62.) The current through inductors 10C and 10F is flowing in the same direction and current flowing through inductors 10D and 10E are flowing in the opposite direction. (Ex. 1005, 5:2-5; Ex. 1002, ¶75.) Therefore, the magnetic fields generated by inductors 10C, 10D, 10E, and 10F are at least partially cancelled. (Ex. 1005, 5:5-8; Ex. 1002, ¶75.) As such, if inductors 10C and 10D are viewed as the first and second inductors, a third inductor 10E is at least partially cancelling the magnetic field produced by the first inductor 10C. (Ex. 1002, ¶75.)

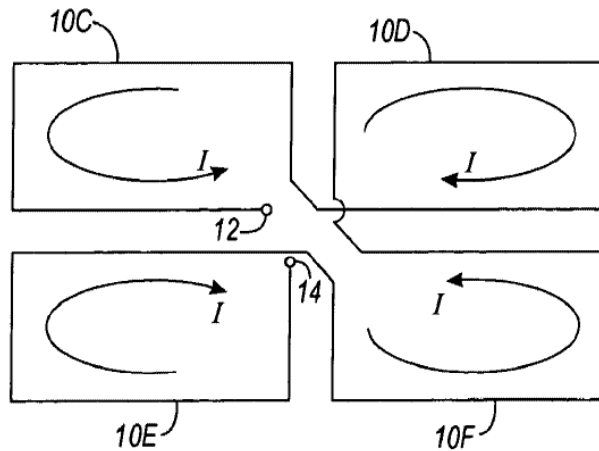


FIG. 4B

(Ex. 1005, FIG. 4B.)

9. Claim 10

- (a) “The array of claim 1 further comprising a third inductor coil that generates a third magnetic field that cancels at least a portion of the second magnetic field.”**

Marques discloses this claim feature. (Ex. 1002, ¶76.) Marques discloses in Figure 4B above, four inductors 10C, 10D, 10E, and 10F coupled in series between terminals 12 and 14. (Ex. 1005, 4:61-62.) The current through inductors 10C and 10F is flowing in the same direction and current flowing through inductors 10D and 10E are flowing in the opposite direction. (Ex. 1005, 5:2-5; Ex. 1002, ¶76.) Therefore, the magnetic fields generated by inductors 10C, 10D, 10E, and 10F are at least partially cancelled. (Ex. 1005, 5:5-8; Ex. 1002, ¶76.) As such, if inductors 10C and 10D are viewed as the first and second inductors, a third inductor 10F could

be viewed as generating a third magnetic field that partially cancels the magnetic field produced by the second inductor 10D. (Ex. 1002, ¶76.)

10. Claim 17

- (a) “A method for reducing the amount of parasitic mutual inductance between inductors, the method comprising:”**

To the extent that the preamble is limiting, Marques discloses this claim feature. (Ex. 1002, ¶77.) Marques discloses that parasitic loops can cause interference between circuit components. (Ex. 1005, 2:59-67.) Marques further discloses that for proper circuit function, interference needs to be reduced or minimized. (*Id.*, 2:67-3:2.) Interference caused by parasitic loops is viewed as the equivalent of parasitic mutual inductance in this context. (Ex. 1002, ¶77.) Therefore, Marques discloses a method for reducing the amount of parasitic mutual inductance between inductors. (*Id.*)

- (b) “generating a first magnetic field, from a first inductor coil communicating a first current in a first direction;”**

Marques discloses this claim feature. (*Id.*, ¶¶78-79.) Marques discloses in annotated Figure 5 below, first and second inductors coupled in series between terminals 12 and 14. (Ex. 1005, 5:12-14; Ex. 1002, ¶78.)

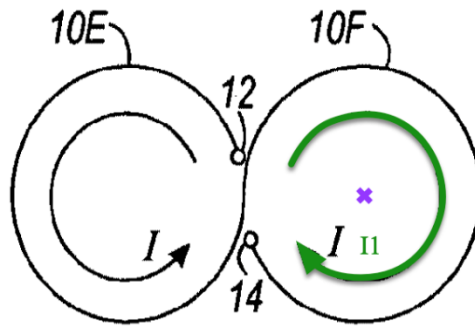


FIG. 5

(Ex. 1005, FIG. 5 (annotated).)

The magnetic field induced by the current flowing through the first inductor in a clockwise direction will be opposite to the magnetic field induced by the current flowing in a counterclockwise direction through the second inductor (the purple “x” in annotated Figure 5 above depicts the first magnetic field going into the page). (Ex. 1005, 4:20-22, 5:21-25, 5:25-29; Ex. 1002, ¶79.) Therefore, Marques discloses generating a first magnetic field from a first inductor coil communicating a first current in a first direction. (Ex. 1002, ¶79.)

- (c) “generating a second magnetic field, from a second inductor coil communicating a second current in a second direction that is opposite to the first direction, the second magnetic field having an opposing orientation to the first magnetic field; and;”

Marques discloses this claim feature. (*Id.*, ¶¶80-81.) Marques discloses in annotated Figure 5 below, first and second inductors coupled in series between terminals 12 and 14. (Ex. 1005, 5:12-14; Ex. 1002, ¶80.)

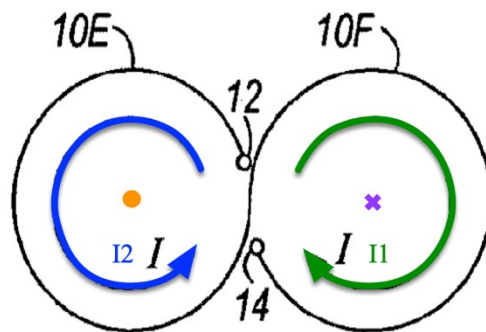


FIG. 5

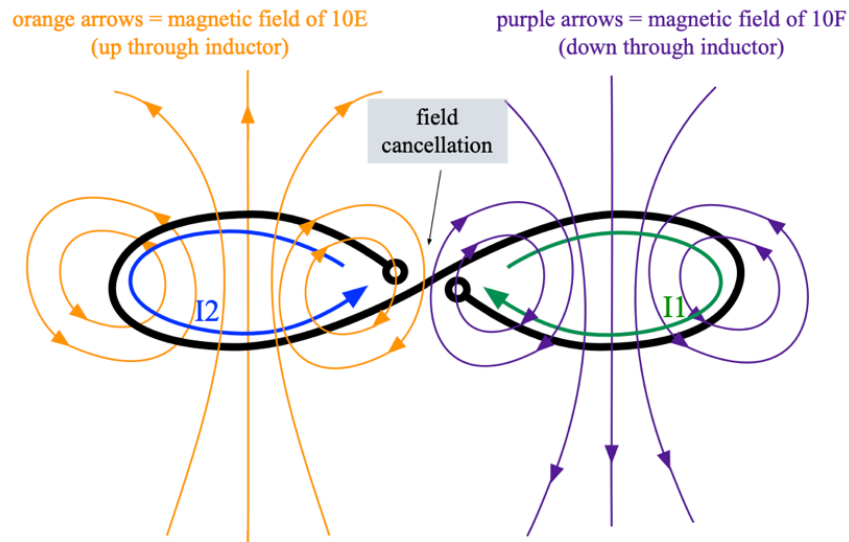
(Ex. 1005, FIG. 5 (annotated).)

Marques discloses that the magnetic field induced by the current flowing through the first inductor in a clockwise direction will be opposite to the magnetic field induced by the current flowing in a counterclockwise direction through the second inductor (as indicated in annotated Figure 5 above by the purple “x” depicting the first magnetic field going into the page in the first inductor and the orange dot

depicting the second magnetic field going out of the page in the second inductor). (Ex. 1005, 4:20-22, 5:21-25, 5:25-29; Ex. 1002, ¶81.) Therefore, Marques discloses generating a second magnetic field from a second inductor coil communicating a second current in a second direction that is opposite to the first direction where the second magnetic field has an opposing orientation to the first magnetic field. (Ex. 1002, ¶81.)

(d) “canceling at least a portion of the first and second magnetic fields by magnetic cancellation resulting from the opposing orientations of the first and second magnetic fields.”

Marques discloses this claim feature. (*Id.*, ¶82.) Marques discloses in redrawn, annotated Figure 5 below that since the magnetic field induced by the current flowing through the first inductor will be opposite to the magnetic field induced by the current flowing through the second inductor, the total magnetic field will at least partially cancel out. (Ex. 1005, 4:20-24; Ex. 1002, ¶82.)



(Ex. 1005, FIG. 5 (redrawn, annotated); Ex. 1002, ¶82.)

11. Claim 18

- (a) “The method of claim 17 wherein the magnitude of the first and second magnetic fields are related such that a change in the first magnetic field result in a change in the second magnetic field.”

Marques inherently discloses this claim feature. (Ex. 1002, ¶83.) As discussed above, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Therefore, because current I flows through inductors 10E and 10F (as shown in annotated Figure 5 above), a change in current I would change the magnetic fields produced by both inductors. (*Id.*, ¶83.) To cause a change in the second magnetic field, a change in current I

would need to occur which would cause a change in the first magnetic field as well.

