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PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS	Patent Number	11,201,500
	Issue Date	2021-12-14
	First Named Inventor	Afshin Partovi
	Title	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
	Attorney Docket No.	1343/5/7 UTIL

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

115007

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

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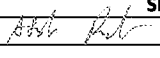
I am the:

☒ Applicant.

OR

☐ Patent owner.

☐ Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.
SIGNATURE of Applicant or Patent Owner

Signature		Date	2023-3-10
Name	Afshin Partovi	Telephone	650-892-5001
Title and Company	CEO, Mojo, Mobility Inc.		

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☒ A total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/055,109

RECEIPT DATE / TIME
03/13/2023 03:56:11 PM ET

ATTORNEY DOCKET #
AFPA-01013US6

Title of Invention

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	11201500
CONFIRMATION #	7571	FILED BY	Jana Passe
PATENT CENTER #	61731939	FILING DATE	08/05/2018
CUSTOMER #	133328	FIRST NAMED INVENTOR	Afshin Partovi
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Douglas Meier

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
1343-5-7UTIL-20230310- POA-signed.pdf	2	Power of Attorney	1784 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
1343-5-7UTIL-20230310-POA- signed.pdf	A094D7FB50E07E136288C171DF15B0634A42E59B984C3E16F EB33372DA5F91C85FF7018C9B0756BEFD6BF4D7BA137E5E02 2E959091A72B32F81762D22C054FEC

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized

by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court Eastern District of Texas on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 1:22-cv-00433	DATE FILED 10/7/2022	U.S. DISTRICT COURT Eastern District of Texas
PLAINTIFF Mojo Mobility Inc.		DEFENDANT Samsung Electronics Co., Ltd and Samsung Electronics America, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 7,948,208	5/24/2011	Mojo Mobility Inc.
2 US 9,577,440	2/21/2017	Mojo Mobility Inc.
3 US 11,292,349	4/5/2022	Mojo Mobility Inc.
4 US 11,201,500	12/14/2021	Mojo Mobility Inc.
5 US 11,316,371	4/26/2022	Mojo Mobility Inc.

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

ATTACHMENT TO FORM AO-120
REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A
PATENT OR TRADEMARK
(Mojo Mobility Inc. v. Samsung Electronics Co., Ltd and Samsung Electronics America, Inc.)

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
6 US 11,342,777	5/24/2022	Mojo Mobility Inc.
7 US 11,462,942	10/4/2022	Mojo Mobility Inc.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 11,201,500 B2
APPLICATION NO. : 16/055109
DATED : December 14, 2021
INVENTOR(S) : Afshin Partovi and Michael Sears

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 1, Lines 64-67, “one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver coil and information associated with the one” should read -- one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils and information associated with the one --.

Claim 22, Line 1, “The system of claim 19, further comprising 1 or more” should read -- The system of claim 1, further comprising 2 or more --.

Signed and Sealed this
First Day of February, 2022



Drew Hirshfeld
*Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office*

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 11,201,500
 APPLICATION NO.: 16/055,109
 ISSUE DATE : Dec. 14, 2021
 INVENTOR(S) : Afshin Partovi, Michael Sears

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 1, lines 64-67, "one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver coil and information associated with the one" should read --one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils and information associated with the one --.

Claim 22, line 1, "The system of claim 19, further comprising 1 or more" should read -- The system of claim 1, further comprising 2 or more --.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Terrile, Cannatti & Chambers LLP
 11675 Jollyville Road, Suite 100
 Austin, TX 78759

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Patent No.	11,201,500	Issue Date:	December 14, 2021
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
January 2, 2022

REQUEST FOR CERTIFICATE OF CORRECTION

This paper requests issuance of a Certificate of Correction that corrects 2 mistakes in US Patent No. 11, 201,500 (referred to herein as the “‘500 Patent”).

The first mistake is a mistake by the Office directed in claim 22, line 1 of the ‘500 Patent and are corrected under 37 C.F.R. § 1.322 and in accordance with MPEP §1480.

The second mistake is a mistake by the Applicant in claim 1, lines 64-66 and is corrected under 37 C.F.R. § 1.323 and in accordance with MPEP §1481. Because the mistakes include a mistake by Applicant, Applicant is paying the fee under 37 C.F.R. § 1.20(a).

- The ‘500 Patent is not involved in an interference or trial before the Patent Trial and Appeal Board.

This Request for a Certificate of Correction is also accompanied by a certificate of correction form, PTO/SB/44 in accordance with MPEP § 1485.

OFFICE MISTAKE IN CLAIM 22, LINE 1.

Patentee requests correction of claim 22, line 1:

“The system of claim 19, further comprising 1 or more”

should read:

-- The system of claim 1, further comprising 2 or more --

Evidence and Discussion:

Exhibit-1 - 37 C.F.R. § 1.312 Amendment 2021-10-19.

35 USC § 254, 37 C.F.R. § 1.322, and MPEP §1480 permit the Office to correct a mistake in a patent incurred through the fault of the Patent and Trademark Office. 35 USC § 254 states:

Whenever a mistake in a patent, incurred through the fault of the Patent and Trademark Office, is clearly disclosed by the records of the Office, the Director may issue a certificate of correction stating the fact and nature of such mistake, under seal, without charge, to be recorded in the records of patents.

Thus, in claim 22, line 1, (A) “claim 19” should be changed to “claim 1” and (B) “1 or more” should be changed to “2 or more.” Regarding, changing “claim 19” to “claim 1,” on October 19, 2021, Applicant filed a 37 C.F.R. § 1.312 Amendment (Exhibit-1), which was the last amendment to the claims filed by Applicant prior to issuance of the ‘500 Patent. Referring to Exhibit-1, claim 49 reads:

49. The system *of claim 19* further comprising 2 or more arc shaped permanent magnet components that are 3 attached or placed surrounding the charger coils or the receiver coils in a circular pattern and 4 concentric with the charger coils or the receiver coils to assist the user in alignment of the 5 charger coils with the receiver coils during inductive power transfer. (emphasis added).

Referring to Exhibit-1, claims 1-18 had been previously canceled, and claim 19 was the first independent claim. In the issued ‘500 Patent, the Office renumbered renumbered claim 19

as claim 1 and renumbered claim 49 as claim 22. Thus, claim 49 in *Exhibit-1* corresponds to claim 22 of the '500 Patent. In accordance with renumbering ***claim 19*** to ***claim 1*** in the '500 Patent, the Office also changed the dependency of all claims depending from claim 19 to depend from now renumbered claim 1, except for issued claim number 22. Rather than also changing the dependency in now claim 22 to ***claim 1***, the Office left claim 22 dependent on claim 19. Claim 22 of the '500 Patent reads:

22. The system of ***claim 19***, further comprising 1 or more arc shaped permanent magnet components that are attached or placed surrounding at least one of the one or more primary coils in a circular pattern and concentric with the at least one of the one or more primary coils to assist the user in alignment of the at least one of the one or more primary coils with the one or more receiver coils during inductive power transfer. (emphasis added).

Accordingly, to maintain the dependency as indicated in Exhibit-1, the Office should have also changed the dependency of issued claim 22 from claim 19 to claim 1 as the Office did with all other claims that originally depended from claim 19 prior to renumbering.

Accordingly, the Office erred in not renumbering the dependency of claim 22 to claim 1.

Regarding changing "1 or more" to "2 or more," in Applicant's last filed claim amendments in the October 19, 2021 37 C.F.R. § 1.312 Amendment, claim 49 read:

49. The system of claim 19 further comprising ***2 or more arc shaped*** permanent magnet components that are 3 attached or placed surrounding the charger coils or the receiver coils in a circular pattern and 4 concentric with the charger coils or the receiver coils to assist the user in alignment of the 5 charger coils with the receiver coils during inductive power transfer. (emphasis added).

As supported above with regard to Mistake 1, the Office renumbered claim 49 to claim 22 in the '500 Patent. Claim 22 of the issued '500 Patent reads:

22. The system of claim 19, further comprising ***1 or more arc shaped*** permanent magnet components that are attached or placed surrounding at least

one of the one or more primary coils in a circular pattern and concentric with the at least one of the one or more primary coils to assist the user in alignment of the at least one of the one or more primary coils with the one or more receiver coils during inductive power transfer. (emphasis added).

Applicant did not amend claim 49 (renumbered as claim 22 in the '500 Patent) to change "2 or more arc shaped" to "1 or more arc shaped." Accordingly, the change from "2 or more arc shaped" to "1 or more arc shaped" in the issued '500 Patent was an Office mistake.

APPLICANT MISTAKE IN CLAIM 11, LINES 64-67 -
CLERICAL AND TYPOGRAPHICAL

Patentee requests correction of claim 1, lines 64-67:

“one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver coil and information associated with the one”

should read:

--one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils and information associated with the one --

Evidence and Discussion:

Exhibit-1 - 37 C.F.R. § 1.312 Amendment 2021-10-19.

Exhibit-2 - 37 C.F.R. § 1.312 Amendment 2021-10-05.

35 USC § 255, 37 C.F.R. § 1.323, and MPEP § 1481 permit the Office to issue a certificate of correction for an Applicant’s mistake. 35 USC § 255 states:

Whenever a mistake of a clerical or typographical nature, or of minor character, which was not the fault of the Patent and Trademark Office, appears in a patent and a showing has been made that such mistake occurred in good faith, the Director may, upon payment of the required fee, issue a certificate of correction, if the correction does not involve such changes in the patent as would constitute new matter or would require reexamination.

MPEP § 1481 states:

Two separate statutory requirements must be met before a Certificate of Correction for an applicant’s mistake may issue. The first statutory requirement concerns the nature, i.e., type, of the mistake for which a correction is sought. The mistake must be:

- (1) of a clerical nature,

- (2) of a typographical nature, or
- (3) a mistake of minor character.

The second statutory requirement concerns the nature of the proposed correction. The correction must not involve changes which would:

- (1) constitute new matter or
- (2) require reexamination.

Exhibit-2 is a 37 C.F.R. § 1.132 Amendment filed on October 5, 2021 that amended claim 1, lines 34-36 to read:

... one or more outputs of the **one or more** receiver rectifier circuits induced by the one or more primary coils and **the one or more receiver coils** and information associated with the one ... (emphasis added)

In Applicant's last filed claim amendments in the October 19, 2021 37 C.F.R. § 1.312 Amendment (Exhibit-1), the foregoing portion of claim 1 in Exhibit-2 was not amended. However, corresponding claim 1, lines 35-37 in the latter filed Exhibit-1 inadvertently contained omissions and a spelling error, which are clerical and typographical errors, causing corresponding claim 1, lines 35-37 to read:

... one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver **coil** and information associated with the one ... (emphasis added)

Accordingly, the October 19, 2021 37 C.F.R. § 1.312 Amendment contains clerical errors that inadvertently omitted "one or more" receiver rectifier circuits and "the one or more" receiver and inadvertently contained a typographical error by typing receiver "coil" instead of receiver "coils."

First Statutory Requirement - Met. Because Applicant's mistake is of a clerical or typographical nature, Applicant's mistake meets the first statutory requirement.

Second Statutory Requirement - Met. Because Applicant's requested correction restores claim 1 to its previously presented state as evidenced by Exhibit-2, and Applicant did not amend claim 1 in the last filed 37 C.F.R. § 1.312 amendment on October 19, 2021 where Applicant's mistake was inadvertently introduced, as evidenced by Exhibit-2, Applicant's mistake does not constitute new matter and does not require reexamination.

Accordingly, Applicant requests correction of claim 1, lines 64-67 to correct the clerical nature and typographical error in compliance with 35 USC § 255, 37 C.F.R. § 1.323, and MPEP § 1481.

CERTIFICATE OF TRANSMISSION

I hereby certify that on January 2, 2022 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

Kent B. Chambers
Attorney for Applicant(s)
Reg. No. 38,839

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
October 19, 2021

AMENDMENT UNDER 37 C.F.R. §1.312

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

AMENDMENTS TO THE CLAIMS

1-18. (Canceled)

1 19. (Currently Amended) A system for inductive powering or charging of portable
2 devices, the system comprising:
3 one or more primary coils that are substantially planar and parallel to a surface of the
4 system for powering or charging one or more compatible portable devices
5 including batteries and receiver units, each receiver unit including a receiver coil
6 and a receiver circuit including a receiver rectifier circuit;
7 one or more drive circuits including one or more FET drivers, FET switches, and
8 capacitors coupled to the one or more primary coils that when operated apply an
9 alternating electrical current to the one or more primary coils to generate a
10 magnetic field in a direction substantially perpendicular to the plane of the one or
11 more primary coils and the surface of the system to provide power to the one or
12 more portable devices capable of being powered or charged by the system when
13 present and near the one or more primary coils;
14 one or more sense circuits to monitor the current through the one or more primary coils to
15 sense communications from the one or more receiver coils; and
16 one or more communication and control circuits including one or more microcontrollers
17 coupled to the one or more drive circuits and the one or more sense circuits that
18 detect communications through the one or more sense circuits via the one or more
19 primary coils and control the one or more drive circuits to control the powering or
20 charging of the one or more compatible portable devices; process;
21 wherein the one or more communication and control circuits:
22 operate the one or more drive circuits near a first resonant frequency of a circuit
23 formed by a primary coil and a drive circuit and a receiver coil and a
24 receiver circuit of a compatible portable device when nearby;
25 switch the one or more primary coils at a frequency and power level sufficient
26 to transfer power to one or more of the receiver units when near the one or
27 more primary coils for a sufficiently long period of time to activate the

one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents;
detect, through the one or more sense circuits, communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver coil and information associated with the one or more portable devices and/or receiver units to enable the ~~base-unit~~ one or more communication and control circuits to identify the one or more portable devices and/or receiver units and to determine any one or more appropriate charging or powering algorithm profiles therefor;
for each portable device, determine the primary coil electromagnetically most aligned with the receiver coil of the portable device;
drive the one or more FET switches associated with the most aligned one or more primary coils;
periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and
regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

20. (Previously Presented) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

1 21. (Previously Presented) The system of claim 19, wherein the one or more drive
2 circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage
3 Switching or Zero Current Switching mode during inductive power transfer to a portable device.

1 22. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits are designed to receive from a receiver unit of a portable
3 device identification information including one or more codes identifying the manufacturer of
4 the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a
5 charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

1 23. (Previously Presented) The system of claim 19, wherein the system comprises
2 more than one primary coil which are of different sizes and functions and provide different
3 power levels to portable devices with different power requirements.

1 24. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits, prior to activating the one or more ~~receivers~~ receiver circuits
3 for communication and further identification, drive each primary coil for a short period of time
4 near a nominal second resonant frequency of each primary coil and associated capacitor without
5 a receiver coil present, and the one or more sense circuits monitor the current through the
6 primary coil to detect a higher than a baseline current draw to indicate potential portable devices
7 or metallic objects near the primary coil for further investigation.

1 25. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils include coils arrayed in multiple layers such that any location on the effective charger area
3 of the surface of the system is located at a distance equal to or less than half a radius or half a
4 side-to-center length of at least one coil.

1 26. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits use encryption for at least a portion of the communication
3 with a portable device for powering or charging for security.

1 27. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits can provide bi-directional digital communication between
3 the one or more primary coils and the receiver coils for a verification process to ensure that a
4 receiver unit that can be charged or powered by the system is present and to determine the
5 voltage or power requirements of the receiver unit.

1 28. (Previously Presented) The system of claim 19, further comprising a $1 \times N$ switch,
2 wherein N primary coils of the system share a common drive circuit and a common sense circuit
3 that are switched by the one or more communication and control circuits to connect the common
4 drive circuit and the common sense circuit to the N primary coils by the $1 \times N$ switch where the
5 number N is equal or greater than 2.

1 29. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils are constructed of a Printed Circuit Board comprising multiple layers connected by vias.

1 30. (Previously Presented) The system of claim 19, wherein the system is
2 incorporated into a portable device or battery pack comprising an internal rechargeable battery
3 that can be periodically recharged and can operate the system for inductive charging or powering
4 for a period of time.

1 31. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more of the one or more primary coils to enable the
3 system and its internal battery to be charged or powered inductively.

1 32. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more coils separate from the one or more primary coils to
3 charge or power the system and its internal battery inductively.

1 33. (Previously Presented) The system of claim 30, wherein the system is
2 incorporated into a battery pack that can be clipped or attached to a portable device to extend
3 battery run time of the portable device.

1 34. (Previously Presented) The system of claim 30, wherein the system is
2 incorporated into a battery pack that is incorporated into a case for a portable device.

1 35. (Previously Presented) The system of claim 19, wherein the system further
2 includes a common mode filter circuit at an input.

1 36. (Previously Presented) The system of claim 19, further wherein the one or more
2 communication and control circuits use a Proportional-Integral-Derivative control technique to
3 regulate one or more outputs of the one or more receiver rectifier circuits.

1 37. (Previously Presented) The system of claim 19, further comprising an internal
2 data storage system and a data communication system that can establish wireless communication
3 using WiFi or Bluetooth with one or more of the portable devices during charging and upload or
4 download user digital data between the one or more portable devices and the internal data
5 storage system.