(*Id.*)

12. Claim 20

- (a) **“The method of claim 17 wherein the first and second magnetic coils are structured in a spiral configuration.”**

Marques discloses this claim feature. (Ex. 1002, ¶84.) Marques discloses in Figure 5 below, first and second inductors having a spiral (round) configuration. (Ex. 1005, 5:14-15; Ex. 1002, ¶84.) As such, Marques discloses that the first and second magnetic coils are structured in a spiral configuration. (Ex. 1002, ¶84.)

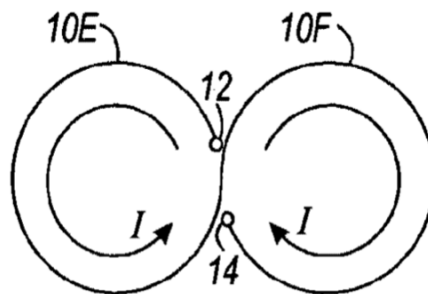


FIG. 5

(Ex. 1005, FIG. 5.)

B. Ground 2 – Marques Renders Claims 3 and 19 Obvious

As shown in detail below, Marques discloses or suggests all of the features recited in claims 3 and 19 of the '330 Patent. (Ex. 1002, ¶¶85-91.) While the

limitations of claims 3 and 19 are not explicitly disclosed by Marques, the differences between claims 3 and 19 and Marques are such that the claimed invention as a whole would have been obvious at the time of the alleged invention to a POSITA. (*Id.*, ¶85.)

Marques is analogous art to the '330 Patent because Marques and the '330 Patent are in the same field of endeavor. (*Id.*, ¶86.) Marques discloses an inductor structure for use in various circuitry to reduce interference caused by parasitic inductance (Ex. 1002, ¶86; Ex. 1005, 2:61-3:4, 3:20-34.) Similarly, the '330 Patent discloses an inductor design to be used in numerous different circuits to reduce parasitic mutual inductance. (Ex. 1002, ¶86; Ex. 1001, 2:26-30.)

A POSITA would have been motivated to modify the shape of the inductor structure of Marques based on what was generally known in the art at the time of the alleged invention and would have done so with a reasonable expectation of success. (Ex. 1002, ¶87.) Planar spiral inductor shapes were well known in the art and usually selected based on personal preference or the availability of design tools. (*Id.*) A shape modification can improve performance improvement in the inductor structure and would therefore result in a reasonable expectation of success. (*Id.*)

Further, courts typically find shape modifications without clear significance to be obvious. *See In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (holding

that the configuration of the claimed disposable plastic nursing container was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.) The '330 Patent discloses that the “inductors may be provided in various forms such as conventional octagonal and conventional spiral structures.” (Ex. 1001, 2:39-41.) The '330 Patent further discloses that the “octagonal spiral may be implemented to reduce the complexity of manufacturing.” (*Id.*, 5:20-21.) Therefore, while an octagonal inductor shape may reduce complexity, the shape itself is not a significant functional feature of the inductor structure of the '330 Patent.

1. Claim 3

(a) “The array of claim 1 wherein the first inductor coil and the second inductor coil are octagonal structures.”

Marques discloses or suggests this claim feature. (Ex. 1002, ¶¶88-90.) Inductor coils having octagonal structures were widely known to a POSITA at the time of the alleged invention. (*Id.*, ¶88.) The most widely used on-chip inductor around the time of the alleged invention was the planar spiral. (*Id.*) Octagonal and circular spirals were favored planar spiral shapes with slightly better performance than other shapes. (*Id.*)

Marques discloses in Figure 6 below, a first and second inductor having a hexagonal shape. (Ex. 1005, 5:29-30.)

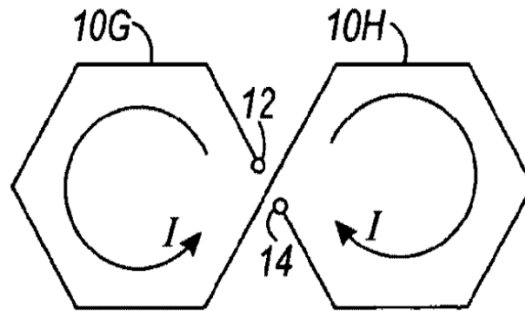


FIG. 6

(*Id.*, FIG. 6.)

A POSITA would have found it obvious to modify the hexagonal spiral shape of Marques to another highly common planar spiral structure (an octagonal spiral shape) to improve performance or to make use of available layout tools. (Ex. 1002, ¶90.)

2. Claim 19

- (a) “The method of claim 17 wherein the first and second magnetic coils are structured in an octagonal configuration.”**

Marques discloses or suggests this claim feature. (*Id.*, ¶91.) Marques discloses in Figure 6 above, a first and second inductor having a hexagonal shape. (Ex. 1005, 5:29-30.) As discussed above, a POSITA would find it obvious to adjust

the hexagonal spiral shape of Marques to another highly common planar spiral structure (an octagonal spiral shape) to improve performance or to make use of available layout tools. (Ex. 1002, ¶91.)

C. Ground 3 – Marques in View of Lee Renders Claims 3, 11-16, and 19 Obvious

As shown in detail below, Marques in combination with Lee discloses or suggests all of the features recited in claims 3, 11-16, and 19 of the '330 Patent. (Ex. 1002, ¶¶92-120.)

As discussed above, Marques is analogous art to the '330 Patent because Marques and the '330 Patent are in the same field of endeavor. (Ex. 1002, ¶92.) Marques discloses an inductor structure to be used in various circuitry to reduce interference caused by parasitic inductance (Ex. 1002, ¶92; Ex. 1005, 2:61-3:4, 3:20-34.) Similarly, the '330 Patent discloses an inductor design to be used in numerous different circuits to reduce parasitic mutual inductance. (Ex. 1002, ¶92; Ex. 1001, 2:26-30.)

Lee is also analogous art to the '330 Patent because Lee and the '330 Patent are in the same field of endeavor. (Ex. 1002, ¶93.) Lee provides discussion and schematics for common IC components and circuitry such as differential low noise amplifiers (DLNAs) at the time of the alleged invention. (Ex. 1002, ¶93; Ex. 1007,

136-137², 388.) Lee discusses that high frequency amplifiers face serious constraints due to “ever-present parasitic capacitances and inductances.” (Ex. 1002, ¶93; Ex. 1007, 270.) Similarly, the ’330 Patent discloses that the impact of cross-coupling or crosstalk is a more significant issue in circuits operating at high frequencies. (Ex. 1002, ¶93; Ex. 1001, 1:16-21.) The ’330 Patent discloses that the counter wound inductor structure may be used in a DLNA to minimize crosstalk and maintain the reliability of the circuit. (Ex. 1002, ¶93; Ex. 1001, 2:42-50.)

A POSITA would have been motivated to modify Marques in view of Lee and would have done so with a reasonable expectation of success. (Ex. 1002, ¶94.) As discussed above, Marques discloses an inductor structure where oppositely wound inductors cause magnetic field cancellation causing a reduction in parasitic mutual inductance between the inductors. (Ex. 1005, 1:36-45.) The technical problem addressed by Marques is interference between components in an IC. (*Id.*, 1:29-33.) This technical problem is specifically mentioned in Lee as an issue regarding high frequency amplifiers (i.e., “ever-present” parasitic inductance). (Ex. 1007, 270.)

² Citations are to page numbers of THOMAS A. LEE, THE DESIGN OF CMOS RADIO-FREQUENCY INTEGRATED CIRCUITS 387-90 (2d ed. 2004) (“Lee”) that are on the top of each page.

Because DLNAs include closely positioned inductors and interference between inductors is discussed as a known issue in both Marques and Lee, a POSITA at the time of the alleged invention would have been motivated to combine the inductor structure of Marques into the DLNA disclosed by Lee in order to reduce parasitic interference between inductors (i.e., a known issue). (Ex. 1002, ¶95.) Further modifications of Marques in view of Lee would involve adjusting the inductor structure of Marques to other widely known and common shapes. (*Id.*)

A POSITA would have a reasonable expectation of success in applying Marques' inductor structure to the circuitry of Lee given that the DLNA of Lee includes closely positioned inductors and the purpose of Marques is to reduce interference between closely positioned inductors. (*Id.*, ¶96.) Further, adjusting the shape of the inductors of Marques to other well-known planar spiral shapes disclosed by Lee would be successful because the adjustment can improve performance or convenience. (*Id.*)

Further, courts typically find shape modifications without clear significance to be obvious. *See In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (holding that the configuration of the claimed disposable plastic nursing container was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container

was significant.) The '330 Patent discloses that the “inductors may be provided in various forms such as conventional octagonal and conventional spiral structures.” (Ex. 1001, 2:39-41.) The '330 Patent further discloses that the “octagonal spiral may be implemented to reduce the complexity of manufacturing.” (*Id.*, 5:20-21.) Therefore, the disclosure of the '330 Patent does not state a specific significance of the octagonal inductor shape other than its use may reduce complexity.

1. Claim 3

(a) “The array of claim 1 wherein the first inductor coil and the second inductor coil are octagonal structures.”

While Marques in combination with what was known by a POSITA at the time of the alleged invention renders claim 3 obvious as discussed above, Marques in combination with Lee also discloses or suggests this claim feature. (Ex. 1002, ¶¶97-99.) Marques discloses in Figure 6 below, a first and second inductor having a hexagonal shape. (Ex. 1005, 5:29-30.)

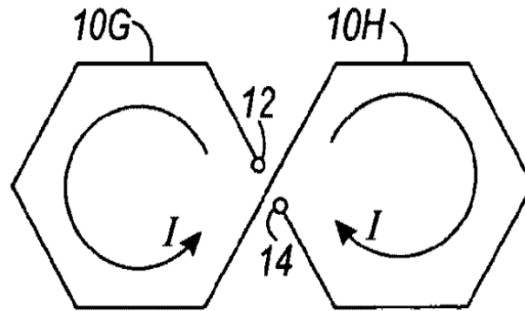


FIG. 6

(*Id.*, FIG. 6.)

Marques does not explicitly disclose inductors having an octagonal structure. However, Lee discloses that “the most widely used on-chip inductor is the planar spiral, which can assume many shapes.” (Ex. 1007, 136.) Lee discloses in Figure 4.21 below planar spiral shapes to include an octagonal shape. (*Id.*, 137.) Lee further discloses that the choice of shape is more often made on the basis of convenience or habit than anything else. (*Id.*, 136.) Lee discloses that octagonal and circular spirals are favored planar spiral shapes with slightly better performance than other shapes. (*Id.*)

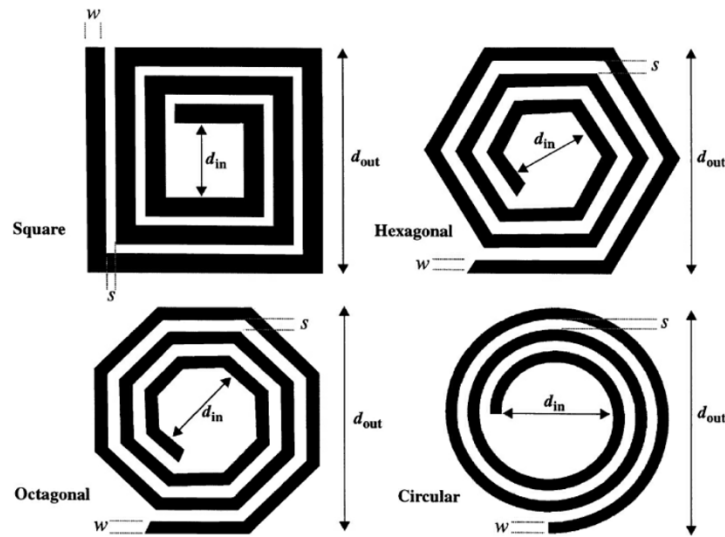


FIGURE 4.21. Planar spiral inductors.

(*Id.*, FIGURE 4.21.)

In view of Lee, octagonal inductor structures were well known in the art at the time of the alleged invention and were widely used in RF apparatuses. (Ex. 1002, ¶¶99.) Marques and Lee are references in the same field and both disclose inductor structures in the context of RF apparatuses. (*Id.*) Therefore, a POSITA would have found it obvious to modify the hexagonal structure of Marques Figure 6 to an octagonal structure based on desired design features of the circuit or personal preference. (*Id.*)

2. Claim 11

(a) “A differential low noise amplifier comprising:”

To the extent that the preamble is limiting, Marques in view of Lee discloses or suggests this claim feature. (*Id.*, ¶¶100-102.) While Marques discusses the use of inductors in various circuitry, Marques does not explicitly disclose using its inductor structure in a differential low noise amplifier. (Ex. 1005, 1:20-32.) However, Lee discloses in annotated Figure 12.10 below, a differential low noise amplifier (DLNA) schematic. (Ex. 1007, 388.)

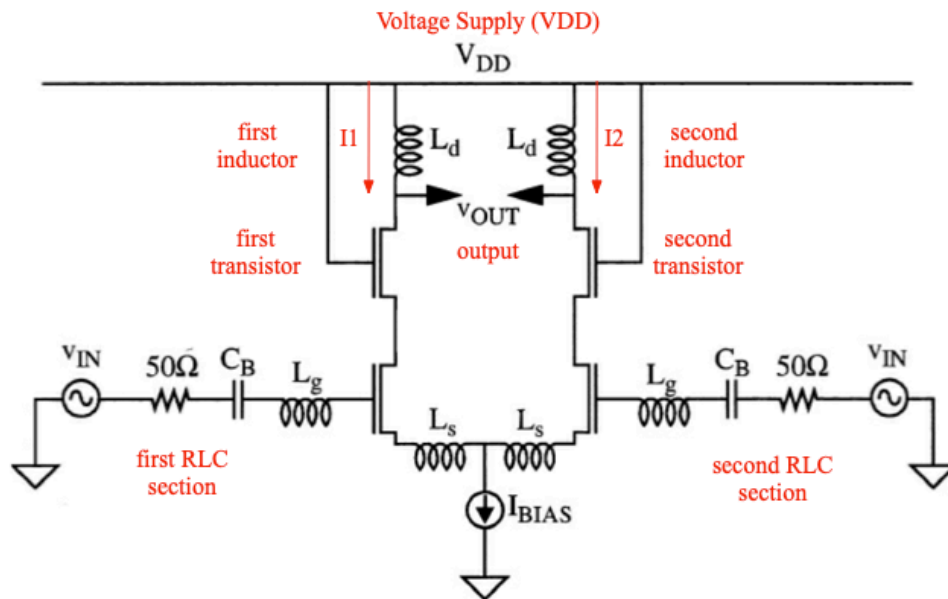


FIGURE 12.10. Differential LNA (simplified).

(*Id.*, FIGURE 12.10 (annotated).)

In fact, the '330 Patent discloses the above circuit diagram as Prior Art Figure 2 and discusses the motivation for using an inductor structure with magnetic field cancellation in a DLNA. (Ex. 1001, 1:60-65, 2:43-48 (“Because this invention minimizes the crosstalk between inductors placed in close proximity to each other, the overall chip geometry may be reduced and component density improved. In implementations such as a DLNA, the counter wound inductor design having a common node may be utilized.”).)

Marques includes similar motivation for reducing parasitic interference in any desired application by at least partially canceling magnetic fields. (Ex. 1005, 2:38-66, 3:20-23; Ex. 1002, ¶102.) Because DLNAs include closely positioned inductors and Lee describes parasitic inductance as a known issue, a POSITA would have been motivated to combine the inductor structure of Marques into the known DLNA structure disclosed by Lee in order to reduce parasitic interference between inductors. (Ex. 1007, 270, 388; Ex. 1002, ¶102.)

(b) “a voltage supply that generates a first current and a second current;”

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶103.) Lee discloses in annotated Figure 12.10 above, a voltage source (VDD). (Ex. 1007, 388.) The voltage source connected to two parallel inductors as

shown in annotated Figure 12.10 above will provide a first current (I1) through the first inductor and a second current (I2) through the second inductor. (Ex. 1002, ¶103.) Therefore, the voltage source of Lee supplies a first and second current.

(c) **“a first inductor coil, coupled to the voltage supply and to a first transistor, that communicates the first current in a first direction and generates a first magnetic field;”**

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶¶104-105.) Lee discloses in annotated Figure 12.10 above, a first inductor coil coupled to the voltage source (VDD) and to a first transistor. (Ex. 1007, 388.)

Marques discloses in annotated Figure 7 below, a first inductor 16 that communicates a first current I1 in a first direction (shown here as counterclockwise) that generates a magnetic field (shown as an orange dot indicating a magnetic field going out of the page). (Ex. 1002, 105; Ex. 1005, 5:41-51.) A POSITA would have been motivated to combine the inductor structure of Marques into the known DLNA schematic of Lee in order to reduce parasitic interference due to the closely positioned inductors in Lee. (Ex. 1002, ¶105.)

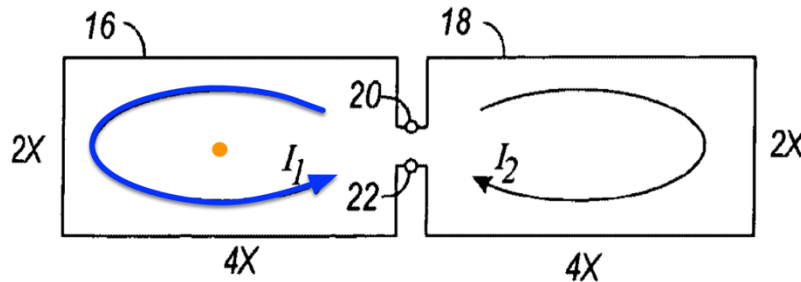


FIG. 7

(Ex. 1005, FIG. 7 (annotated).)

- (d) “a second inductor coil, coupled to the voltage supply, a second transistor, and in parallel with the first inductor coil, that communicates the second current in a second direction that is opposite to the first direction and generates a second magnetic field having an opposing orientation to the first magnetic field;”

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶¶106-108.) Lee discloses in annotated Figure 12.10 above, a second inductor coil coupled to the voltage source (VDD), a second transistor, and in parallel with the first inductor coil. (Ex. 1007, 388.)

Marques discloses in annotated Figure 7 below, a first inductor 16 in parallel with a second inductor 18 where the second inductor 18 communicates a second current I_2 in a second direction (shown here as clockwise) that generates a magnetic field (shown here as a purple “x” going into the plane of the paper whereas the

magnetic field of the first inductor 16 is going out of the plane of the paper as shown by the orange dot). (Ex. 1002, ¶107; Ex. 1005, 6:5-10.)