1 38. (Previously Presented) A portable device including a battery capable of receiving
2 inductive power from an inductive charging system including a base unit with one or more
3 primary coils and associated circuits, the portable device comprising:

4 a receiver coil which has a substantially planar shape and located parallel to a surface of
5 the portable device so that a magnetic field received from a primary coil in a base
6 unit of an inductive charging system in a direction substantially perpendicular to
7 the plane of the receiver coil is used to inductively generate a current in the
8 receiver coil to power or charge the portable device;

9 a ferrite material layer placed behind the receiver coil and opposite to the surface of the
10 portable device to provide shielding in the portable device from electromagnetic
11 fields;

12 a receiver circuit designed to operate near a resonant frequency of a circuit formed by the
13 receiver coil, the receiver circuit, and a compatible base unit primary coil and
14 associated circuit when adjacent to the portable device for inductive powering or
15 charging;

16 wherein the receiver circuit is part of a receiver unit and comprises:
17 a receiver rectifier circuit including one or more rectifiers and one or more
18 capacitors; and
19 a receiver communication and control circuit including a microcontroller and a
20 communication FET to modulate the input impedance of the receiver
21 circuit to communicate with the base unit through the primary coil;
22 wherein when a current is generated in the receiver coil inductively by the
23 primary coil in the base unit, the current is rectified by the one or more
24 rectifiers and smoothed by the one or more capacitors in the receiver
25 rectifier circuit and is used to power and activate the receiver
26 communication and control circuit and to power or charge the portable
27 device; and
28 wherein upon powering and activation of the receiver circuit by a primary coil in
29 the base unit, the receiver circuit:
30 communicates information corresponding to a voltage at an output of the
31 receiver rectifier circuit and information associated with the
32 portable device and/or receiver unit to enable the base unit to
33 identify the portable device and/or receiver unit, to determine any
34 appropriate charging or powering algorithm therefor, and to
35 identify one or more primary coils of the base unit most aligned
36 with the receiver coil for use in charging or powering the portable
37 device; and
38 subsequently, periodically communicates information corresponding to an
39 output voltage or current of the receiver rectifier circuit to the base
40 unit to enable the base unit to regulate in a closed loop manner the
41 output voltage or current of the receiver rectifier circuit during the
42 charging or powering of the portable device.

1 39. (Previously Presented) The portable device of claim 38, wherein the
2 communication and control circuit communicates information including one or more codes
3 identifying the manufacturer of the portable device, a unique portable device and/or receiver unit
4 ID, a charge algorithm profile, and a power requirement of the portable device and/or receiver
5 unit.

1 40. (Previously Presented) The portable device of claim 38, further wherein the
2 receiver circuit can additionally receive communication from the base unit via the receiver coil
3 inductively from the primary coil for bi-directional communication.

1 41. (Previously Presented) The portable device of claim 38, further including an
2 output disconnect switch under the control of the receiver communication and control circuit to
3 disconnect the battery from the receiver rectifier circuit output.

1 42. (Previously Presented) The portable device of claim 38, wherein the receiver coil
2 is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a
3 layer of ferrite material.

1 43. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit communicates an end of charge message to terminate power transfer from the base unit
3 upon the battery reaching a desired charged state.

1 44. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit further comprises a regulator or charge management circuit, coupled to the output of the
3 receiver rectifier circuit, that regulates or controls an output voltage or output current provided to
4 the battery, to ensure proper charging of the battery.

1 45. (Previously Presented) The portable device of claim 38, further comprising a
2 base unit circuit to enable the portable device to operate as an inductive charger or power supply
3 using the receiver coil of the portable device to inductively charge or power another portable
4 device including a battery which is capable of receiving power inductively.

1 46. (Previously Presented) The portable device of claim 38, whereby the receiver coil
2 and/or receiver circuit further comprises a near-field communication (NFC) antenna and/or
3 circuit.

1 47. (Previously Presented) The system of claim 19, further comprising a metallic
2 layer designed to remove heat from the one or more primary coils during power transfer.

1 48. (Previously Presented) The system of claim 19, further comprising a fan designed
2 to remove heat from the system during power transfer.

1 49. (Currently Amended) The system of claim 19, further comprising 2 or more arc
2 shaped permanent magnet components that are attached or placed surrounding at least one of the
3 one or more primary coils in a circular pattern and concentric with the at least one of the one or
4 more primary coils to assist the user in alignment of the at least one of the one or more primary
5 coils with the one or more receiver coils during inductive power transfer.

1 50. (Previously Presented) The portable device of claim 38, further comprising a fan
2 designed to remove heat from the portable device during power transfer.

1 51. (Previously Presented) The portable device of claim 38, further comprising 2 or
2 more arc shaped permanent magnet components that are attached or placed surrounding the
3 receiver coil in a circular pattern and concentric with the receiver coil to assist the user in
4 alignment of the one or more primary coils with the receiver coil during inductive power
5 transfer.

REMARKS

Claims 19-47 are allowed.

The issue fee has not been paid.

Claims 48-49 were objected to in the preceding *ex parte Quayle* action.

Claims 50 and 51 were added Applicant's response to the *ex parte Quayle* action.

Claims 19, 24, and 49 have been amended for clarity.

NOTE: Claims 19, 28, 37, 38, 47, and 49-51 were previously amended in an October 5, 2021 amendment under 37 C.F.R. § 1.312. The presently filed amendment incorporates the amendments to claims 19, 28, 37, 38, 47, and 49-51 made in the October 5, 2021 37 C.F.R. § 1.312 amendment. The present amendment is an additional amendment to claim 19.

37 C.F.R. § 1.312 and MPEP §714.16 permit an applicant to amend an application after allowance and before payment of the issue fee (unless the amendment is required by the Office of Data Management). The MPEP §714.16 states that “where amendments of the type noted [below] are shown (A) to be needed for proper disclosure or protection of the invention, and (B) to require no substantial amount of additional work on the part of the Office, they may be considered and, if proper, entry may be recommended by the primary examiner.” Types of amendments permitted under 37 C.F.R. § 1.312:

- (A) an amendment to the specification,
- (B) a change in the drawings,
- (C) an amendment to the claims,
- (D) a change in the inventorship,
- (E) the submission of prior art,
- (F) a petition to correct the spelling of an inventor's name,

- (G) a petition to change the order of the names of the inventors, etc.

The amendments requested herein are of the type noted above are shown (i) to be needed for proper disclosure or protection of the invention, and (ii) to require no substantial amount of additional work on the part of the Office.

AMENDMENTS TO THE CLAIMS

Claim 19 has been amended for clarity.

- Claim 19:
 - Line 4 has been amended to recite “one or more compatible portable devices.” This amendment is consistent with lines 38-39, which recites “the one or more portable devices.”
 - Lines 18-20 have been amended to recite “the one or more primary coils and control the one or more drive circuits to control the powering or charging of the one or more compatible portable devices.” This amendment is consistent with the “system for powering or charging one or more compatible portable devices” in line 4.
 - Lines 37 and 38 have been amended to correct an antecedent basis issue by replacing “the base unit” with “the one or more communication control circuits.”. The term “the base unit” on line 37 does not have antecedent basis. The correct antecedent basis is “the one or more communication control circuits.”
- Claim 24:
 - Line 2 has been amended to correct an antecedent basis issue by replacing “receivers” with “receiver circuits.” Claim 19, lines 28 and 29 refer to “one or more receiver circuits.”

- Claim 49:
 - Claim 49 has been amended to correct an antecedent basis issue by replacing “the receiver coils” with “the one or more receiver coils.” Claim 19, lines 15 and 29 refer to “one or more receiver coils.”

CONCLUSION

Applicant respectfully submits that this Supplemental Amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Accordingly, Applicant respectfully requests entry of the amendments herein. Nonetheless, should any issues remain that might be subject to resolution through a telephone interview, the Examiner is requested to telephone the undersigned at 512-338-9100.

CERTIFICATE OF TRANSMISSION

I hereby certify that on October 19, 2021 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
October 5, 2021

AMENDMENT UNDER 37 C.F.R. §1.312

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

AMENDMENTS TO THE FIGURES

Please replace Figures 1-75 with the Replacement Sheets filed herewith.

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph 0012 as follows:

[0012] Systems and methods are provided for inductive powering and/or charging of electric or electronic devices or batteries. The system typically includes a base unit, such as a charger or power supply, which includes one or more primary coils generally having a planar or curved surface. Each of the one or more primary coils can be activated to generate a magnetic field in a direction substantially perpendicular to the planar or curved surface to provide power to one or more inductive power receiver coils of one or more receivers to power or charge one or more portable devices or batteries. The base unit is capable of detecting a wireless communication signal or a modulation communication signal in the one or more primary coils created by modulation of one or more receivers' impedance or impedances and is capable of using the wireless communication signal or the modulation communication signal to control output voltage, current or power from the one or more receivers.

Please amend paragraph 0260 as follows:

[0260] FIG. 26 shows a high level view of a flyback power supply geometry 580 in accordance with an embodiment. During the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary (receiver) coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred μ Henry are typical for 10's or 100's of Watts of power supply power.

Please amend paragraph 0264 as follows:

[0264] For example, for a coil of 10 turns, an outer radius of 15 mm, and inner radius of zero, then $L = 1 \mu\text{H}$. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor.

Please amend paragraph 0538 as follows:

[0538] FIG. 74 shows an embodiment 1100 in which magnetic arc shaped parts around a circular coil are used. This case may be combined with the matching magnet on the other coil having the same shape or a ring shape similar to FIG. 73. For example, in a mobile battery application where the battery with an integrated inductive receiver is charged by placement on an inductive charger pad, the size of the coil determines the received power and may require the width of the battery to be equal or similar to the receiver coil. To allow attachment of alignment magnets, two arcs as shown in FIG. 74 can be attached to the coil. In this case, the magnets can be placed in between the battery and the coil PCB to allow the coil to be on the top surface and therefore closest to the charger coil. The matching magnet in the charger can be a ring or a similar set of arcs or another shape or size to facilitate alignment. If a ring is used behind the charger coil, then central symmetry between the two parts is retained and the parts can be rotated with respect to each other while keeping alignment for optimum operation.

AMENDMENTS TO THE CLAIMS

1-18. (Canceled)

1 19. (Currently Amended) A system for inductive powering or charging of portable
2 devices, the system comprising:
3 one or more primary coils that are substantially planar and parallel to a surface of the
4 system for powering or charging compatible portable devices including batteries
5 and receiver units, each receiver unit including a receiver coil and a receiver
6 circuit including a receiver rectifier circuit;
7 one or more drive circuits including one or more FET drivers, FET switches, and
8 capacitors coupled to the one or more primary coils that when operated apply an
9 alternating electrical current to the one or more primary coils to generate a
10 magnetic field in a direction substantially perpendicular to the plane of the one or
11 more primary coils and the surface of the system to provide power to the one or
12 more portable devices capable of being powered or charged by the system when
13 present and near the one or more primary coils;
14 one or more sense circuits to monitor the current through the one or more primary coils to
15 sense communications from the one or more receiver coils; and
16 one or more communication and control circuits including one or more microcontrollers
17 coupled to the one or more drive circuits and the one or more sense circuits that
18 detect communications through the one or more sense circuits via the one or more
19 primary coils and control the one or more drive circuits to control the charging
20 process;
21 wherein the one or more communication and control circuits:
22 operate the one or more drive circuits near a first resonant frequency of a circuit
23 formed by a primary coil and a drive circuit and a receiver coil and a
24 receiver circuit of a compatible portable device when nearby;
25 sequentially switch the one or more primary coils at a frequency and power
26 level sufficient to transfer power to one or more of the receiver units
27 when near the one or more primary coils for a sufficiently long period of

time to activate the one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents; detect, through the one or more sense circuits, communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils[[,]] and information associated with the one or more portable devices and/or receiver units to enable the base unit to identify the one or more portable devices and/or receiver units and to determine any one or more appropriate charging or powering algorithm profiles therefor; for each portable device, determine the ~~one or more~~ primary [[coils]] coil electromagnetically most aligned with the ~~one or more~~ receiver [[coils]] coil of the portable device; drive the one or more FET switches associated with [[those]] the most aligned one or more primary coils; periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

20. (Previously Presented) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

1 21. (Previously Presented) The system of claim 19, wherein the one or more drive
2 circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage
3 Switching or Zero Current Switching mode during inductive power transfer to a portable device.

1 22. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits are designed to receive from a receiver unit of a portable
3 device identification information including one or more codes identifying the manufacturer of
4 the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a
5 charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

1 23. (Previously Presented) The system of claim 19, wherein the system comprises
2 more than one primary coil which are of different sizes and functions and provide different
3 power levels to portable devices with different power requirements.

1 24. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits, prior to activating the one or more receivers for
3 communication and further identification, ~~sequentially~~ drive each primary coil for a short period
4 of time near a nominal second resonant frequency of each primary coil and associated capacitor
5 without a receiver coil present, and the one or more sense circuits monitor the current through
6 the primary coil to detect a higher than a baseline current draw to indicate potential portable
7 devices or metallic objects near the primary coil for further investigation.

1 25. (Currently Amended) The system of claim 19, wherein the one or more primary
2 coils ~~[[are]]~~ include coils arrayed in multiple layers such that any location on the effective
3 charger area of the surface of the system is located at a distance equal to or less than half a radius
4 or half a side-to-center length of at least one coil.

1 26. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits use encryption for at least a portion of the communication
3 with a portable device for powering or charging for security.

1 27. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits can provide bi-directional digital communication between
3 the one or more primary coils and the receiver coils for a verification process to ensure that a
4 receiver unit that can be charged or powered by the system is present and to determine the
5 voltage or power requirements of the receiver unit.

1 28. (Currently Amended) The system of claim 19, further comprising a 1xN switch,
2 wherein N primary coils of the system share a common drive circuit and a common sense circuit
3 that are switched by the one or more communication and control circuits to connect the common
4 drive circuit and the common sense circuit to the N primary coils by ~~one or more~~ the 1xN
5 ~~switches~~ switch where the number N is equal or greater than 2.

1 29. (Currently Amended) The system of claim 19, wherein the one or more primary
2 coils are constructed of a Printed Circuit Boards Board comprising multiple layers connected by
3 vias.

1 30. (Previously Presented) The system of claim 19, wherein the system is
2 incorporated into a portable device or battery pack comprising an internal rechargeable battery
3 that can be periodically recharged and can operate the system for inductive charging or powering
4 for a period of time.

1 31. (Currently Amended) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more of the one or more primary coils to enable the
3 system and its internal battery to be charged or powered inductively.

1 32. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more coils separate from the one or more primary coils to
3 charge or power the system and its internal battery inductively.

1 33. (Currently Amended) The system of claim 30, wherein the system is incorporated
2 into a battery pack that can be clipped or attached to a portable device to extend [[its]] battery
3 run time of the portable device.

1 34. (Currently Amended) The system of claim 30, wherein the system is incorporated
2 into a [[the]] battery pack that is incorporated into a case for a portable device.

1 35. (Previously Presented) The system of claim 19, wherein the system further
2 includes a common mode filter circuit at an input.

1 36. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits use a Proportional-Integral-Derivative control technique to
3 regulate one or more outputs of the one or more receiver ~~rectification~~ rectifier circuits.

1 37. (Currently Amended) The system of claim 19, further comprising an internal data
2 storage system and a data communication system ~~such as WiFi or Bluetooth~~ that can establish
3 wireless communication using WiFi or Bluetooth with one or more of the portable devices
4 during charging and upload or download user digital data between the one or more portable
5 devices and the internal data storage system.

1 38. (Currently Amended) A portable device including a battery capable of receiving
2 inductive power from an inductive charging system including a base unit with one or more
3 primary coils and associated circuits, the portable device comprising:

4 a receiver coil which has a substantially planar shape and located parallel to a surface of
5 the portable device so that a magnetic field received from a primary coil in a base
6 unit of an inductive charging system in a direction substantially perpendicular to
7 the plane of the receiver coil is used to inductively generate a current in the
8 receiver coil to power or charge the portable device;

9 a ferrite material layer placed behind the receiver coil and opposite to the surface of the
10 portable device to provide shielding in the portable device from electromagnetic
11 fields;

12 a receiver circuit designed to operate near a resonant frequency of a circuit formed by the
13 receiver coil, the receiver circuit, and a compatible base unit primary coil and
14 associated circuit when adjacent to the portable device for inductive powering or
15 charging;

16 wherein the receiver circuit is part of a receiver unit and comprises:

17 a receiver rectifier circuit including one or more rectifiers and one or more
18 capacitors; and

19 a receiver communication and control circuit including a microcontroller and a
20 communication FET to modulate the input impedance of the receiver
21 circuit to communicate with the base unit through the primary coil;

22 wherein when a current is generated in the receiver coil inductively by the
23 primary coil in the base unit, the current is rectified by the one or more
24 rectifiers and smoothed by the one or more capacitors in the receiver
25 rectifier circuit and is used to power and activate the receiver
26 communication and control circuit and to power or charge the portable
27 device; and

28 wherein upon powering and activation of the receiver circuit by a primary coil in
29 the base unit, the receiver circuit: [[;]]

30 communicates information corresponding to a voltage at an output of the
31 receiver rectifier circuit and information associated with the ~~one or~~
32 ~~more~~ portable device and/or receiver unit to enable the base unit to
33 identify the portable device and/or receiver unit, to determine any
34 appropriate charging or powering algorithm therefor, and to
35 identify one or more primary coils of the base unit most aligned
36 with the receiver coil for use in charging or powering the portable
37 device; and

38 subsequently, periodically communicates information corresponding to an
39 output voltage or current of the receiver rectifier circuit to the base
40 unit to enable the base unit to regulate in a closed loop manner the
41 output voltage or current of the receiver rectifier circuit during the
42 charging or powering of the portable device.

1 39. (Previously Presented) The portable device of claim 38, wherein the
2 communication and control circuit communicates information including one or more codes
3 identifying the manufacturer of the portable device, a unique portable device and/or receiver unit
4 ID, a charge algorithm profile, and a power requirement of the portable device and/or receiver
5 unit.

1 40. (Previously Presented) The portable device of claim 38, further wherein the
2 receiver circuit can additionally receive communication from the base unit via the receiver coil
3 inductively from the primary coil for bi-directional communication.

1 41. (Previously Presented) The portable device of claim 38, further including an
2 output disconnect switch under the control of the receiver communication and control circuit to
3 disconnect the battery from the receiver rectifier circuit output.

1 42. (Previously Presented) The portable device of claim 38, wherein the receiver coil
2 is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a
3 layer of ferrite material.

1 43. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit communicates an end of charge message to terminate power transfer from the base unit
3 upon the battery reaching a desired charged state.

1 44. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit further comprises a regulator or charge management circuit, coupled to the output of the
3 receiver rectifier circuit, that regulates or controls an output voltage or output current provided to
4 the battery, to ensure proper charging of the battery.

1 45. (Previously Presented) The portable device of claim 38, further comprising a
2 base unit circuit to enable the portable device to operate as an inductive charger or power supply
3 using the receiver coil of the portable device to inductively charge or power another portable
4 device including a battery which is capable of receiving power inductively.

1 46. (Previously Presented) The portable device of claim 38, whereby the receiver coil
2 and/or receiver circuit further comprises a near-field communication (NFC) antenna and/or
3 circuit.

1 47. (Currently Amended) The system of claim 19, further comprising a metallic layer
2 designed to remove heat from the ~~charger coil~~ one or more primary coils during power transfer.

1 48. (Previously Presented) The system of claim 19, further comprising a fan designed
2 to remove heat from the system during power transfer.

1 49. (Currently Amended) The system of claim 19, further comprising 2 or more arc
2 shaped permanent magnet components that are attached or placed surrounding at least one of the
3 ~~charger coil or the receiver coils~~ one or more primary coils in a circular pattern and concentric
4 with the ~~charger coils or the receiver coils~~ at least one of the one or more primary coils to assist
5 the user in alignment of the ~~charger coils~~ at least one of the one or more primary coils with the
6 receiver coils during inductive power transfer.

1 50. (Currently Amended) The portable device of claim 38, further comprising a fan
2 designed to remove heat from the ~~system~~ portable device during power transfer.

1 51. (Currently Amended) The portable device of claim 38, further comprising 2 or
2 more arc shaped permanent magnet components that are attached or placed surrounding the
3 ~~charger coil or the receiver~~ [[coils]] coil in a circular pattern and concentric with the ~~charger~~
4 ~~coils or the receiver~~ [[coils]] coil to assist the user in alignment of the ~~charger coils~~ one or more
5 primary coils with the receiver [[coils]] coil during inductive power transfer.

REMARKS

Claims 19-47 are allowed.

Claims 48-49 were objected to in the preceding *ex parte Quayle* action.

Claims 50 and 51 were added Applicant's response to the *ex parte Quayle* action.

Claims 19, 24, 25, 28, 29, 31, 33, 34, 36, 37, 38, 47, and 49-51 have been amended for clarity.

The issue fee has not been paid.

37 C.F.R. § 1.312 and MPEP §714.16 permit an applicant to amend an application after allowance and before payment of the issue fee (unless the amendment is required by the Office of Data Management). The MPEP §714.16 states that “where amendments of the type noted [below] are shown (A) to be needed for proper disclosure or protection of the invention, and (B) to require no substantial amount of additional work on the part of the Office, they may be considered and, if proper, entry may be recommended by the primary examiner.” Types of amendments permitted under 37 C.F.R. § 1.312:

- (A) an amendment to the specification,
- (B) a change in the drawings,
- (C) an amendment to the claims,
- (D) a change in the inventorship,
- (E) the submission of prior art,
- (F) a petition to correct the spelling of an inventor's name,
- (G) a petition to change the order of the names of the inventors, etc.

The amendments requested herein are of the type noted above are shown (i) to be needed for proper disclosure or protection of the invention, and (ii) to require no substantial amount of additional work on the part of the Office.

AMENDMENTS TO THE FIGURES

Applicant has submitted replacement sheets for all the Figures to provide better clarity to the Figures. The Replacement Sheets are identical to the Figures as filed with the exception of correction of minor errors as described below:

- **Figure 25.** Figure 25 has been amended to show for clarity the alignment of the coils in the circuit diagram 560, which is consistent with standard transformer depictions and consistent with the other depicted transformer circuits in the *Present Application*.
- **Figures 30-32.** In original Figures 30-32, “Vbat” was truncated to produce “Vba” on one line and “t” directly below “Vba.” Amended Figures 30-32 correct the original figures by replacing “Vba” with “Vbat” and deleting the separated letter “t.”
- **Figure 74.** Figure 74 has been amended to conform with Figure 9 of US Provisional Patent Application No. 61/043, 027 (the ‘027 Provisional). The *Present Application* incorporates the ‘027 Provisional application by reference in as set forth in paragraph 0001 of the *Present Application*. (See the last 6 lines of the *Present Application*, ¶0001. The description of Figure 74 in the *Present Application*, ¶¶0086 and 0538 are identical to the description of Figure 9 of the ‘027 Provisional, ¶¶0015 and 0055. Paragraph 0538 of the originally filed *Present Application* actually retains a reference to “Figure 9” in the description of Figure 74. Thus, Figure 74 of the *Present Application* has been amended to reflect the actual priority Figure 9 of the ‘027 Provisional.

No new matter has been added.

AMENDMENTS TO THE SPECIFICATION

The Specification has amended as follows:

- In Paragraph 0012, the Summary has been amended to add a concluding period.
- Paragraph 0260 has been amended to replace “Henry” with “μH.” Support for the amendment is on page 4 of U.S. Provisional Patent Application No. 61/012/924 (the “’924 Provisional”), which is incorporated by reference by the *Present Application* as indicated on p. 2, first paragraph, last 9 sentences of the *Present Application*. Page 4 of the ’924 Provisional references Figure 1, and paragraph 0260 of the *Present Application* references Figure 25. Figure 1 of the ’924 Provisional is identical to Figure 25 of the *Present Application*. The description of the ’924 Provisional Figure 1, which corresponds to Figure 25 of the *Present Application*, states:

Figure 1 shows a high level view of a Flyback power supply geometry wherein, during the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred μHenry are typical for 10 's or 100 's of Watts of power supply power. ’924 Provisional, p. 4, ¶2 (emphasis added).

- Paragraph 0264 has been amended to correct an error in the unit of inductance from L=1 H to L=1 μH. Support for the amendment is on page 6 of the ’924 Provisional. Page 6 of the ’924 Provisional provides the exact same formula and sample problem as paragraphs 0263 and 0264 of the *Present Application*. The inductance for the example problem in the ’924 Provisional is L=1 μH. The relevant portion of page 6 of the ’924 Provisional is copied below for convenient reference:

For a spiral coil, the inductance of a coil is given by:

$$L = \frac{r^2 N^2}{(2r + 2.8d) \times 10^5}$$

Where

L = inductance (H)

r = mean radius of coil (m)

N = number of turns

d – depth of coil (outer radius minus inner radius) (m)

For example, for a coil of 10 turns, and outer radius of 15 mm and inner radius of zero, $L = 1 \mu H$. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor. '924 Provisional, p. 6, ¶5 (emphasis added).

- Paragraph 0538 has been amended to correct a Figure reference error from “Fig. 9” to “Fig. 74.”

No new matter has been added.

AMENDMENTS TO THE CLAIMS

Claims 19, 28, 37, 38, 47, and 49-51 have been amended for clarity. Also, the indentation of lines 22-40 of claim 19 has been revised for consistency.

- Claim 19:
 - line 7 has been amended to clarify that the one or more drive circuits include one or more FET drivers, FET switches, and capacitors coupled to the one or more primary coils as shown in, for example, in Fig. 25.
 - line 25 has been amended to clarify that ‘sequential’ switching is not required. See, for example, ¶0261, lines 8-10.
 - lines 32 and 36 have been amended for clarity.
 - line 39 has been amended for clarity.
 - lines 41-43 has been amended for clarity.
 - line 44 has been amended for consistency with amended line 7.
- Claim 24 has been amended for consistency with amended line 25 of claim 1.

- Claim 25 has been amended for clarity.
- Claim 28 has been amended to correct an antecedent basis issue.
- Claim 29 has been amended for clarity.
- Claim 31 has been amended to correct an antecedent basis issue.
- Claim 34 has been amended for clarity.
- Claim 36 has been amended to correct an antecedent basis issue.
- Claim 37 has been amended for grammar and for clarity to remove redundancy.
- Claim 38:
 - lines 23-24 have been amended to reference the antecedent in line 17;
 - line 29 has been amended for grammar to replace the semi-colon with a colon; and
 - lines 31-32 have been amended to correct a grammar and an antecedent basis issue.
- Claims 47 and 49-51 have been amended to correct antecedent basis issues and for internal consistency.

CONCLUSION

Applicant respectfully submits that this Supplemental Amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Accordingly, Applicant respectfully requests entry of the amendments herein. Nonetheless, should any issues remain that might be subject to resolution through a telephone interview, the Examiner is requested to telephone the undersigned at 512-338-9100.

CERTIFICATE OF TRANSMISSION

I hereby certify that on October 5, 2021 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

Kent B. Chambers
Attorney for Applicant(s)
Reg. No. 38,839

Electronic Patent Application Fee Transmittal				
Application Number:		16055109		
Filing Date:		05-Aug-2018		
Title of Invention:		EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
First Named Inventor/Applicant Name:		Afshin Partovi		
Filer:		Kent Bryan Chambers		
Attorney Docket Number:		AFPA-01013US6		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	1811	1	160	160

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Electronic Acknowledgement Receipt

EFS ID:	44649956
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Kent Bryan Chambers
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	02-JAN-2022
Filing Date:	05-AUG-2018
Time Stamp:	23:22:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 160
RAM confirmation Number	E202212N22432494
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	AFPA-01013US_Certificate_of_Correction_2021-12-28_Form_PTO-SB44.pdf	466421	no	2
			424012ef84f0c058728c611adcd5029200c3cdc1		
Warnings:					
Information:					
2	Request for Certificate of Correction	AFPA-01013US_Certificate_of_Correction_2021-12-28.pdf	131484	no	7
			563b675823966b9f897744a04f64d7e65d90bd17		
Warnings:					
Information:					
3	Request for Certificate of Correction	Exhibit-1_AFPA-01013US_1-31_2_Amd-2_2021-10-19.pdf	147039	no	12
			7870e9fae2cff32d51638d8e166e8d1a34c930f9		
Warnings:					
Information:					
4	Request for Certificate of Correction	Exhibit-2_AFPA-01013US_1-31_2_Amd_2021-10-05.pdf	180581	no	18
			d4f6e85b58cee2455b573ac50ce5224d4d7abea2		
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	38274	no	2
			3f34d22eccfbc4b507d602b2a67afb9c3022aca6		
Warnings:					
Information:					
Total Files Size (in bytes):			963799		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	12/14/2021	11201500	AFPA-01013US6	7571

133328 7590 11/23/2021
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Mojo Mobility, Inc., Santa Clara, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16055109
Filing Date		2019-08-05
First Named Inventor	Afshin Partovi	
Art Unit		2859
Examiner Name	ZHOU, ZIHUAN	
Attorney Docket Number		AFPA-01013US6

74	20090284083		2009-11-19	Karalis	
75	20090267710		2009-10-29	Joannopoulos	
76	20090267709		2009-10-29	Joannopoulos	
77	20090224856		2009-09-10	Karalis	
78	20090195333		2009-08-06	Joannopoulos	
79	20090195332		2009-08-06	Joannopoulos	
80	20080278264		2008-11-13	Karalis	
81	20110266878		~~2008-11-13~~ 11/2011	Cook	
82	20100038970		2010-02-18	Cook	
83	20090243397		2009-10-01	Cook	
84	20090224609		2009-09-10	Cook	

Change(s) applied
to document,
/M.H.E./
10/21/2021

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16055109
Filing Date	2019-08-05
First Named Inventor	Afshin PARTOVI
Art Unit	2859
Examiner Name	ZHOU, ZIHUAN
Attorney Docket Number	AFPA-01013US6

23	20100327804	2010-12-30	Takahashi
24	20110057606	2011-03-10	Saunamaki
25	20070139000	2007-06-21	Kozuma
26	20110050164	2011-03-03	Partovi
27	20060202665	2006-09-14	Hsu
28	20060238930	2006-10-26	Baerman
29	20020089305	2002-07-11	Park
30	20060202665	~~2011-03-10~~ 09/2006	Hsu Feng-Hsiung
31	20060108977	2006-05-25	Kagermeier
32	20100081473	2010-04-01	Chatterjee
33	20070279002	2007-12-07	Partovi

Change(s) applied
to document,

/M.H.E./
10/21/2021

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16055109
Filing Date		2019-08-05
First Named Inventor	Afshin PARTOVI	
Art Unit		2859
Examiner Name	ZHOU, ZIHUAN	
Attorney Docket Number		AFPA-01013US6

	1	20070178945		2007-08-02	Cook	
Change(s) applied to document, /M.H.E./ 10/21/2021	2	20050007067		~~2007-02-08~~ 01/2005	Baarman	
	3	20100007307		2010-01-14	Baarman	
	4	20080272889		2008-11-06	Symons	
	5	20100277121		2010-11-04	Hall	
	6	20100127660		2010-05-27	Cook	
	7	20110012556		2011-01-20	Lai	
	8	20100081473		2010-04-01	Chatterjee	
	9	20090284227		2009-11-19	Mohammadian	
	10	20090049554		2009-02-19	Vuong	
	11	20060106965		2006-05-18	Falcon	

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
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Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

133328 7590 10/01/2021
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571

TITLE OF INVENTION: EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	01/03/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
ZHOU, ZIXUAN	2859	320-108000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Mojo Mobility, Inc.

Sunnyvale, California

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 502264

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Kent B. Chambers/ Date October 27, 2021
Type or printed name Kent B. Chambers Registration No. 38,839

Electronic Patent Application Fee Transmittal				
Application Number:		16055109		
Filing Date:		05-Aug-2018		
Title of Invention:		EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
First Named Inventor/Applicant Name:		Afshin Partovi		
Filer:		Kent Bryan Chambers/Celeste Scarborough		
Attorney Docket Number:		AFPA-01013US6		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	600	600

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				600

Electronic Acknowledgement Receipt

EFS ID:	44141255
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Kent Bryan Chambers/Celeste Scarborough
Filer Authorized By:	Kent Bryan Chambers
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	27-OCT-2021
Filing Date:	05-AUG-2018
Time Stamp:	19:53:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$600
RAM confirmation Number	E20210QJ55504257
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	AFPA-01013US6_IssueFeeXmtl _2021-10-27_.pdf	858346	no	1
			aea3ba31a299a9764ab995f3bf080c93e7f985f7		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38357	no	2
			d97b995f2495a30cf11826a0e3c4e620878d4ce3		
Warnings:					
Information:					
Total Files Size (in bytes):			896703		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	10/27/2021	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074				
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			10/27/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Response to Rule 312 Communication	Application No. 16/055,109	Applicant(s) Partovi et al.	
	Examiner ZIXUAN ZHOU	Art Unit 2859	AIA (FITF) Status No
-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address -- 1. ☒ The amendment filed on <u>19 October 2021</u> under 37 CFR 1.312 has been considered, and has been: a) ☐ entered. b) ☒ entered as directed to matters of form not affecting the scope of the invention. c) ☐ disapproved because the amendment was filed after the payment of the issue fee. Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue. d) ☐ disapproved. See explanation below. e) ☐ entered in part. See explanation below. _____			
/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Afshin Partovi, Michael Sears
Applicant: Mojo Mobility, Inc.
Title: Efficiencies and Flexibilities in Inductive (Wireless) Charging
Application No.: 16/055,109 Filed: August 5, 2018
Confirmation No. 7571
Examiner: Zixuan Zhou Group Art Unit: 2859
Docket No.: AFPA-01013US6 Customer No.: 33438

ELECTRONICALLY FILED

Austin, Texas
October 19, 2021**AMENDMENT UNDER 37 C.F.R. §1.312**

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

Electronic Acknowledgement Receipt

EFS ID:	44071003
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Kent Bryan Chambers
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	19-OCT-2021
Filing Date:	05-AUG-2018
Time Stamp:	19:22:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment after Notice of Allowance (Rule 312)	AFPA-01013US_1-312_Amd-2_2021-10-19.pdf	136643 ff12eb2788bf52a4231c906523d97603e916d143	no	12

Warnings:

Information:	
Total Files Size (in bytes):	136643
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
October 19, 2021

AMENDMENT UNDER 37 C.F.R. §1.312

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

AMENDMENTS TO THE CLAIMS

1-18. (Canceled)

1 19. (Currently Amended) A system for inductive powering or charging of portable
2 devices, the system comprising:
3 one or more primary coils that are substantially planar and parallel to a surface of the
4 system for powering or charging one or more compatible portable devices
5 including batteries and receiver units, each receiver unit including a receiver coil
6 and a receiver circuit including a receiver rectifier circuit;
7 one or more drive circuits including one or more FET drivers, FET switches, and
8 capacitors coupled to the one or more primary coils that when operated apply an
9 alternating electrical current to the one or more primary coils to generate a
10 magnetic field in a direction substantially perpendicular to the plane of the one or
11 more primary coils and the surface of the system to provide power to the one or
12 more portable devices capable of being powered or charged by the system when
13 present and near the one or more primary coils;
14 one or more sense circuits to monitor the current through the one or more primary coils to
15 sense communications from the one or more receiver coils; and
16 one or more communication and control circuits including one or more microcontrollers
17 coupled to the one or more drive circuits and the one or more sense circuits that
18 detect communications through the one or more sense circuits via the one or more
19 primary coils and control the one or more drive circuits to control the powering or
20 charging of the one or more compatible portable devices; process;
21 wherein the one or more communication and control circuits:
22 operate the one or more drive circuits near a first resonant frequency of a circuit
23 formed by a primary coil and a drive circuit and a receiver coil and a
24 receiver circuit of a compatible portable device when nearby;
25 switch the one or more primary coils at a frequency and power level sufficient
26 to transfer power to one or more of the receiver units when near the one or
27 more primary coils for a sufficiently long period of time to activate the

one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents;
detect, through the one or more sense circuits, communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the receiver rectifier circuits induced by the one or more primary coils and receiver coil and information associated with the one or more portable devices and/or receiver units to enable the ~~base-unit~~ one or more communication and control circuits to identify the one or more portable devices and/or receiver units and to determine any one or more appropriate charging or powering algorithm profiles therefor;
for each portable device, determine the primary coil electromagnetically most aligned with the receiver coil of the portable device;
drive the one or more FET switches associated with the most aligned one or more primary coils;
periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and
regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

20. (Previously Presented) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

1 21. (Previously Presented) The system of claim 19, wherein the one or more drive
2 circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage
3 Switching or Zero Current Switching mode during inductive power transfer to a portable device.