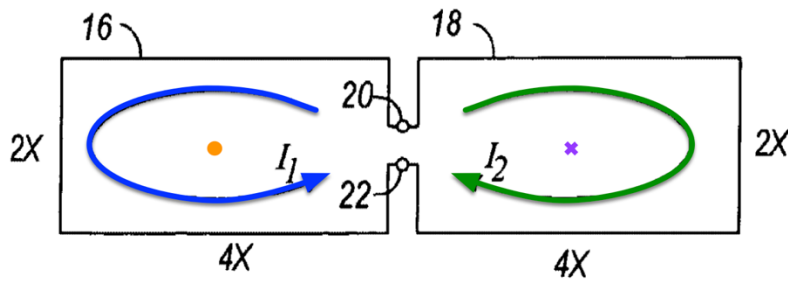
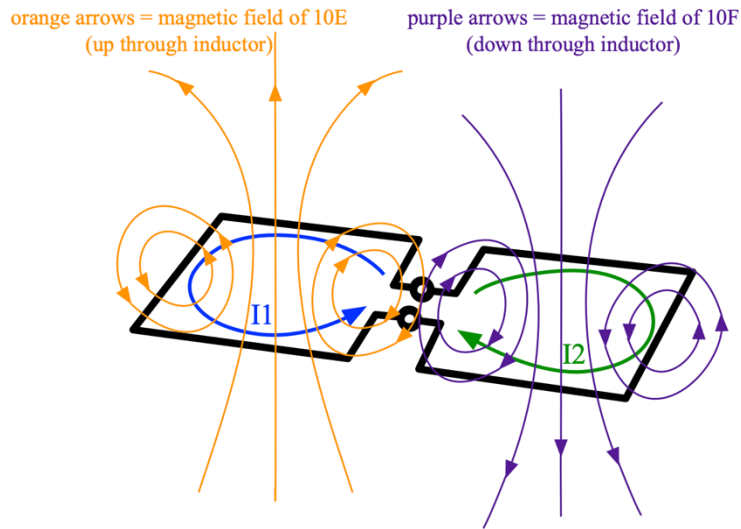


FIG. 7

(Ex. 1005, FIG. 7 (annotated).)

Figure 7 of Marques is redrawn and annotated below with the parallel inductor structure at an angle to show magnetic field lines. (Ex. 1002, ¶108.) The second inductor 18 communicates a second current I_2 in a second direction (i.e., clockwise) that generates a magnetic field (purple lines) going downward through the second inductor whereas the first current I_1 is in a first direction (i.e., counterclockwise) through the first inductor 18 and generates a magnetic field (orange lines) going up out of the first inductor 16. (Ex. 1002, ¶108; Ex. 1005, 6:5-10.) A POSITA would have been motivated to use the inductor structure of Marques in the DLNA of Lee in order to reduce interference between closely positioned inductors. (Ex. 1002, ¶108.)



(Ex. 1005, FIG. 7 (redrawn, annotated).)

(e) “a first RLC section that is coupled to the first inductor coil;”

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶109.) Lee discloses in annotated Figure 12.10 below, a first RLC section coupled (via intermediary components) to the first inductor coil. (Ex. 1007, 388.)

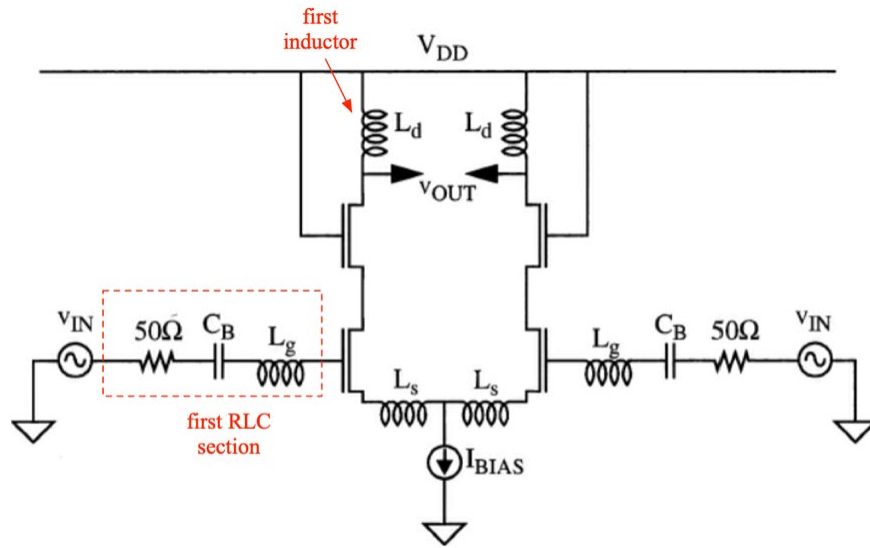


FIGURE 12.10. Differential LNA (simplified).

(*Id.*, Figure 12.10 (annotated).)

(f) “a second RLC section that is coupled to the second inductor coil;”

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶110.) Lee discloses in annotated Figure 12.10 below, a second RLC section coupled (via intermediary components) to the second inductor coil. (Ex. 1007, 388.)

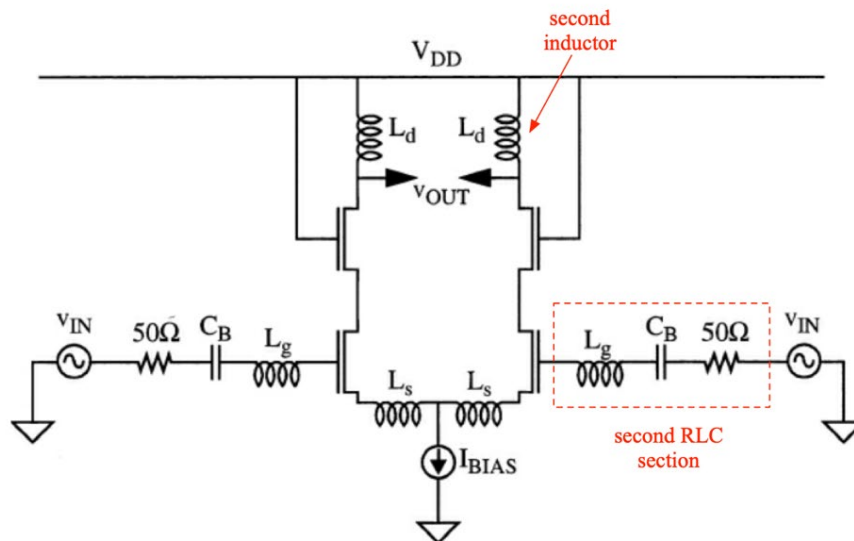


FIGURE 12.10. Differential LNA (simplified).

(*Id.*, Figure 12.10 (annotated).)

(g) “an output that is coupled to the first inductor coil, the second inductor coil, the first transistor, and the second transistor.”

Marques in combination with Lee discloses or suggests this claim feature.

(Ex. 1002, ¶111.) Lee discloses in annotated Figure 12.10 below, an output (V_{out}) coupled to the first inductor coil, the second inductor coil, the first transistor, and the second transistor. (Ex. 1007, 388.)

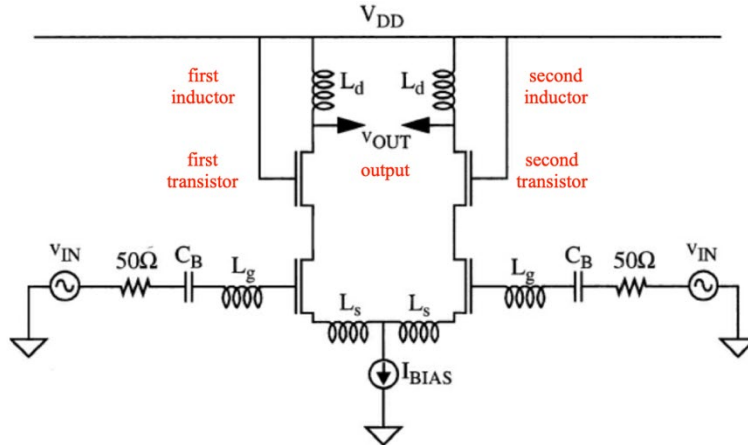


FIGURE 12.10. Differential LNA (simplified).

(*Id.*, Figure 12.10 (annotated).)

3. Claim 12

- (a) “The amplifier of claim 11 wherein a first polarity of the first inductor coil is opposite to a second polarity of the second inductor coil.”

Marques in combination with Lee discloses or suggests this claim feature. (Ex. 1002, ¶112.) The polarity of an inductor is a reference to indicate the direction of current flow. (*Id.*) With this understanding, Marques discloses in annotated Figure 7 above a first polarity of the first inductor 16 is opposite to a second polarity of the second inductor coil 18 due to the opposite flow of current in each inductor. (Ex. 1005, 6:5-10; Ex. 1002, ¶112.) A POSITA would have been motivated to use the inductor structure of Marques in the DLNA of Lee in order to reduce interference between closely positioned inductors. (Ex. 1002, ¶112.)

4. Claim 13

- (a) “The amplifier of claim 11 wherein the first and second inductor coils are spiral structured.”