1 22. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits are designed to receive from a receiver unit of a portable
3 device identification information including one or more codes identifying the manufacturer of
4 the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a
5 charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

1 23. (Previously Presented) The system of claim 19, wherein the system comprises
2 more than one primary coil which are of different sizes and functions and provide different
3 power levels to portable devices with different power requirements.

1 24. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits, prior to activating the one or more ~~receivers~~ receiver circuits
3 for communication and further identification, drive each primary coil for a short period of time
4 near a nominal second resonant frequency of each primary coil and associated capacitor without
5 a receiver coil present, and the one or more sense circuits monitor the current through the
6 primary coil to detect a higher than a baseline current draw to indicate potential portable devices
7 or metallic objects near the primary coil for further investigation.

1 25. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils include coils arrayed in multiple layers such that any location on the effective charger area
3 of the surface of the system is located at a distance equal to or less than half a radius or half a
4 side-to-center length of at least one coil.

1 26. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits use encryption for at least a portion of the communication
3 with a portable device for powering or charging for security.

1 27. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits can provide bi-directional digital communication between
3 the one or more primary coils and the receiver coils for a verification process to ensure that a
4 receiver unit that can be charged or powered by the system is present and to determine the
5 voltage or power requirements of the receiver unit.

1 28. (Previously Presented) The system of claim 19, further comprising a $1 \times N$ switch,
2 wherein N primary coils of the system share a common drive circuit and a common sense circuit
3 that are switched by the one or more communication and control circuits to connect the common
4 drive circuit and the common sense circuit to the N primary coils by the $1 \times N$ switch where the
5 number N is equal or greater than 2.

1 29. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils are constructed of a Printed Circuit Board comprising multiple layers connected by vias.

1 30. (Previously Presented) The system of claim 19, wherein the system is
2 incorporated into a portable device or battery pack comprising an internal rechargeable battery
3 that can be periodically recharged and can operate the system for inductive charging or powering
4 for a period of time.

1 31. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more of the one or more primary coils to enable the
3 system and its internal battery to be charged or powered inductively.

1 32. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more coils separate from the one or more primary coils to
3 charge or power the system and its internal battery inductively.

1 33. (Previously Presented) The system of claim 30, wherein the system is
2 incorporated into a battery pack that can be clipped or attached to a portable device to extend
3 battery run time of the portable device.

1 34. (Previously Presented) The system of claim 30, wherein the system is
2 incorporated into a battery pack that is incorporated into a case for a portable device.

1 35. (Previously Presented) The system of claim 19, wherein the system further
2 includes a common mode filter circuit at an input.

1 36. (Previously Presented) The system of claim 19, further wherein the one or more
2 communication and control circuits use a Proportional-Integral-Derivative control technique to
3 regulate one or more outputs of the one or more receiver rectifier circuits.

1 37. (Previously Presented) The system of claim 19, further comprising an internal
2 data storage system and a data communication system that can establish wireless communication
3 using WiFi or Bluetooth with one or more of the portable devices during charging and upload or
4 download user digital data between the one or more portable devices and the internal data
5 storage system.

1 38. (Previously Presented) A portable device including a battery capable of receiving
2 inductive power from an inductive charging system including a base unit with one or more
3 primary coils and associated circuits, the portable device comprising:

4 a receiver coil which has a substantially planar shape and located parallel to a surface of
5 the portable device so that a magnetic field received from a primary coil in a base
6 unit of an inductive charging system in a direction substantially perpendicular to
7 the plane of the receiver coil is used to inductively generate a current in the
8 receiver coil to power or charge the portable device;

9 a ferrite material layer placed behind the receiver coil and opposite to the surface of the
10 portable device to provide shielding in the portable device from electromagnetic
11 fields;

12 a receiver circuit designed to operate near a resonant frequency of a circuit formed by the
13 receiver coil, the receiver circuit, and a compatible base unit primary coil and
14 associated circuit when adjacent to the portable device for inductive powering or
15 charging;

16 wherein the receiver circuit is part of a receiver unit and comprises:
17 a receiver rectifier circuit including one or more rectifiers and one or more
18 capacitors; and
19 a receiver communication and control circuit including a microcontroller and a
20 communication FET to modulate the input impedance of the receiver
21 circuit to communicate with the base unit through the primary coil;
22 wherein when a current is generated in the receiver coil inductively by the
23 primary coil in the base unit, the current is rectified by the one or more
24 rectifiers and smoothed by the one or more capacitors in the receiver
25 rectifier circuit and is used to power and activate the receiver
26 communication and control circuit and to power or charge the portable
27 device; and
28 wherein upon powering and activation of the receiver circuit by a primary coil in
29 the base unit, the receiver circuit:
30 communicates information corresponding to a voltage at an output of the
31 receiver rectifier circuit and information associated with the
32 portable device and/or receiver unit to enable the base unit to
33 identify the portable device and/or receiver unit, to determine any
34 appropriate charging or powering algorithm therefor, and to
35 identify one or more primary coils of the base unit most aligned
36 with the receiver coil for use in charging or powering the portable
37 device; and
38 subsequently, periodically communicates information corresponding to an
39 output voltage or current of the receiver rectifier circuit to the base
40 unit to enable the base unit to regulate in a closed loop manner the
41 output voltage or current of the receiver rectifier circuit during the
42 charging or powering of the portable device.

1 39. (Previously Presented) The portable device of claim 38, wherein the
2 communication and control circuit communicates information including one or more codes
3 identifying the manufacturer of the portable device, a unique portable device and/or receiver unit
4 ID, a charge algorithm profile, and a power requirement of the portable device and/or receiver
5 unit.

1 40. (Previously Presented) The portable device of claim 38, further wherein the
2 receiver circuit can additionally receive communication from the base unit via the receiver coil
3 inductively from the primary coil for bi-directional communication.

1 41. (Previously Presented) The portable device of claim 38, further including an
2 output disconnect switch under the control of the receiver communication and control circuit to
3 disconnect the battery from the receiver rectifier circuit output.

1 42. (Previously Presented) The portable device of claim 38, wherein the receiver coil
2 is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a
3 layer of ferrite material.

1 43. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit communicates an end of charge message to terminate power transfer from the base unit
3 upon the battery reaching a desired charged state.

1 44. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit further comprises a regulator or charge management circuit, coupled to the output of the
3 receiver rectifier circuit, that regulates or controls an output voltage or output current provided to
4 the battery, to ensure proper charging of the battery.

1 45. (Previously Presented) The portable device of claim 38, further comprising a
2 base unit circuit to enable the portable device to operate as an inductive charger or power supply
3 using the receiver coil of the portable device to inductively charge or power another portable
4 device including a battery which is capable of receiving power inductively.

1 46. (Previously Presented) The portable device of claim 38, whereby the receiver coil
2 and/or receiver circuit further comprises a near-field communication (NFC) antenna and/or
3 circuit.

1 47. (Previously Presented) The system of claim 19, further comprising a metallic
2 layer designed to remove heat from the one or more primary coils during power transfer.

1 48. (Previously Presented) The system of claim 19, further comprising a fan designed
2 to remove heat from the system during power transfer.

1 49. (Currently Amended) The system of claim 19, further comprising 2 or more arc
2 shaped permanent magnet components that are attached or placed surrounding at least one of the
3 one or more primary coils in a circular pattern and concentric with the at least one of the one or
4 more primary coils to assist the user in alignment of the at least one of the one or more primary
5 coils with the one or more receiver coils during inductive power transfer.

1 50. (Previously Presented) The portable device of claim 38, further comprising a fan
2 designed to remove heat from the portable device during power transfer.

1 51. (Previously Presented) The portable device of claim 38, further comprising 2 or
2 more arc shaped permanent magnet components that are attached or placed surrounding the
3 receiver coil in a circular pattern and concentric with the receiver coil to assist the user in
4 alignment of the one or more primary coils with the receiver coil during inductive power
5 transfer.

REMARKS

Claims 19-47 are allowed.

The issue fee has not been paid.

Claims 48-49 were objected to in the preceding *ex parte Quayle* action.

Claims 50 and 51 were added Applicant's response to the *ex parte Quayle* action.

Claims 19, 24, and 49 have been amended for clarity.

NOTE: Claims 19, 28, 37, 38, 47, and 49-51 were previously amended in an October 5, 2021 amendment under 37 C.F.R. § 1.312. The presently filed amendment incorporates the amendments to claims 19, 28, 37, 38, 47, and 49-51 made in the October 5, 2021 37 C.F.R. § 1.312 amendment. The present amendment is an additional amendment to claim 19.

37 C.F.R. § 1.312 and MPEP §714.16 permit an applicant to amend an application after allowance and before payment of the issue fee (unless the amendment is required by the Office of Data Management). The MPEP §714.16 states that “where amendments of the type noted [below] are shown (A) to be needed for proper disclosure or protection of the invention, and (B) to require no substantial amount of additional work on the part of the Office, they may be considered and, if proper, entry may be recommended by the primary examiner.” Types of amendments permitted under 37 C.F.R. § 1.312:

- (A) an amendment to the specification,
- (B) a change in the drawings,
- (C) an amendment to the claims,
- (D) a change in the inventorship,
- (E) the submission of prior art,
- (F) a petition to correct the spelling of an inventor's name,

- (G) a petition to change the order of the names of the inventors, etc.

The amendments requested herein are of the type noted above are shown (i) to be needed for proper disclosure or protection of the invention, and (ii) to require no substantial amount of additional work on the part of the Office.

AMENDMENTS TO THE CLAIMS

Claim 19 has been amended for clarity.

- Claim 19:
 - Line 4 has been amended to recite “one or more compatible portable devices.” This amendment is consistent with lines 38-39, which recites “the one or more portable devices.”
 - Lines 18-20 have been amended to recite “the one or more primary coils and control the one or more drive circuits to control the powering or charging of the one or more compatible portable devices.” This amendment is consistent with the “system for powering or charging one or more compatible portable devices” in line 4.
 - Lines 37 and 38 have been amended to correct an antecedent basis issue by replacing “the base unit” with “the one or more communication control circuits.”. The term “the base unit” on line 37 does not have antecedent basis. The correct antecedent basis is “the one or more communication control circuits.”
- Claim 24:
 - Line 2 has been amended to correct an antecedent basis issue by replacing “receivers” with “receiver circuits.” Claim 19, lines 28 and 29 refer to “one or more receiver circuits.”

- Claim 49:
 - Claim 49 has been amended to correct an antecedent basis issue by replacing “the receiver coils” with “the one or more receiver coils.” Claim 19, lines 15 and 29 refer to “one or more receiver coils.”

CONCLUSION

Applicant respectfully submits that this Supplemental Amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Accordingly, Applicant respectfully requests entry of the amendments herein. Nonetheless, should any issues remain that might be subject to resolution through a telephone interview, the Examiner is requested to telephone the undersigned at 512-338-9100.

CERTIFICATE OF TRANSMISSION

I hereby certify that on October 19, 2021 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

Kent B. Chambers
Attorney for Applicant(s)
Reg. No. 38,839



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	10/18/2021	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074				
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			10/18/2021	PAPER

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The time period for reply, if any, is set in the attached communication.

Response to Rule 312 Communication	Application No.	Applicant(s)	
	16/055,109	Partovi et al.	
	Examiner	Art Unit	AIA (FITF) Status
	ZIXUAN ZHOU	2859	No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ The amendment filed on 12 October 2021 under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

b) ☒ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

REPLACEMENT SHEET

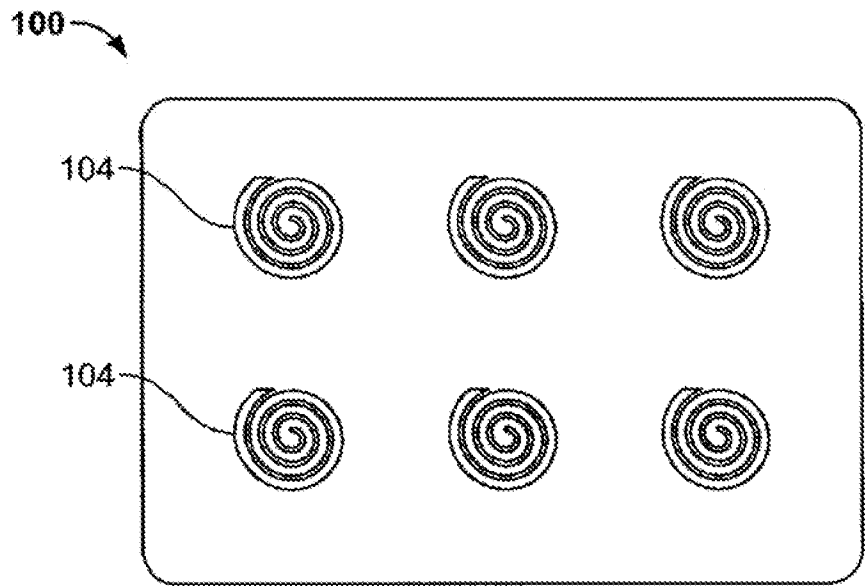


FIG. 1

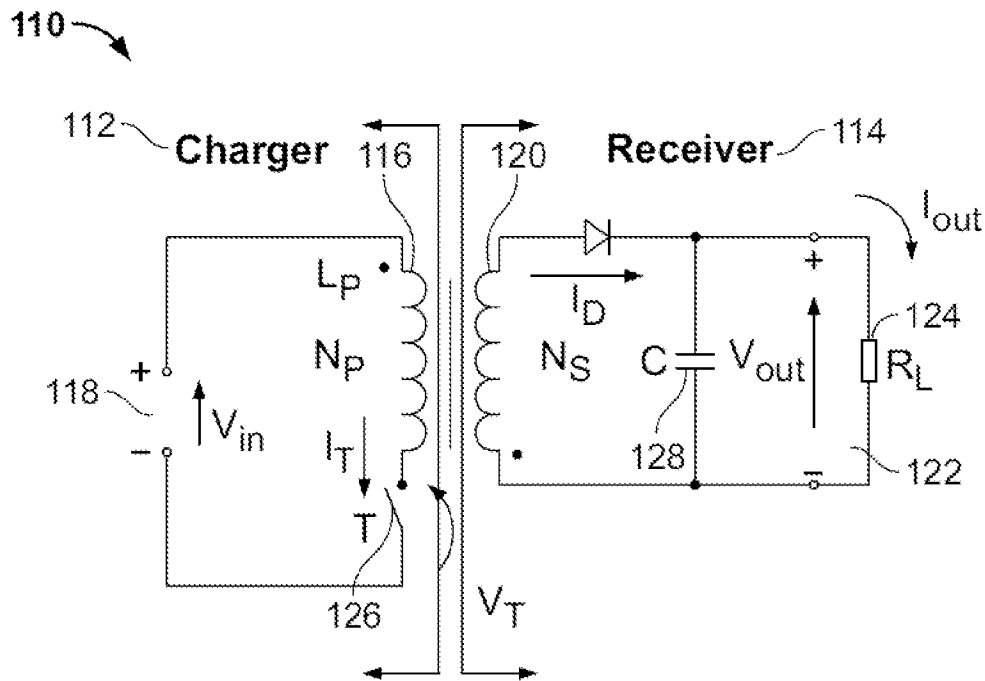


FIG. 2

REPLACEMENT SHEET

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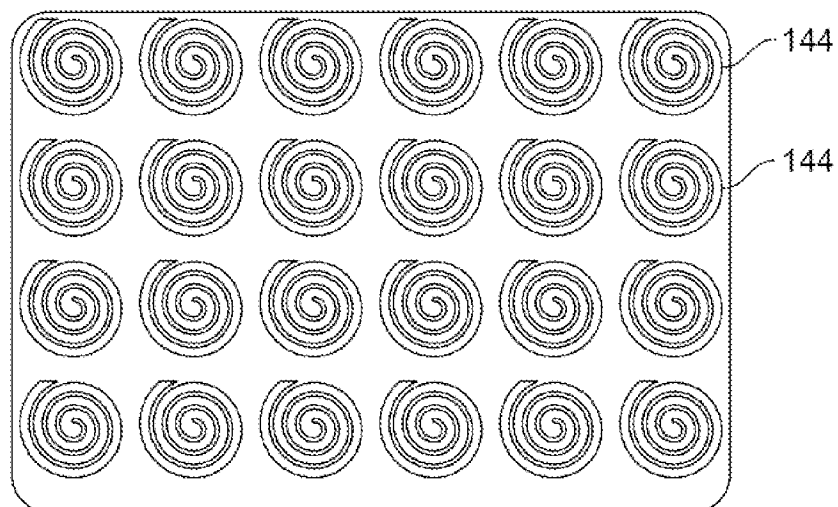


FIG. 3

150

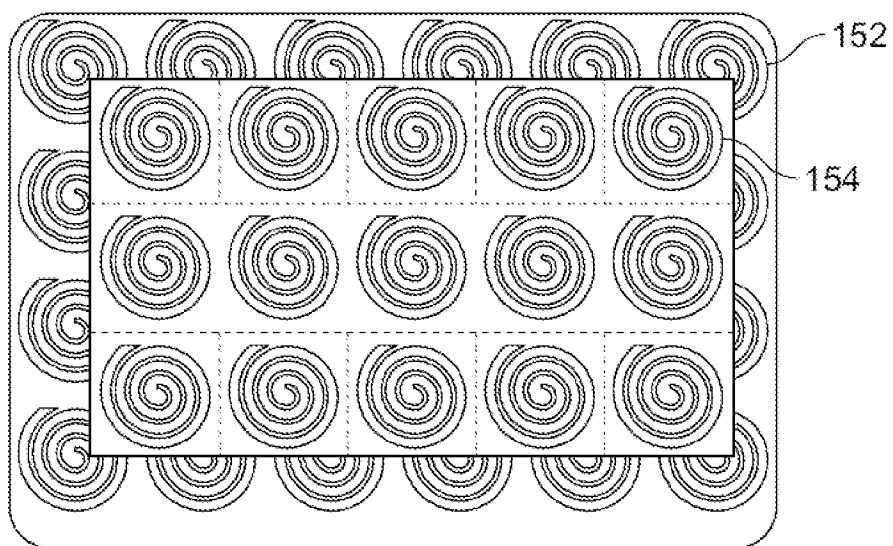


FIG. 4

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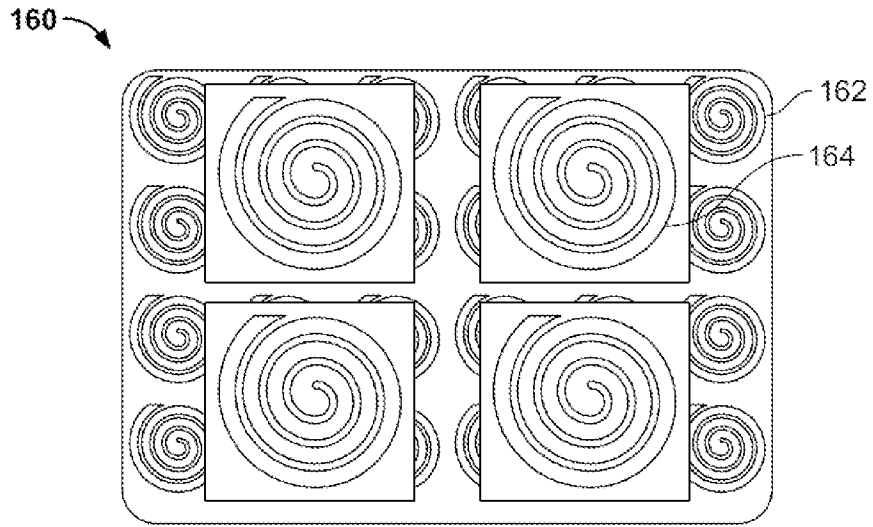


FIG. 5

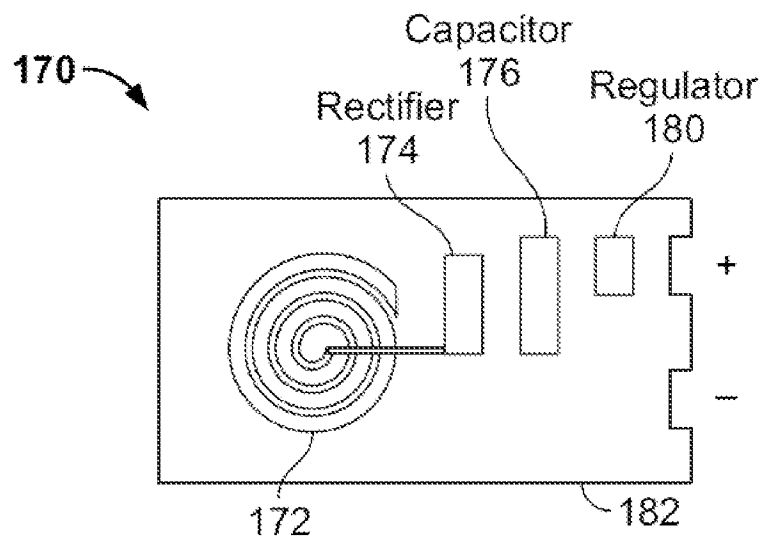


Fig. 6

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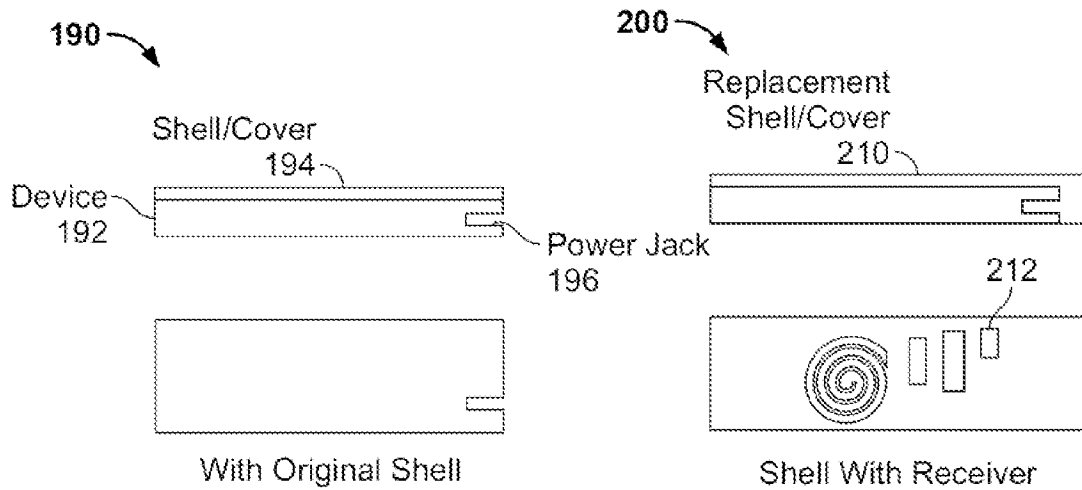


Fig. 7

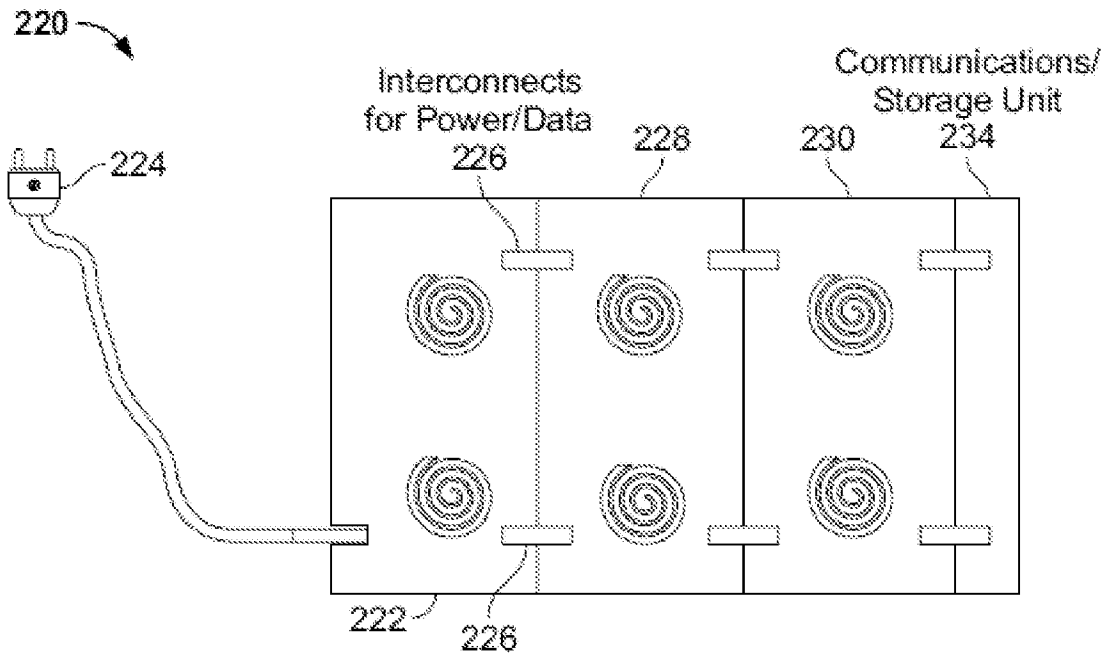


Fig. 8

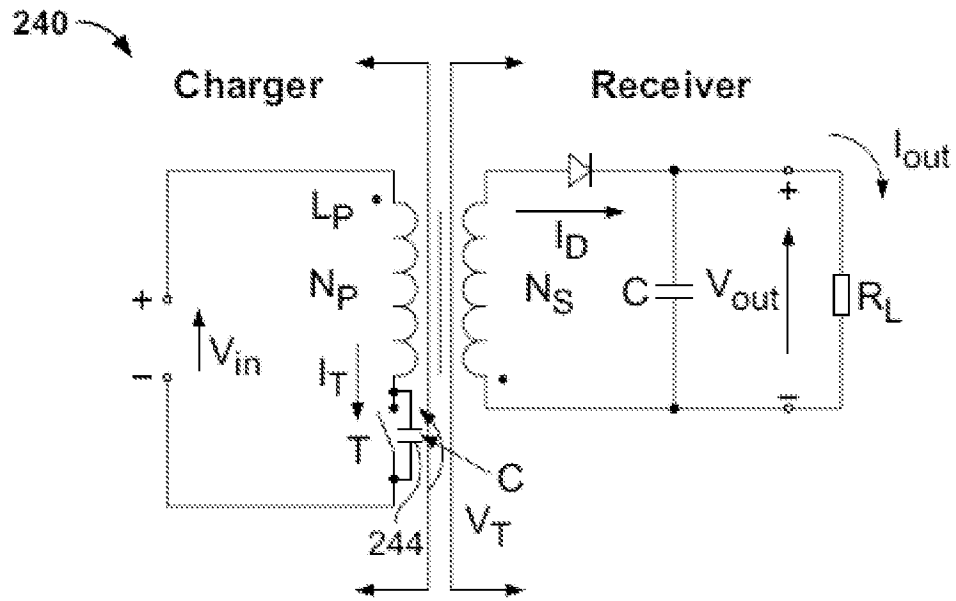


Fig. 9

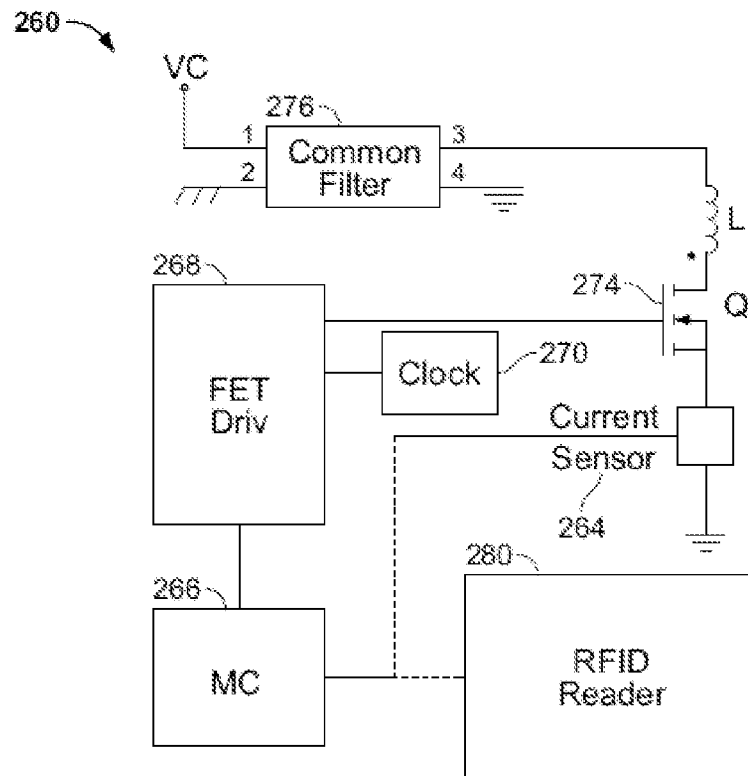
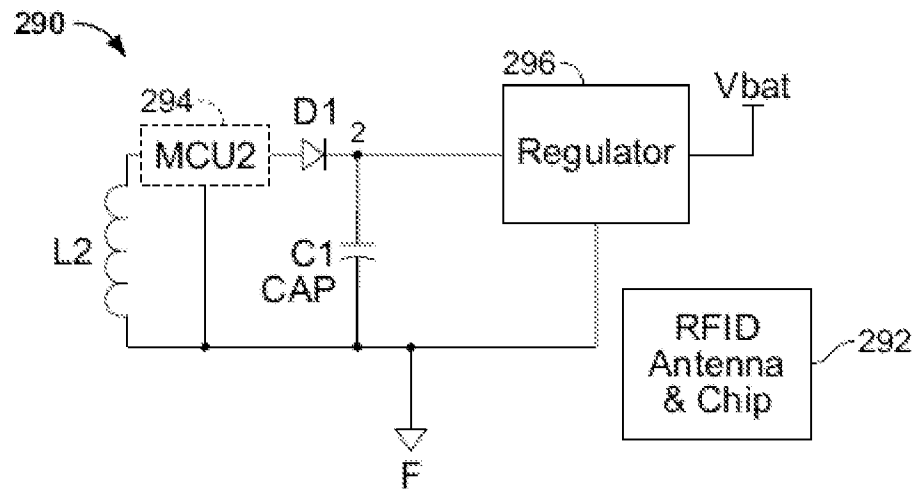
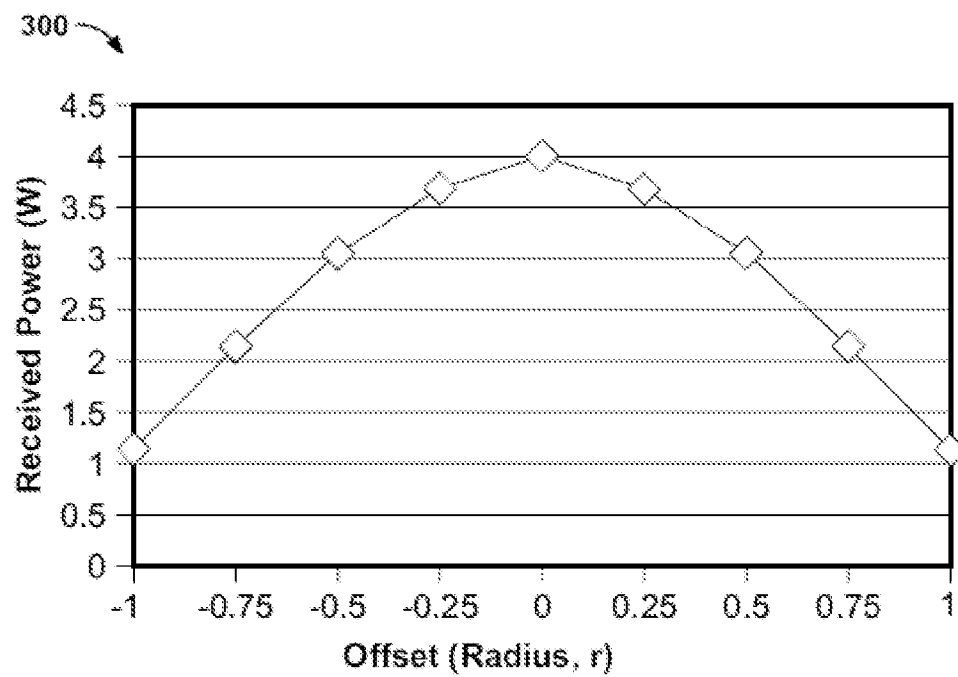