Marques in combination with Lee discloses or suggests this claim feature. (*Id.*, ¶¶113-114.) Marques discloses in annotated Figure 7 above rectangular spiral inductor coils. (Ex. 1005, Figure 7.) Further, Lee discloses that “the most widely used on-chip inductor is the planar spiral, which can assume many shapes.” (Ex. 1007, 136.) Common inductor spiral shapes are shown in Lee’s Figure 4.21 below which includes a square shape as an example of a spiral. (*Id.*, 137.)

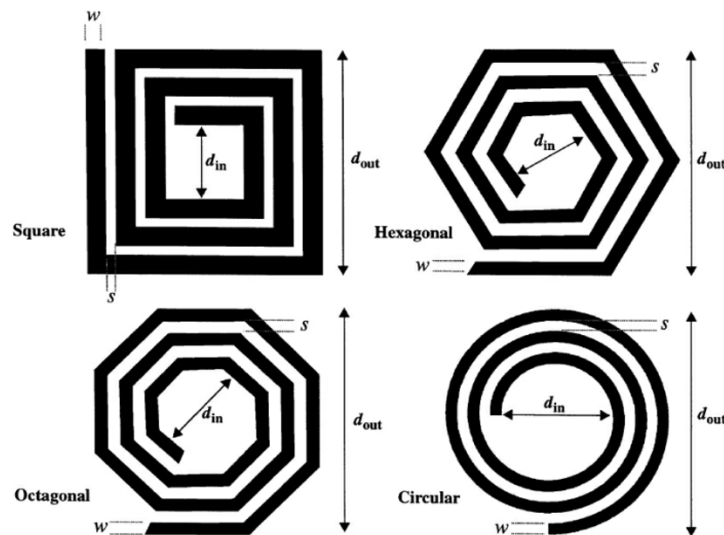


FIGURE 4.21. Planar spiral inductors.

(*Id.*, FIGURE 4.21.)

Spiral inductor structures were well known to persons of ordinary skill in the art and were widely used in RF apparatuses. (Ex. 1002, ¶114.) A POSITA would have been motivated to adjust the spiral structure of Marques to any common spiral structure of Lee based on desired design features of the circuit or personal preference. (*Id.*)

5. Claim 14

(a) “The amplifier of claim 11 wherein the first and second inductor coils are octagonal structured.”

Marques in combination with Lee discloses or suggests this claim feature. (*Id.*, ¶¶115-116.) Marques discloses in annotated Figure 7 above rectangular spiral inductor coils. (Ex. 1005, Figure 7.) Further, Lee discloses that “the most widely used on-chip inductor is the planar spiral, which can assume many shapes.” (Ex. 1007, 136.) Common inductor spiral shapes are shown in Lee’s Figure 4.21 above which includes an octagonal shape. (*Id.*, 137.) Lee further discloses that the choice of shape is more often made on the basis of convenience or habit than anything else. (*Id.*, 136.) Therefore, a POSITA could look to Lee to adjust the spiral structure of Marques to any common spiral structure such as octagonal based on desired design features of the circuit or personal preference. (Ex. 1002, ¶116.)

6. Claim 15

- (a) “The amplifier of claim 11 wherein a change in magnitude of the first magnetic field causes a change in magnitude of the second magnetic field.”**

Marques in combination with Lee discloses or suggests this claim feature. (*Id.*, ¶117.) As discussed previously, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) In order to change the first magnetic field, the first current would need to change, meaning the voltage source supply would change. (*Id.*, ¶117.) With a change in the voltage supply, the second current would also change causing a change in the second magnetic field. (*Id.*)

7. Claim 16

- (a) “The amplifier of claim 1 wherein a change in magnitude of the second magnetic field causes a change in magnitude of the first magnetic field.”**

Marques in combination with Lee discloses or suggests this claim feature. (*Id.*, ¶118.) Similar to the reasoning above, in order to change the second magnetic field, the second current would need to change, meaning the voltage source supply would change. (*Id.*, ¶32, ¶118.) With a change in the voltage supply, the first current would also change causing a change in the first magnetic field. (*Id.*, ¶118.)

8. Claim 19

- (a) “The method of claim 17 wherein the first and second magnetic coils are structured in an octagonal configuration.”**

Marques in combination with Lee discloses or suggests this claim feature. (*Id.*, ¶¶119-120.) Marques discloses in Figure 6 above, a first and second inductor having a hexagonal shape. (Ex. 1005, 5:29-30.) Lee discloses that “the most widely used on-chip inductor is the planar spiral, which can assume many shapes.” (Ex. 1007, 136.) Common inductor spiral shapes are shown in Lee’s Figure 4.21 above which includes an octagonal shape. (*Id.*, 137.) Lee further discloses that the choice of shape is more often made on the basis of convenience or habit than anything else. (*Id.*, 136.)

As such, a POSITA could look to Lee to adjust the inductor structure of Marques Figure 6 to an octagonal structure based on desired design features of the circuit or personal preference. (Ex. 1002, ¶120.)

D. Ground 4 – Menegoli Anticipates Claims 1, 2, 4, 5, and 7-10

As shown in detail below, Menegoli discloses all of the features recited in claims 1, 2, 4, 5, and 7-10 of the ’330 Patent. (Ex. 1002, ¶¶121-137.)

1. Claim 1

(a) “A multiple inductor array comprising:”

To the extent that the preamble is limiting, Menegoli discloses this claim feature. (*Id.*, ¶122.) Menegoli discloses a structure including two or four inductors. (Ex. 1008, 5:44-46 (“an inductor can be formed as a series of two inductors”), 7:38-39 (“FIG. 5 shows an array of four planar spiral inductors”).) As such, Menegoli discloses a multiple inductor array.

(b) “a first node that receives a first current and a second current;”

Menegoli discloses this claim feature. (Ex. 1002, ¶123.) Menegoli discloses in annotated Figure 2A below, a common node between series coupled inductors La and Lb where current (I1) is flowing clockwise in inductor La, and current (I2) is flowing counterclockwise in inductor Lb. (Ex. 1002, 123; Ex. 1008, 8:16-24.) A series connection is defined by two branches joined by a common node. (Ex. 1002, ¶123.) Therefore, the (common) first node between inductors La and Lb can be viewed as the point where I1 and I2 meet (i.e., the first node receives a first and second current). (*Id.*)

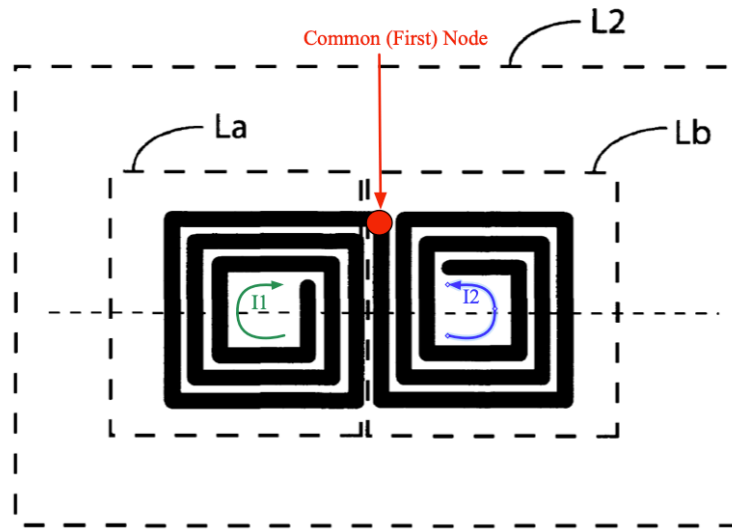


FIG.2A

(Ex. 1008, FIG. 2A (annotated).)

- (c) “a first inductor coil, coupled to the first node and to a second node, that communicates the first current in a clockwise direction and generates a first magnetic field;”

Menegoli discloses this claim feature. (Ex. 1002, ¶¶124-126.) Menegoli discloses in annotated Figure 2A below, a first inductor La coupled to the first node and to a second node due to the series connection of two inductors La and Lb. (Ex. 1002, ¶124; Ex. 1008, 8:16-22.)