Fig. 10

**Fig. 11****Fig. 12**

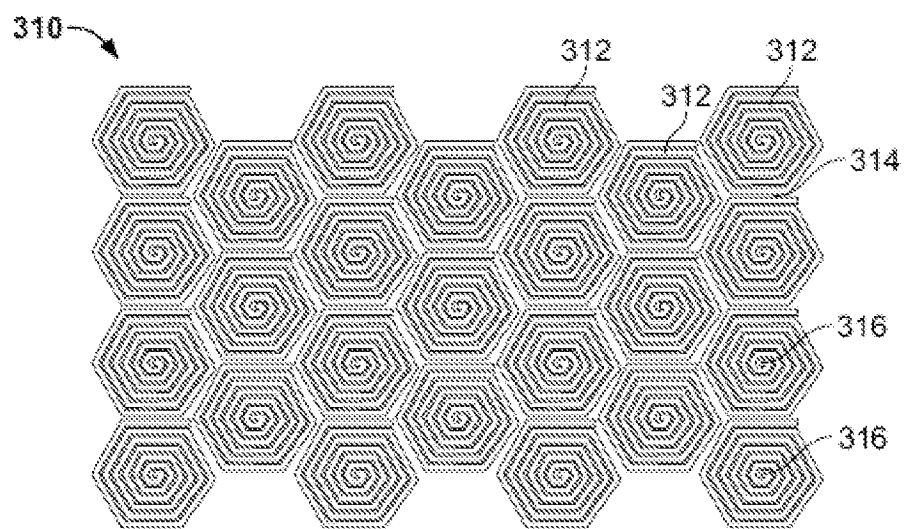


Fig. 13

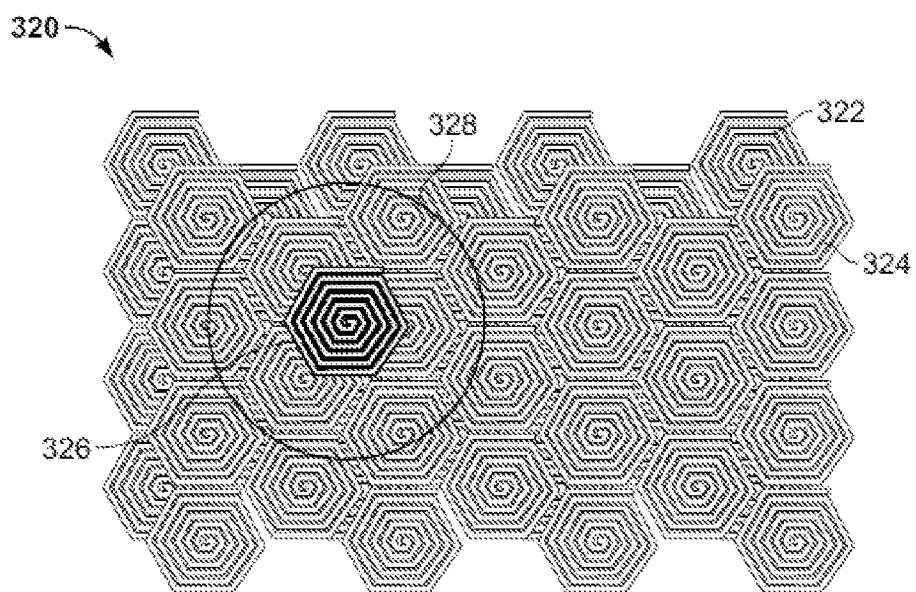


Fig. 14

REPLACEMENT SHEET

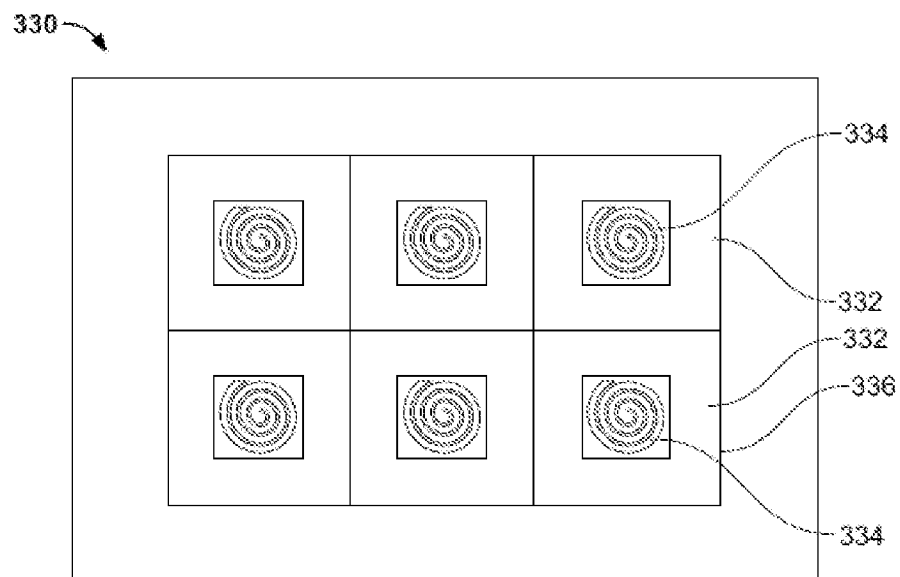


Fig. 15

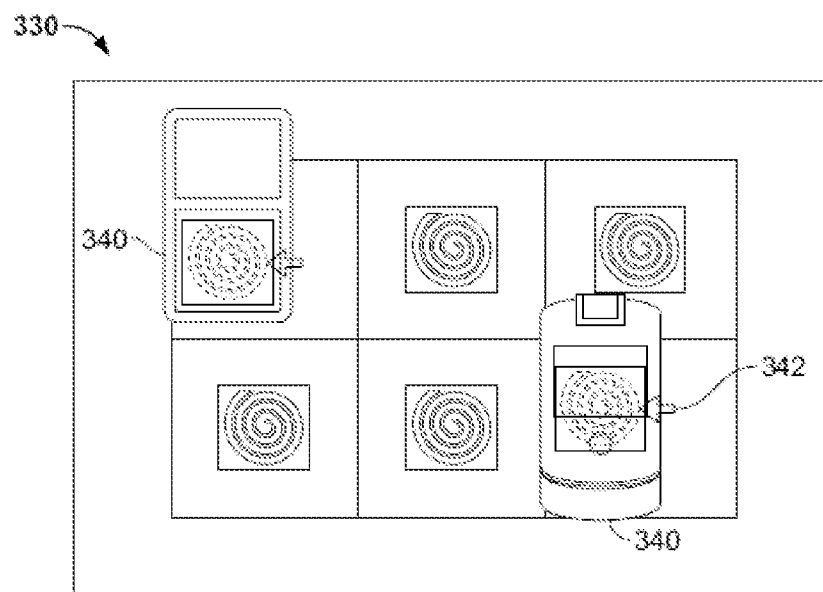


Fig. 16

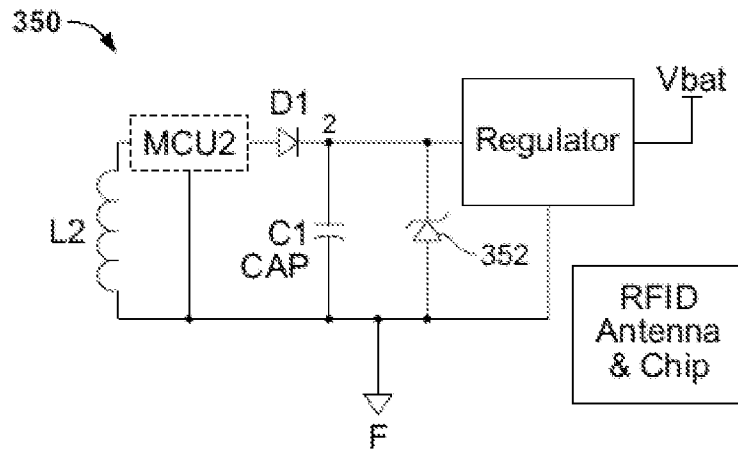


Fig. 17

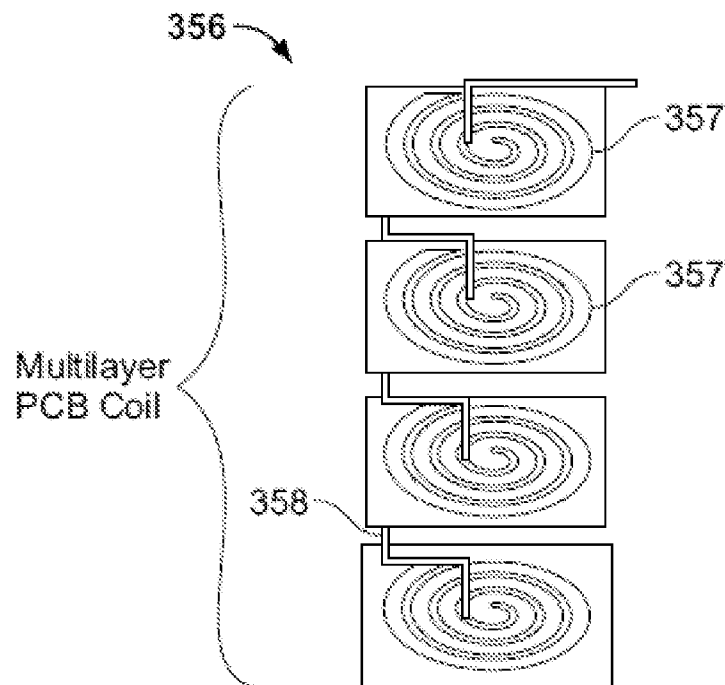


Fig. 18

REPLACEMENT SHEET

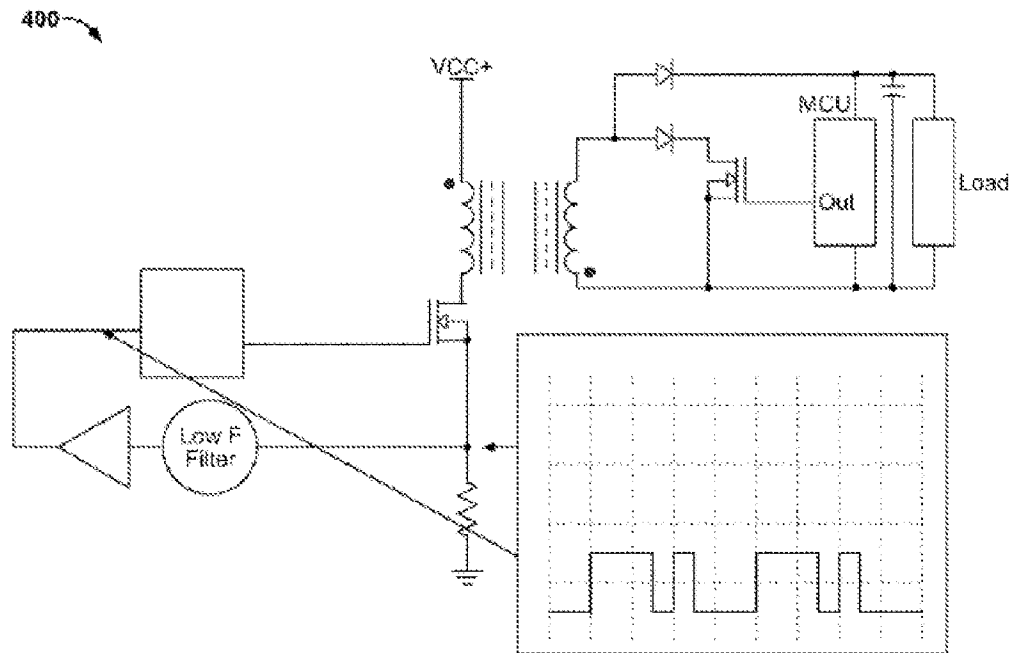


Fig. 19

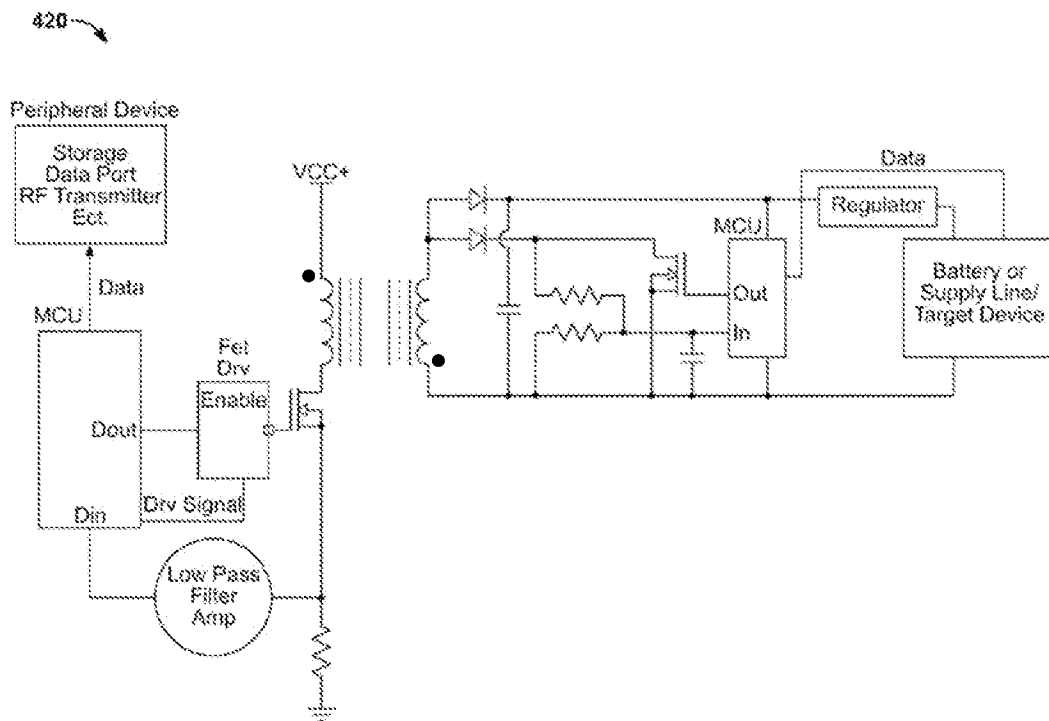


Fig. 20

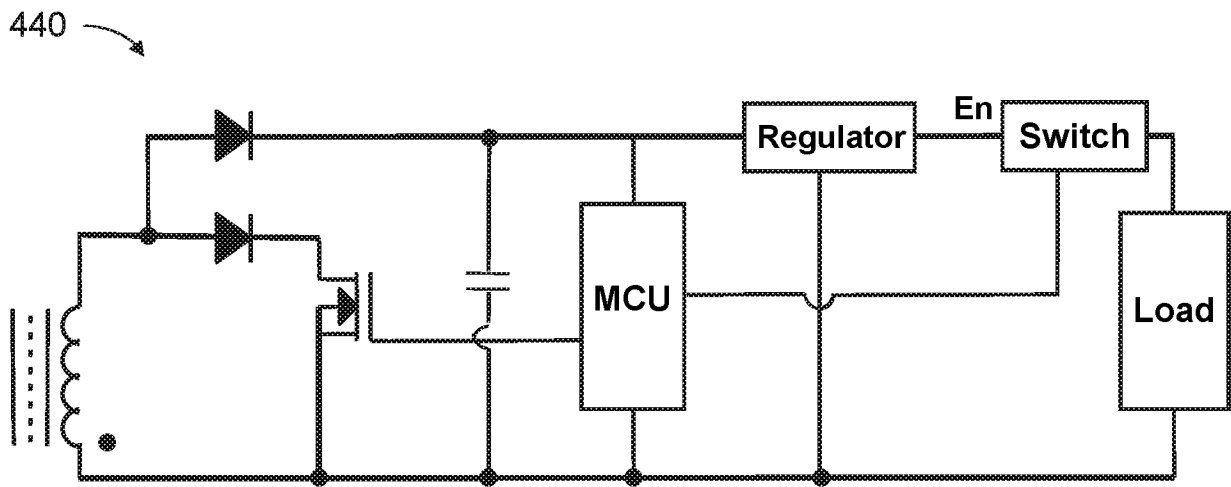


Fig. 21

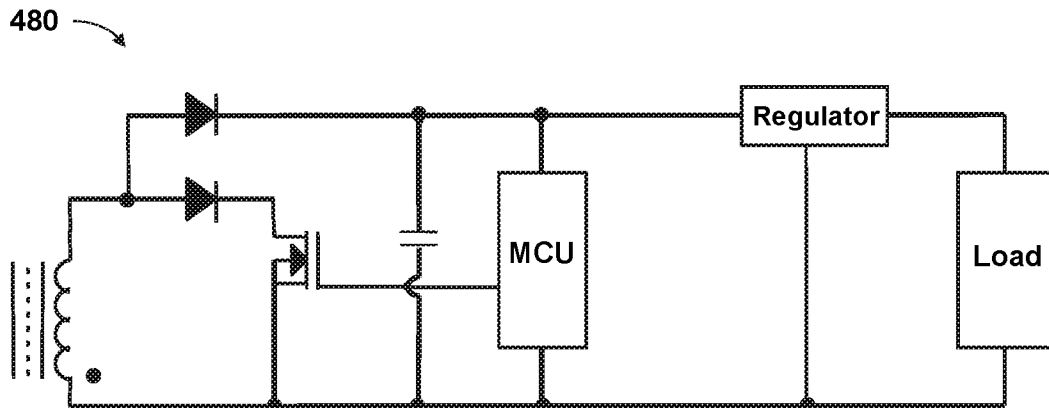


Fig. 22

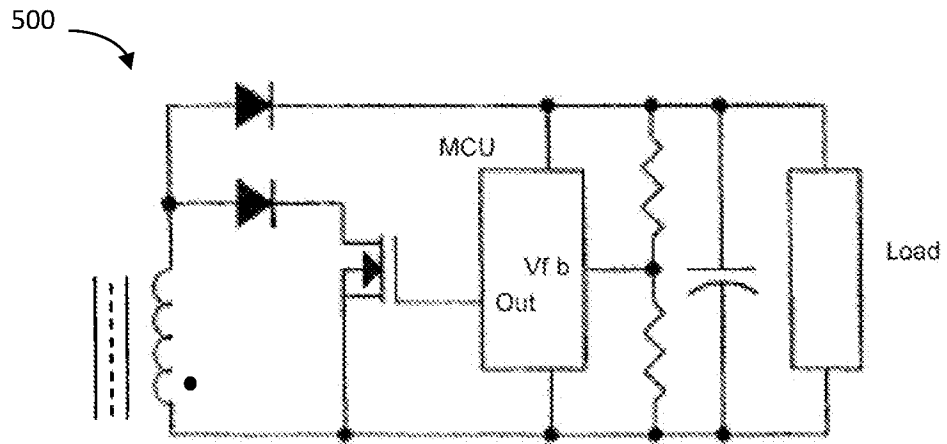


Fig. 23

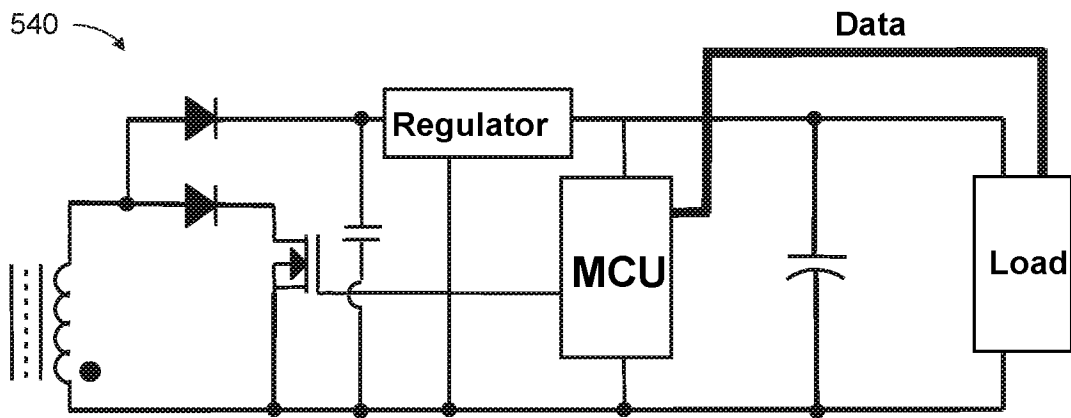


Fig. 24

560

VCC+

Regulator

MCU

Load

MCU

Dout

En

FET Drive

Counter

Drv Signal

Low Pass Filter Amp

Pulse Pattern

Zoom (x4)

RF

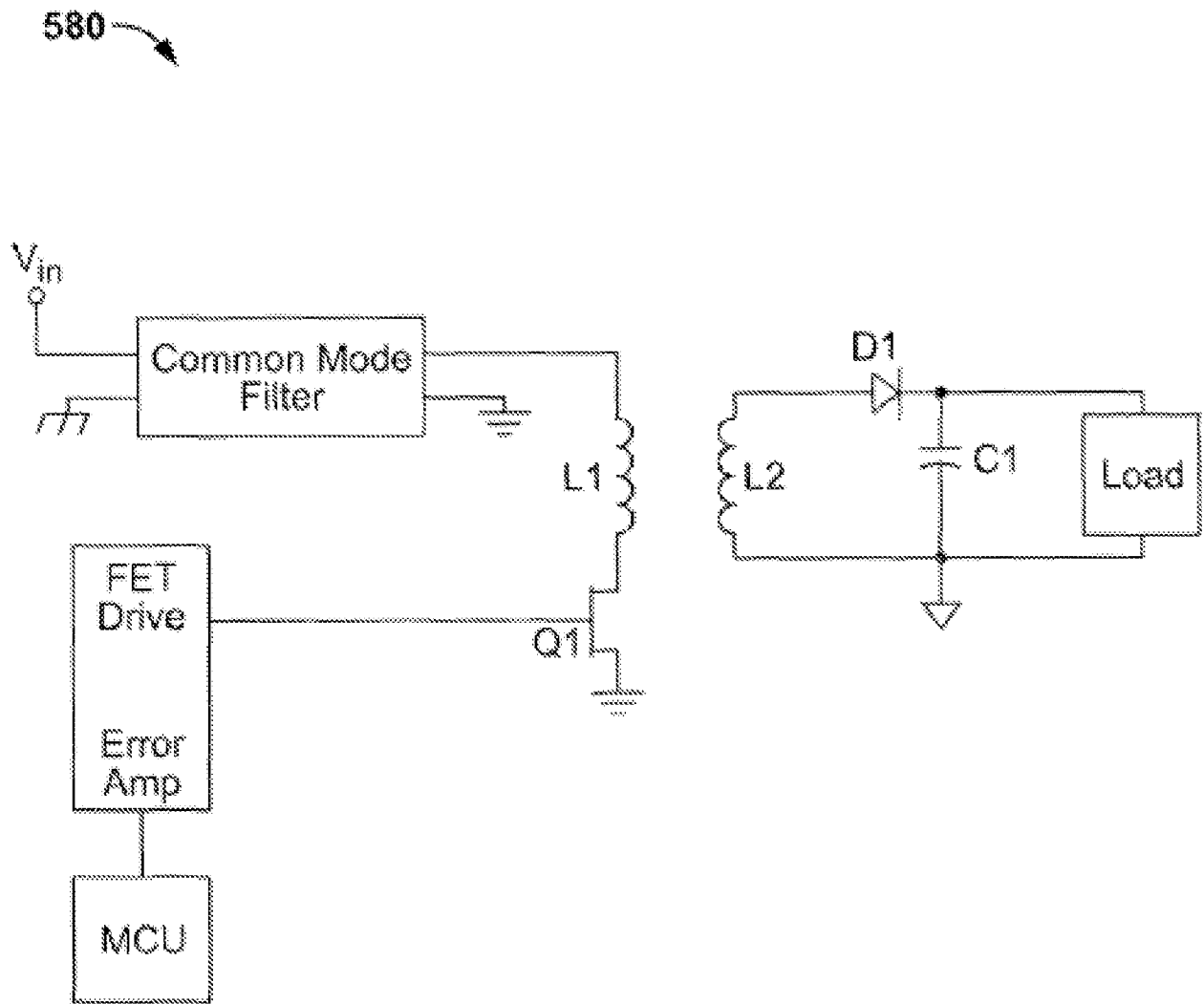
Strobe

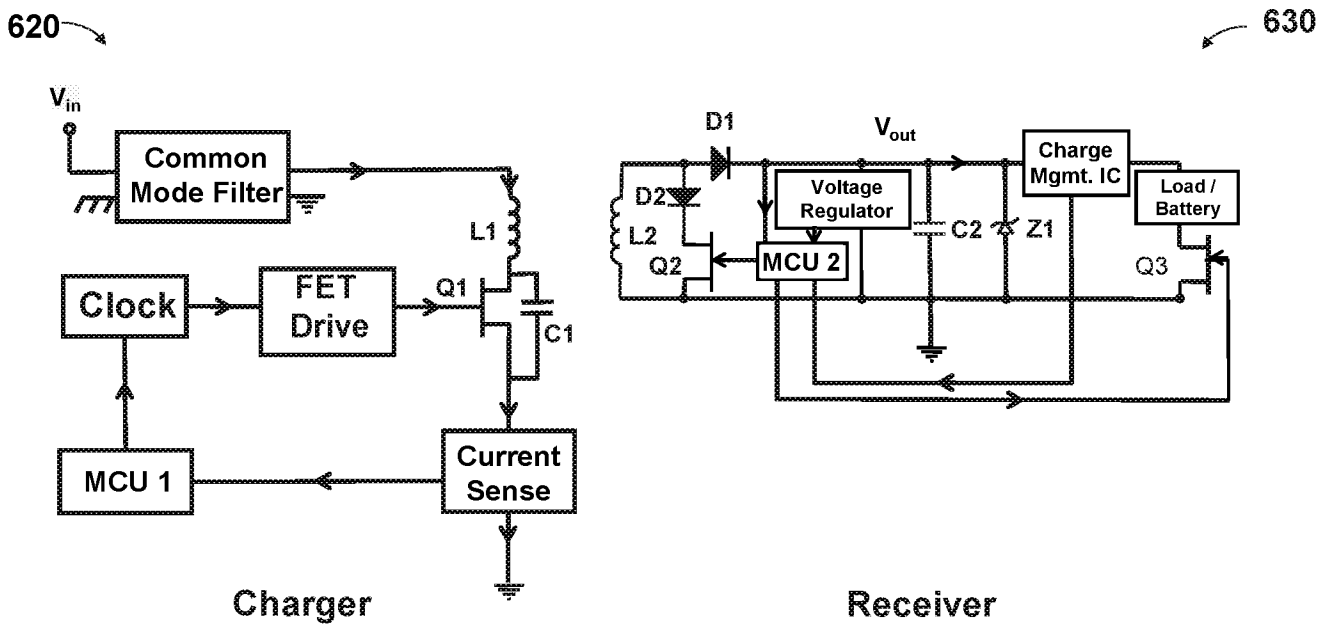
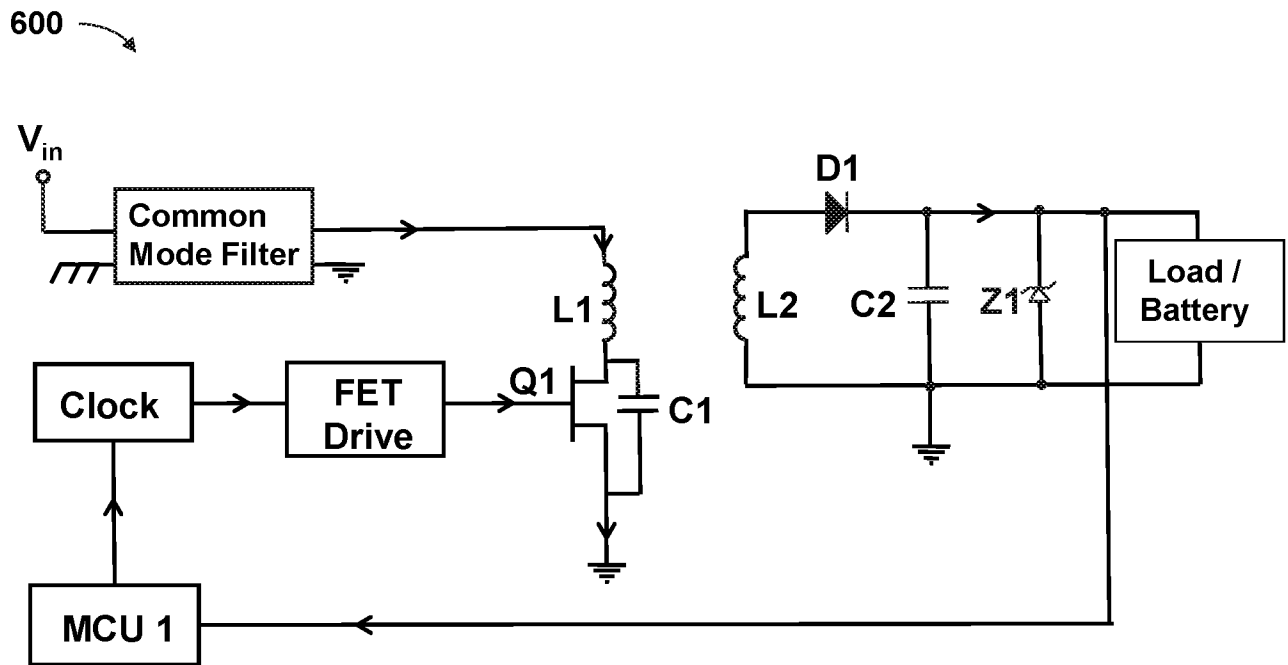
Time (μ s)