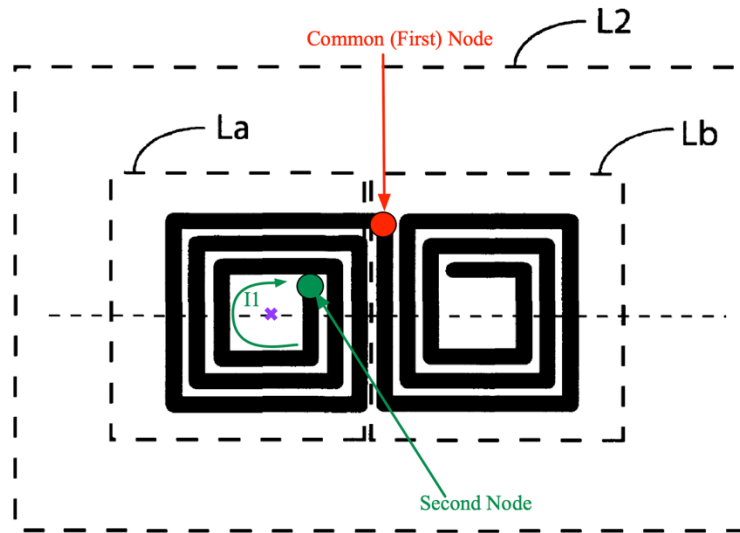
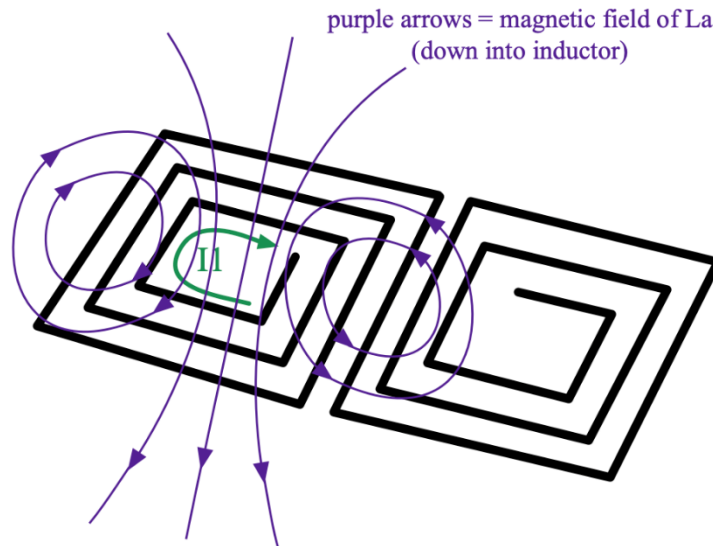


FIG.2A

(Ex. 1008, FIG. 2A (annotated).)

Menegoli discloses that the two adjacent inductors have anti-phase magnetic fields. (*Id.*, 8:40-41.) Menegoli further discloses that if the current is flowing clockwise in inductor La, then the current flows counterclockwise in inductor Lb current such that the radiated energy is contained. (*Id.*, 8:18-22, 8:31-33.) As such, the current I1 flowing in inductor La generates a magnetic field (i.e., a first magnetic field) directed into the plane of the paper (as indicated by the purple “x” in annotated Figure 2A above). (Ex. 1002, ¶125.)

Menegoli Figure 2A has been redrawn below to show the inductor structure at an angle to view magnetic field lines. (Ex. 1002, ¶126.) As shown, the clockwise current I1 in inductor La generates a magnetic field (purple arrows) flowing down into the inductor. (*Id.*)



(Ex. 1008, FIG. 2A (redrawn, annotated); Ex. 1002, ¶126.)

- (d) “a second inductor coil, coupled to the first node and to a third node, that communicates the second current in a counter clockwise direction and generates a second magnetic field having an opposing orientation to the first magnetic field; and”

Menegoli discloses this claim feature. (Ex. 1002, ¶¶127-129.) Menegoli discloses in annotated Figure 2A below, a second inductor Lb coupled to the first node (as discussed above, there is a common node between the first and second inductors) and to a third node due to the series connection of two inductors La and Lb. (Ex. 1002, ¶127; Ex. 1008, 8:16-22.)

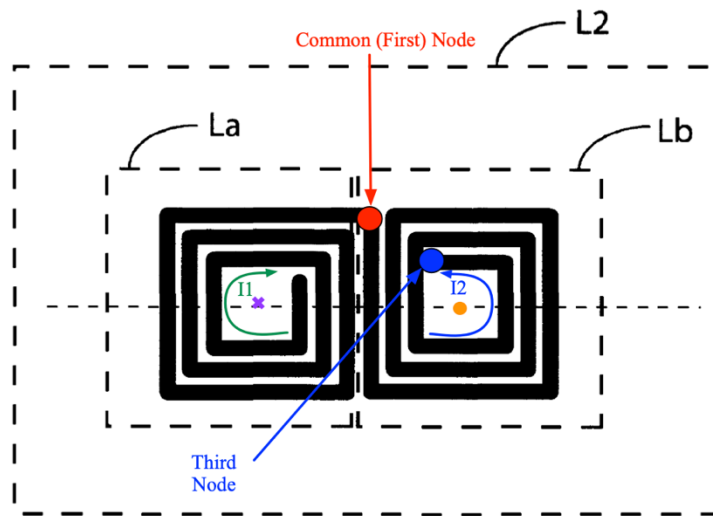


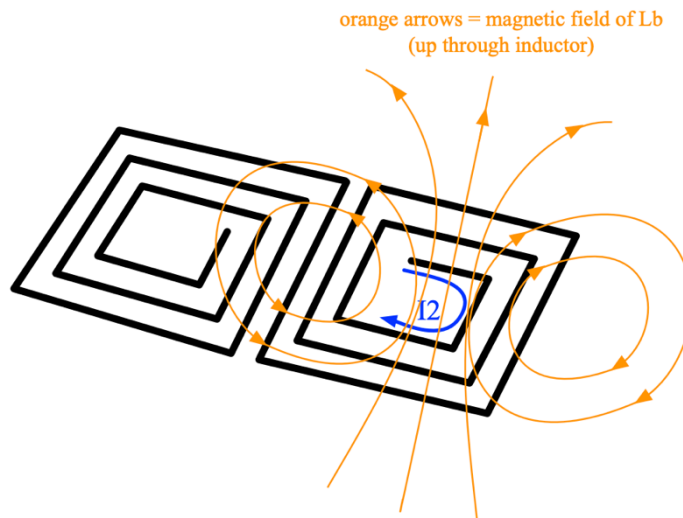
FIG.2A

(Ex. 1008, FIG. 2A (annotated).)

Menegoli discloses that the two adjacent inductors have anti-phase magnetic fields. (*Id.*, 8:40-41.) Menegoli further discloses that if the current is flowing clockwise in inductor La, then the current flows counterclockwise in inductor Lb current such that the radiated energy is contained. (*Id.*, 8:18-22, 8:31-33.) As such, the current I2 flowing in inductor Lb generates a magnetic field (i.e., a second magnetic field) directed out of the plane of the paper (as indicated by the orange dot). (Ex. 1002, ¶128.)

Menegoli Figure 2A has been redrawn below to show the inductor structure at an angle to view magnetic field lines. (Ex. 1002, ¶129.) As shown, the counterclockwise current I2 in inductor Lb generates a magnetic field (orange

arrows) flowing upwards out through the inductor. (*Id.*) As such, Menegoli discloses a second inductor coil coupled to a first and third node that communicates the second current in a counterclockwise direction and generates a second magnetic field having an opposing orientation to the first magnetic field. (*Id.*)

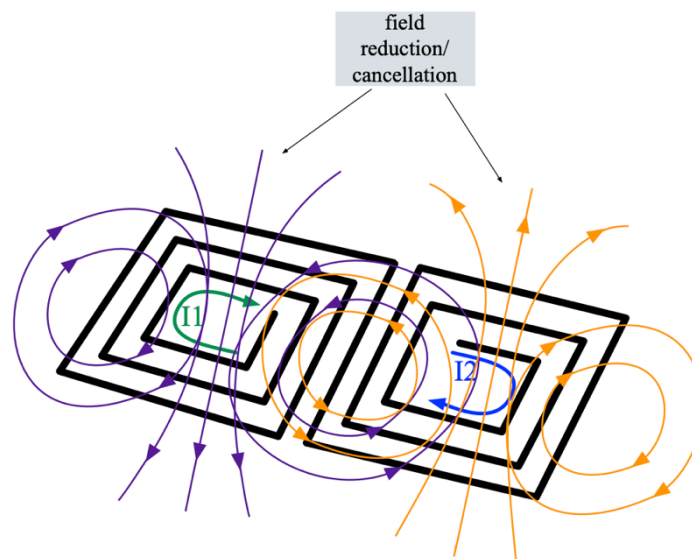


(Ex. 1008, FIG. 2A (redrawn, annotated); Ex. 1002, ¶129.)

(e) “wherein the first magnetic field and the second magnetic field at least partially cancel at an interference point.”

Menegoli discloses this claim feature. (Ex. 1002, ¶¶130.) Menegoli discloses that if two inductors with anti-phase magnetic fields are adjacent to each other, a portion of the magnetic field of the other and the total resultant magnetic field around the inductors is reduced. (Ex. 1008, 5:38-43.) Therefore, Menegoli discloses a first

and second magnetic field that cancel at an interference point (e.g., a point around the inductors). (Ex. 1002, ¶130.) As illustrated in redrawn, annotated Figure 2A below, at least a portion of the opposing magnetic fields in inductors La and Lb will cancel based on the interference of the oppositely oriented fields. (*Id.*)



(Ex. 1008, FIG. 2A (redrawn, annotated); Ex. 1002, 130.)

2. Claim 2

- (a) **“The array of claim 1 wherein the first inductor coil and the second inductor coil are spiral structures.”**

Menegoli discloses this claim feature. (Ex. 1002, ¶131.) Menegoli discloses in annotated Figures 2A above, a series connection of two spiral inductors. (Ex. 1008, 8:15-16.) Therefore, Menegoli discloses that first and second inductor coils are spiral structures. (Ex. 1002, ¶131.)

3. Claim 4

- (a) “The array of claim 1 wherein a change in magnitude of the first magnetic field causes a change in magnitude of the second magnetic field.”**

Menegoli inherently discloses this claim feature. (Ex. 1002, ¶132.) As discussed in the technical background section of Dr. Kiaei’s Declaration, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Therefore, because current flows through inductors La and Lb (as shown in annotated Figure 2A above), a change in the current would change the magnetic fields produced by both inductors. (*Id.*, ¶132.) To cause a change in the first magnetic field, a change in current applied to the entire structure would need to occur which would cause a change in the second magnetic field as well. (*Id.*)

4. Claim 5

- (a) “The array of claim 1 wherein a change in magnitude of the second magnetic field causes a change in magnitude of the first magnetic field.”**

Menegoli inherently discloses this claim feature. (*Id.*, ¶133.) As discussed above, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Therefore, because current flows through inductors La and Lb (as shown in annotated Figure 2A above), a change in the

current would change the magnetic fields produced by both inductors. (*Id.*, ¶133.) To cause a change in the second magnetic field, a change in current applied to the entire structure would need to occur which would cause a change in the first magnetic field as well. (*Id.*)

5. Claim 7

(a) “The array of claim 1 wherein the first and second currents flow in opposing directions.”

Menegoli discloses this claim feature. (*Id.*, ¶134.) Menegoli discloses that the structure includes two spiral formed interconnection structures La and Lb where when the current is flowing clockwise in spiral inductor La, the current is flowing counter-clockwise into the spiral inductor Lb.” (Ex. 1008, 8:18-21.) As such, Menegoli discloses that first and second currents flow in opposing directions. (Ex. 1002, ¶134.)

6. Claim 8

- (a) “The array of claim 1 wherein the magnitudes of the first and second currents are related so that a change in the first current causes a corresponding change in the second current in order to cause a reactionary interference cancellation.”**

Menegoli inherently discloses this claim feature. (*Id.*, ¶135.) As discussed above, when a current flows through an inductor, a magnetic field proportional to the current is produced. (*Id.*, ¶32.) Because current flows through inductors La and Lb (as currents I1 and I2 in annotated Figure 2A above), a change in current to the structure would change both the first and second currents through the inductors. (*Id.*, ¶135.) Therefore, to change the current through one inductor, a change in current needs to occur which ultimately changes the current in the other inductor and produces opposing magnetic fields proportional to the new current (i.e., reactionary interference cancellation). (*Id.*)

7. Claim 9

- (a) “The array of claim 1 further comprising a third inductor coil that generates a third magnetic field that cancels at least a portion of the first magnetic field.”**

Menegoli discloses this claim feature. (*Id.*, ¶136.) Menegoli discloses in Figure 5 below, four planar spiral inductors electrically connected in series to form alternate phase magnetic fields. (Ex. 1008, 9:45-48.) Menegoli further discloses that the combination of the alternate magnetic fields (indicated in Figure 5 as N for North and S for South) reduces undesirable stray magnetic fields. (*Id.*) Therefore, if the first inductor coil is the inductor coil on the top left of Figure 5 below with the South magnetic field orientation, then the third inductor coil is the bottom left inductor coil with the North magnetic field orientation (i.e., where the third magnetic field cancels at least a portion of the first magnetic field by being anti-phase). (Ex. 1002, ¶136.)

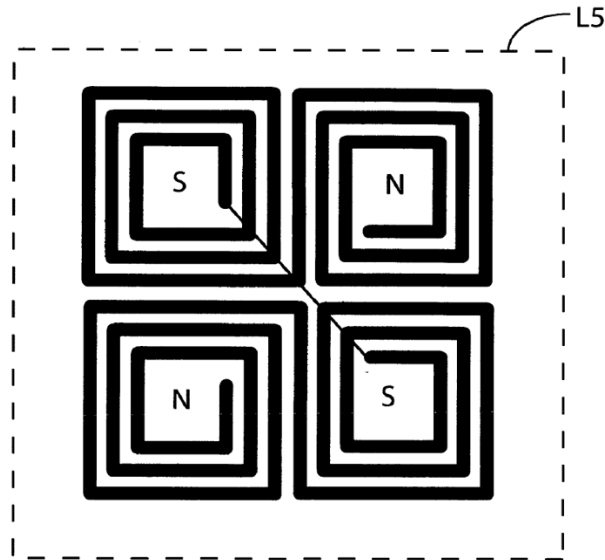


FIG.5

(Ex. 1008, FIG. 5.)

8. Claim 10

- (a) “The array of claim 1 further comprising a third inductor coil that generates a third magnetic field that cancels at least a portion of the second magnetic field.”**

Menegoli discloses this claim feature. (Ex. 1002, ¶137.) Menegoli discloses in Figure 5 above, an array of four planar spiral inductors electrically connected in series to form alternate phase magnetic fields. (Ex. 1008, 9:45-48.) Menegoli further discloses that the combination of the alternate magnetic fields (indicated in Figure 5 as N for North and S for South) improves undesirable stray magnetic fields. (*Id.*) Therefore, if the second inductor coil is the inductor coil on the top right of

Figure 5 above with the North magnetic field orientation, then the third inductor coil is the bottom right inductor coil with the South magnetic field orientation (i.e., where the third magnetic field cancels at least a portion of the second magnetic field by being anti-phase). (Ex. 1002, ¶137.)

E. Ground 5 – Menegoli Renders Claim 3 Obvious

While the limitations of claim 3 are not explicitly disclosed by Menegoli, the differences between Claim 3 and Menegoli are such that the claimed invention as a whole would have been obvious before the time of the alleged invention to a POSITA. (*Id.*, ¶¶138-142.)

Menegoli is analogous art to the '330 Patent because Menegoli and the '330 Patent are in the same field of endeavor. (*Id.*, ¶139.) Menegoli discloses an inductor structure that eliminates magnetic losses when driven at a high frequency. (Ex. 1008, 5:23-43.) Similarly, the '330 Patent discloses an inductor design to be used in high frequency applications where magnetic fields at least partially cancel at an interference point. (Ex. 1001, 1:17-36, 2:16-30.)

A POSITA would have been motivated to modify the shape of the inductor structure of Menegoli based on what was generally known in the art at the time of the alleged invention and would have done so with a reasonable expectation of success. (Ex. 1002, ¶140.) Menegoli discloses that the conventional means of

creating an inductor in an integrated circuit is the spiral inductor. (Ex. 1008, 3:16-18.) Menegoli further discloses that the length, shape, and number of spiral turns of the planar spiral inductors may vary without modifying the spirit and scope of the invention. (*Id.*, 9:59-10:3.) Further, the goal of Menegoli is to reduce stray magnetic fields while increasing mutual inductance. (*Id.*, 5:30-55.) Because an octagonal structure has better inductance than a square, a POSITA would have been motivated to improve the inductance of Menegoli by adjusting the shape of the inductors from a square to an octagon. (Ex. 1002, ¶140.) Planar spiral inductor shapes were well known in the art and usually selected based on personal preference or design tools. (*Id.*) A shape modification may result in a slight performance improvement and therefore adjusting the shape to improve performance or enhance convenience would result in a reasonable expectation of success. (*Id.*)

Further, courts typically find shape modifications without clear significance to be obvious. *See In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (holding that the configuration of the claimed disposable plastic nursing container was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.) The '330 Patent discloses that the “inductors may be provided in various forms such as conventional octagonal and conventional spiral structures.”

(Ex. 1001, 2:39-41.) The '330 Patent further discloses that the “octagonal spiral may be implemented to reduce the complexity of manufacturing.” (*Id.*, 5:20-21.) Therefore, the disclosure of the '330 Patent does not state a specific significance of the octagonal inductor shape other than its use may reduce complexity.

1. Claim 3

(a) “The array of claim 1 wherein the first inductor coil and the second inductor coil are octagonal structures.”

Menegoli discloses or suggests this claim feature. (Ex. 1002, ¶141.) As discussed above, inductor coils having octagonal structures were widely known to a POSITA at the time of the alleged invention. (*Id.*) Octagonal and circular spirals are favored planar spiral shapes with slightly better performance than other shapes. (*Id.*) In light of the reasoning above, a POSITA would find it obvious to adjust the square spiral structures of Menegoli to an octagonal structure based on desired design features of the circuit, layout tools, and/or performance requirements. (*Id.*)

F. Ground 6 – Menegoli in View of Lee Renders Claim 3 Obvious

As shown in detail below, Menegoli in combination with Lee discloses or suggests the features recited in claim 3. (Ex. 1002, ¶¶143-149.) As discussed above, Menegoli is analogous art to the '330 Patent because Menegoli and the '330 Patent are in the same field of endeavor. (*Id.*, ¶143.) Menegoli discloses an inductor

structure that eliminates magnetic losses when driven at a high frequency. (Ex. 1008, 5:23-43.) Similarly, the '330 Patent discloses an inductor design to be used in high frequency applications where magnetic fields at least partially cancel at an interference point. (Ex. 1001, 1:17-36, 2:16-30.)

Lee is also analogous art to the '330 Patent because Lee and the '330 Patent are in the same field of endeavor. (Ex. 1002, ¶144.) Lee provides discussion and schematics for common IC components and circuitry such as differential low noise amplifiers (DLNAs) at the time of the alleged invention. (Ex. 1002, ¶144; Ex. 1007, 136-137, 388.) Lee discusses that high frequency amplifiers face serious constraints due to “ever-present parasitic capacitances and inductances.” (Ex. 1002, ¶144; Ex. 1007, 270.) Similarly, the '330 Patent discloses that the impact of cross-coupling or crosstalk is a more significant issue in circuits operating at high frequencies. (Ex. 1002, ¶144; Ex. 1001, 1:16-21.) The counter wound inductor structure of the '330 Patent may be used in a DLNA to minimize crosstalk and maintain the reliability of the circuit. (Ex. 1002, ¶144; Ex. 1001, 2:42-50.)

A POSITA would have been motivated to modify Menegoli in view of Lee and would have done so with a reasonable expectation of success. (Ex. 1002, ¶145.) Menegoli discloses that the conventional means of creating an inductor in an integrated circuit is the spiral inductor. (Ex. 1008, 3:16-18.) Menegoli further

discloses that the length, shape, and number of spiral turns of the planar spiral inductors may vary without modifying the spirit and scope of the invention. (*Id.*, 9:59-10:3.) Further, the goal of Menegoli is to reduce stray magnetic fields while increasing mutual inductance. (*Id.*, 5:30-55.) Lee discloses that an octagonal structure has better inductance than a square and that planar spiral inductor shapes were well known in the art and usually selected based on personal preference or design tools. (Ex. 1007, 136.). As such, a POSITA would have been motivated to improve the inductance of Menegoli by adjusting the shape of the inductors from a square to an octagon as discussed by Lee. (Ex. 1002, ¶145.) A shape modification may result in a slight performance improvement and therefore adjusting the shape to improve performance or enhance convenience would result in a reasonable expectation of success. (*Id.*)

A POSITA would have a reasonable expectation of success in modifying the inductor structure of Menegoli in accordance with common inductor structures of Lee because doing so would improve aspects of Menegoli and/or provide convenience to a circuit designer. (Ex. 1002, ¶146.) Therefore, a POSITA would have been motivated to combine the known inductor shapes of Lee into the circuitry of Menegoli in order to improve the inductor structure of Menegoli. (*Id.*)

1. Claim 3

- (a) “The array of claim 1 wherein the first inductor coil and the second inductor coil are octagonal structures.”**

While Menegoli in combination with what was known by a POSITA at the time of the alleged invention renders claim 3 obvious as discussed above, Menegoli in combination with Lee also discloses or suggests this claim feature. (Ex. 1002, ¶¶147-149.) While Menegoli does not explicitly disclose inductors having an octagonal structure, Lee discloses that “the most widely used on-chip inductor is the planar spiral, which can assume many shapes.” (Ex. 1007, 136.) Common inductor spiral shapes are shown in Lee’s Figure 4.21 below which includes an octagonal shape. (*Id.*, 137.) Lee further discloses that the choice of shape is more often made on the basis of convenience or habit than anything else. (*Id.*, 136.)

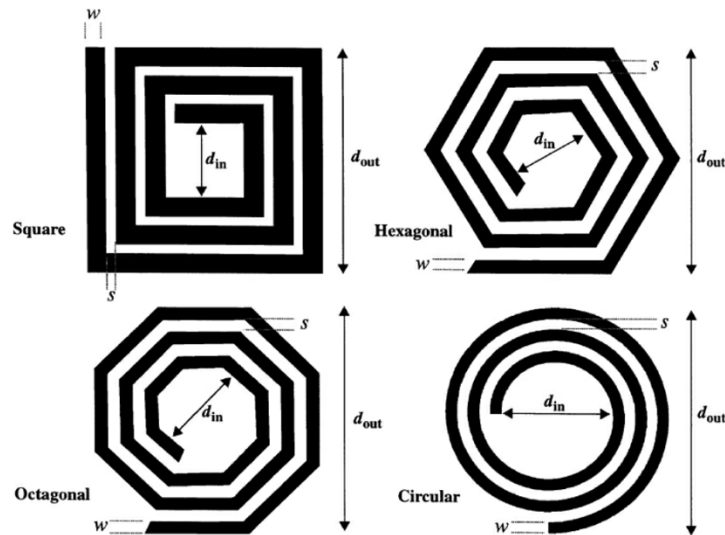


FIGURE 4.21. Planar spiral inductors.

(*Id.*, FIGURE 4.21.)

Lee further discloses that the octagonal spirals are moderately better (i.e., have better inductance) than squares. (*Id.*, 136.) The goal of Menegoli is to reduce stray magnetic fields while increasing mutual inductance. (Ex. 1008, 5:30-55.) Because an octagonal structure has better inductance than a square, a POSITA would have been motivated to improve the inductance of Menegoli by adjusting the shape of the inductors from a square to an octagon. (Ex. 1002, ¶148.)

X. DISCRETIONARY DENIAL IS NOT APPROPRIATE

A. The Board Should Not Deny Institution Under *Fintiv*

The merits of Petitioner's arguments are compelling and the evidence in support is substantial. That "alone demonstrates that the PTAB should not

discretionarily deny institution under *Fintiv*.” (Ex. 1010 at 4-5³.) The six *Fintiv* factors do not justify denying institution.

The **first factor** is neutral because NXP has not yet moved to stay the district court proceeding. *See, e.g., 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** weighs against denial. Jury Trial is set for August 20, 2024 (Ex. 1011). However, on June 23, 2023, the co-pending Central District of California lawsuit was reassigned to the Honorable Hernan D. Vera, which more than likely will result in delay of the Jury trial (Ex. 1012). Therefore, it is likely that the trial will occur after the FWD in this IPR, which is expected prior to the end of October 2024. Further, the discovery has been very limited to date with no depositions taken. Even if the trial proceeds in August 2024, which it likely will not, the above timing does not tip in favor of denying the petition in this case. *See also, e.g., Apple Inc. v. Aire Tech. Ltd.*, IPR2022-01135, Paper 11 at 5-6 (PTAB Jan. 4, 2023).

³ Citations are to page numbers of Memorandum from Director Vidal (dated June 21, 2022) that are on the bottom of each page.

The **third factor** weighs strongly against denial. Defendant served its initial infringement contentions on May 17, 2023. Petitioner's diligence in pursuing this petition less than 5 months after receiving the infringement contentions weighs in favor of institution. *Facebook, Inc. v. USC IP P'ship, L.P.*, IPR2021-00033, Paper 13 at 13 (PTAB April 30, 2021) (finding it was reasonable for Petitioner to wait to file the Petition until shortly after receiving infringement contentions).

The **fourth factor** weighs strongly against denial. This Petition challenges claims 1-20 of the '330 patent. Only claims 1, 2, and 7 of the '330 Patent are asserted against Petitioner in district court. (Ex. 1013). This IPR petition is thus the only venue in which invalidity challenges of claims 3-6 and 8-20 of the '330 Patent will be adjudicated, which promotes system efficiency. *See Fintiv*, Paper 11 at 4. Accordingly, this factor weighs against denial. *See, e.g., Vudu, Inc. v. Ideahub, Inc.*, IPR2020-01688, Paper 16 at 14-15 (PTAB April 19, 2021).

Regarding the **fifth factor**, the Board should give no weight to the fact that Petitioner and Patent Owner 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).

The **sixth factor** (other circumstances) weighs heavily against denial. Lee was cited in a reference considered during prosecution of the '330 Patent. However, Lee itself was not considered by the Examiner. Lee is also used only as a secondary

reference to prior art references that were not considered during prosecution of the '330 Patent.

B. The Board Should Not Deny Institution Under § 325(d)

Other than the inclusion of Lee in Examiner cited reference Eid, none of the prior art cited herein was explicitly considered as prior art by the Patent Office during prosecution of the '330 Patent. (Ex. 1001, Cover (“References Cited” section.)) Even if Lee could be considered as relied upon by the Examiner during prosecution, the Examiner did not rely on any of the *combinations* of the prior art present in the Petition. *See, e.g., Halliburton Energy Services, Inc. v. US Well Services, LLC*, IPR2021-01036, Paper 12 at 20 (PTAB Jan. 19, 2022) (granting institution when the Examiner cited a reference in a rejection during prosecution, but the Petition set forth “obviousness grounds based on combinations of [the reference] with other prior art not considered by the Examiner”).

Lee was never combined with Marques or Menegoli during prosecution, as presented in the Petition. (*See generally* Ex. 1004.) *See Cont’l Auto. Sys.*, IPR2021-0322, Paper 7 at 19. Petitioner is not asking the Office to reconsider any arguments made by the Examiner. Petitioner also presents additional evidence and analysis in the Petition that were not before the Examiner, including the Declaration of Dr. Sayfe Kiaei (Ex. 1002).

Under these circumstances, Petitioner respectfully submit that denial of institution under § 325(d) would not be appropriate.

XI. CONCLUSION

For the foregoing reasons, Petitioner requests IPR and cancellation of claims 1-20 of the '330 Patent.

Respectfully Submitted,

Dated: November 7, 2023

By: /Patricia M. Healy/

Patricia M. Healy (Reg. No. 73,072)
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 7,535,330 contains, as measured by the word processing system used to prepare this paper, 11,201 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: November 7, 2023

By: /Patricia M. Healy/

Patricia M. Healy (Reg. No. 73,072)
Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify that on November 6, 2023, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 7,535,330 and supporting exhibits to be served via Priority Mail Express on the Patent Owner at the following correspondence address of record:

Bell Semiconductor, LLC
401 N. Michigan Ave., Suite 1630
Chicago, IL 60611

Respectfully Submitted,

Dated: November 7, 2023

By: /Patricia M. Healy/

Patricia M. Healy (Reg. No. 73,072)
Counsel for Petitioner