Modulating signal

Radio frequency signal

Fig. 25

**Fig. 26**



REPLACEMENT SHEET

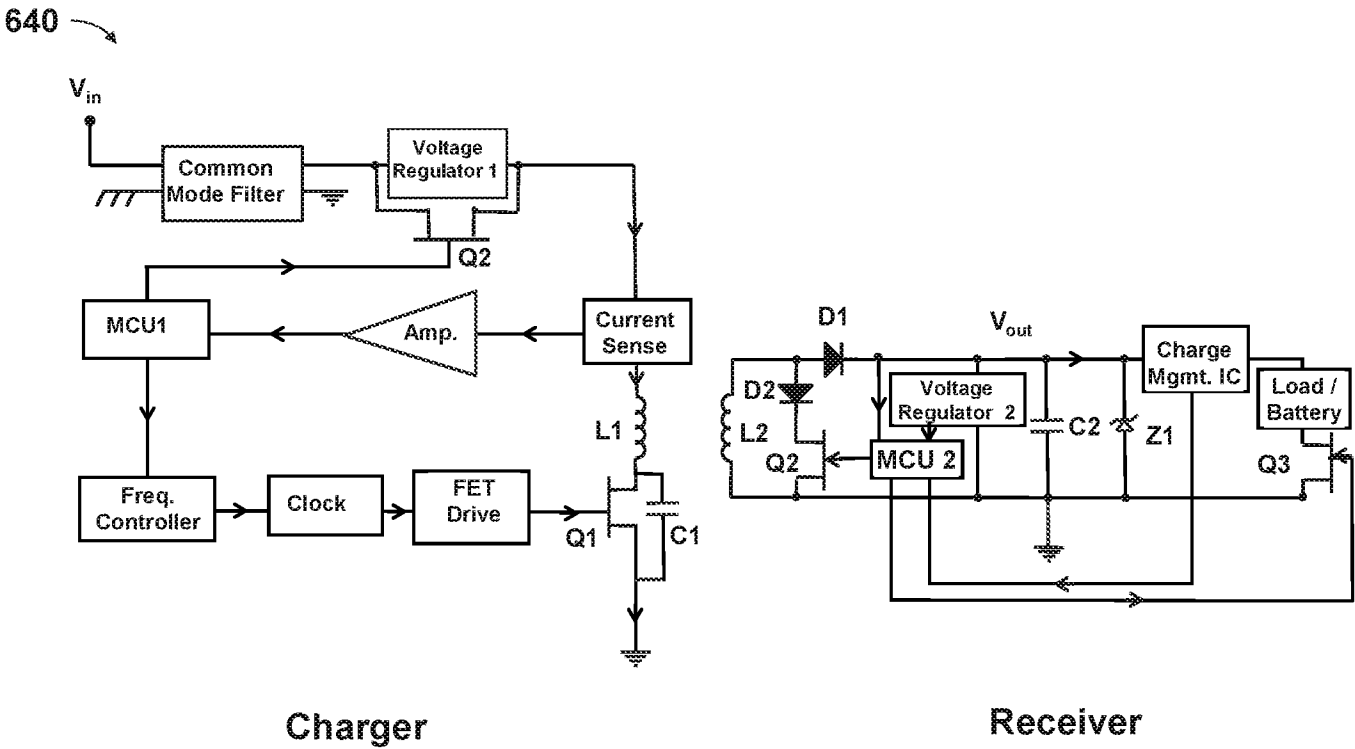


Fig. 29

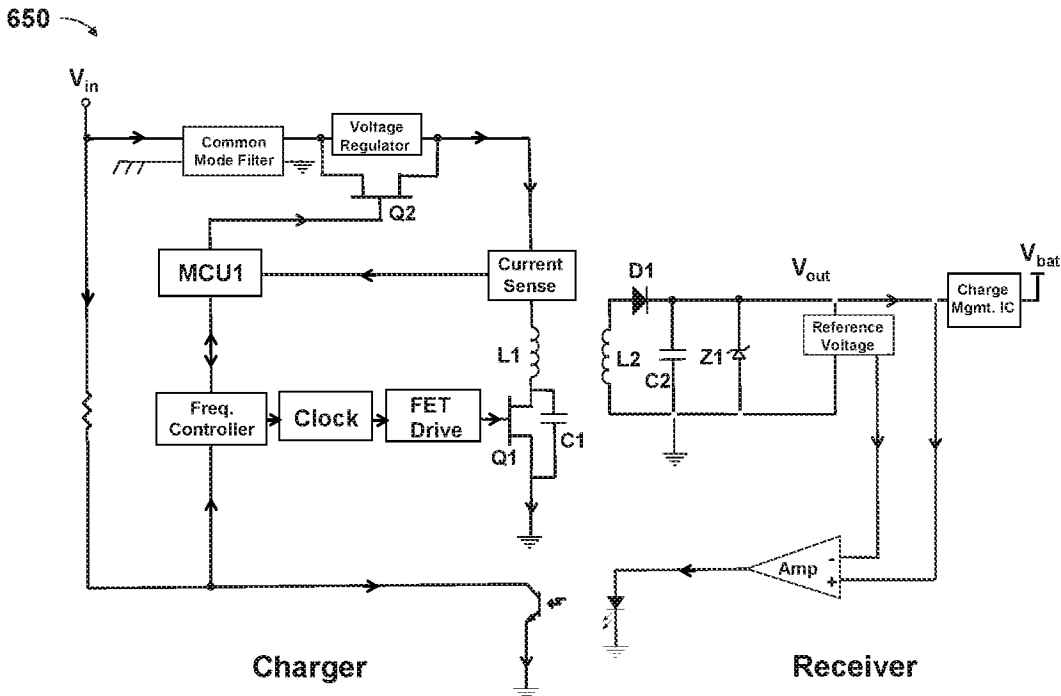


Fig. 30

REPLACEMENT SHEET

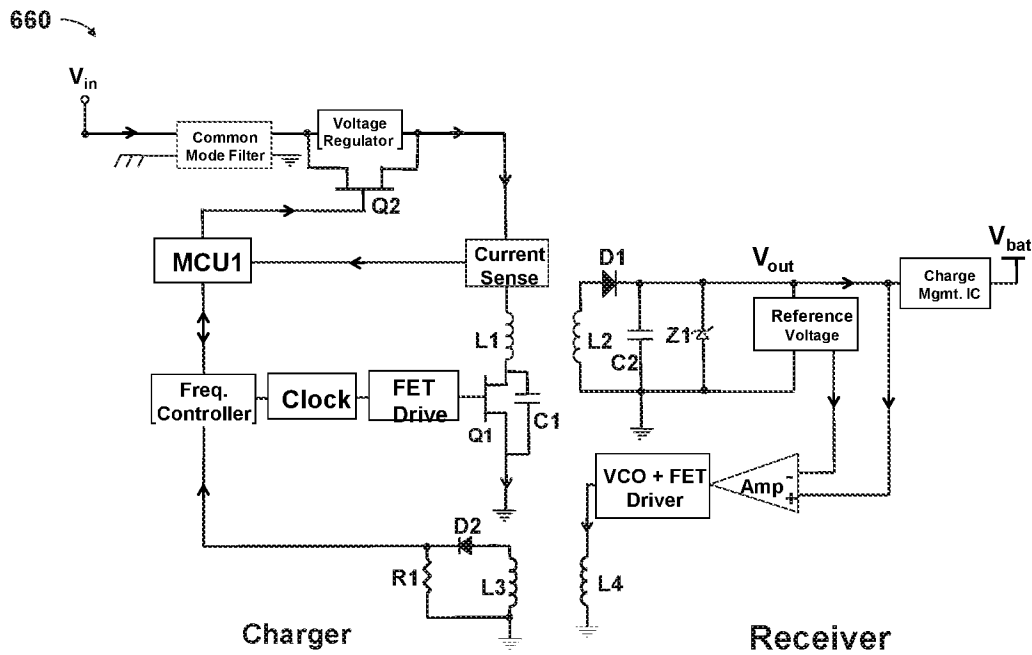


Fig. 31

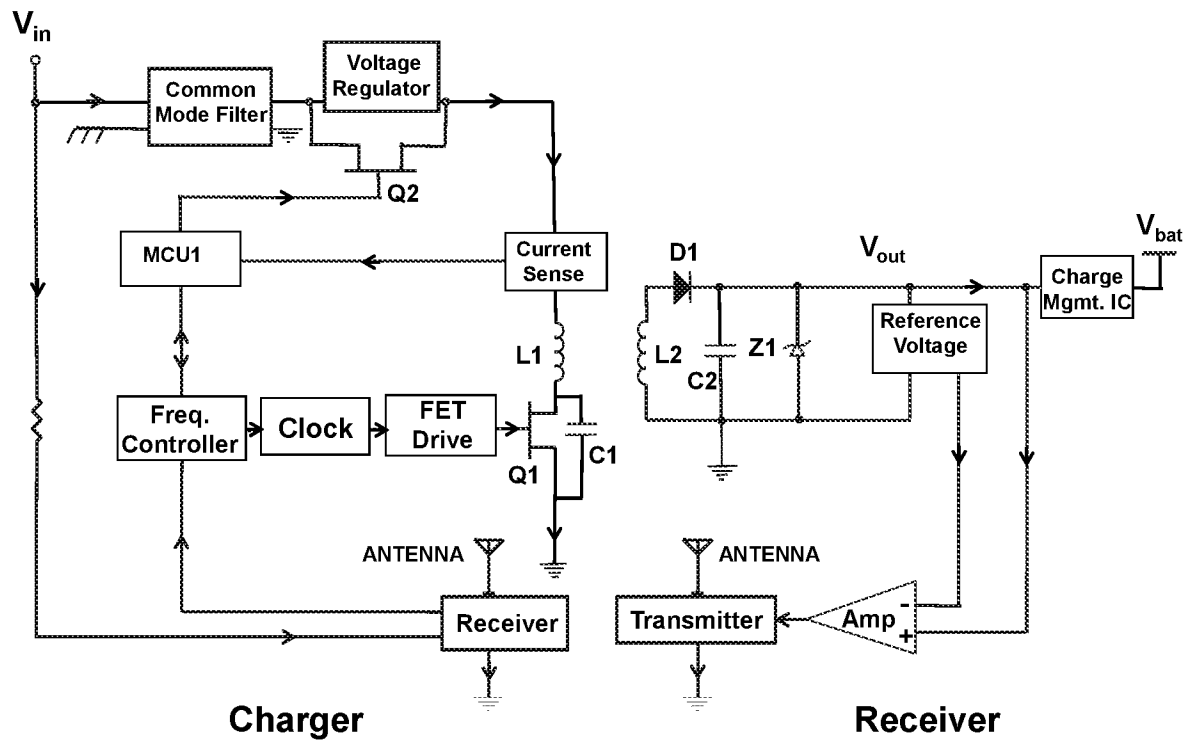


Fig. 32

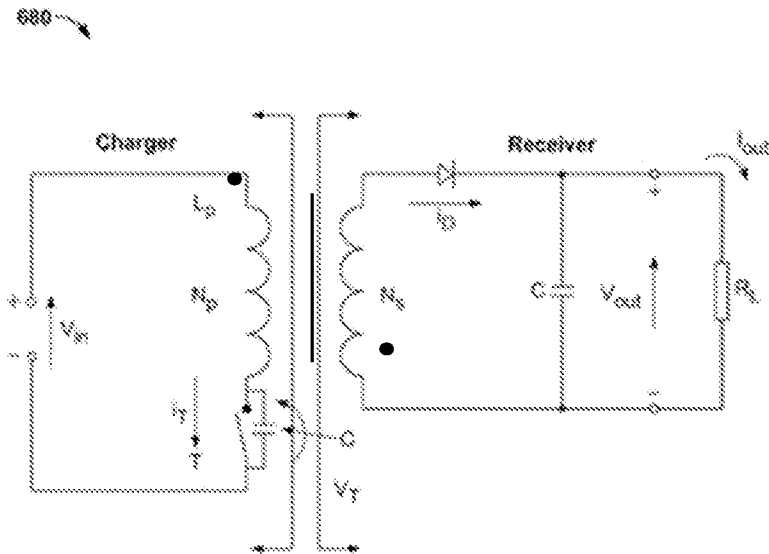


Fig. 33

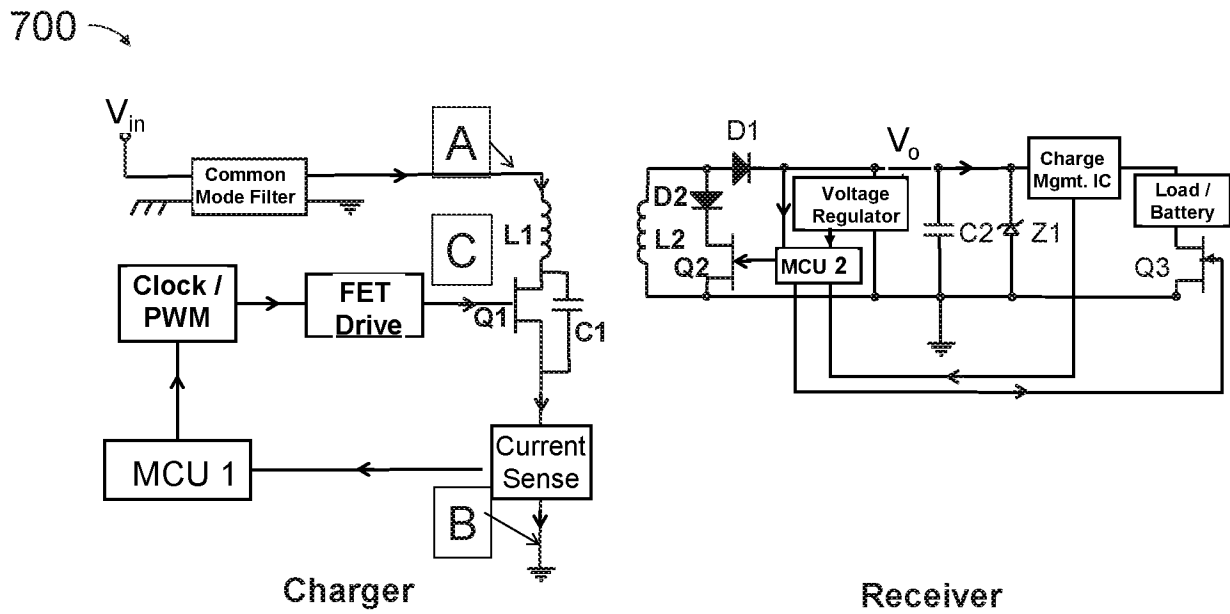


Fig. 34

720

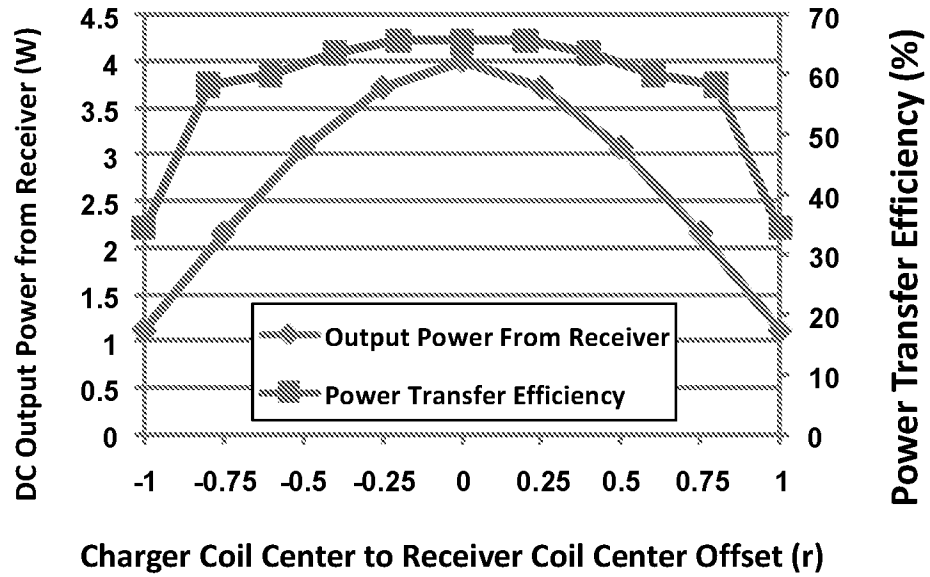


Fig. 35

740

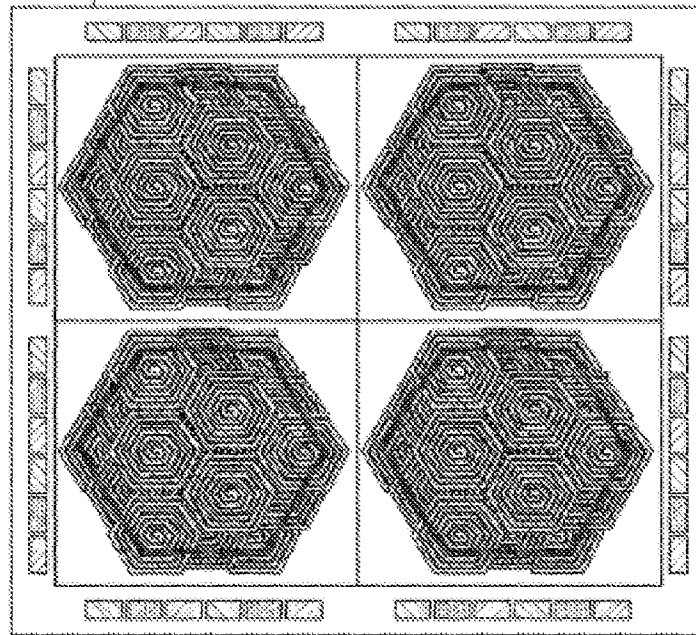
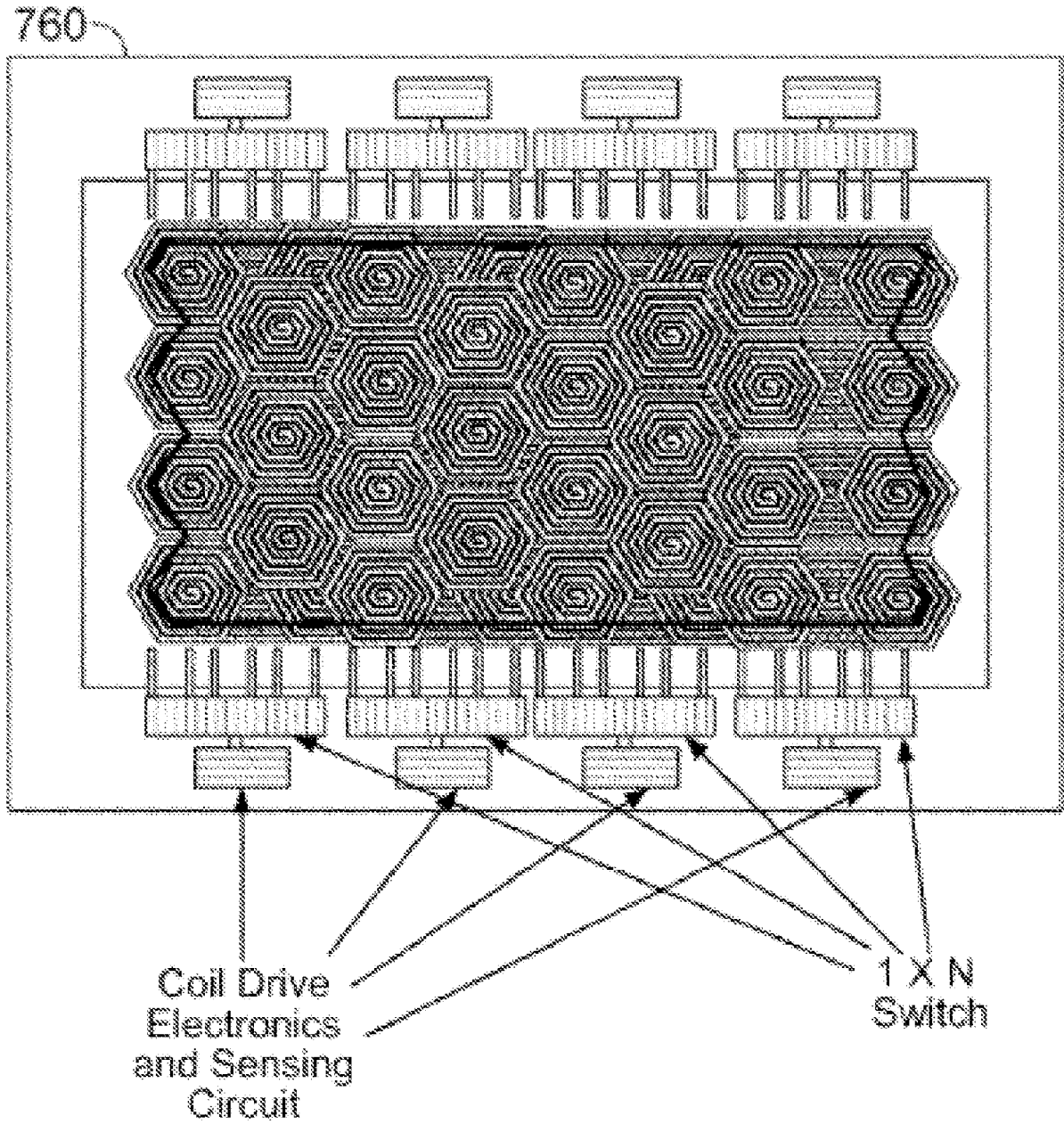


Fig. 36

**Fig. 37**

780

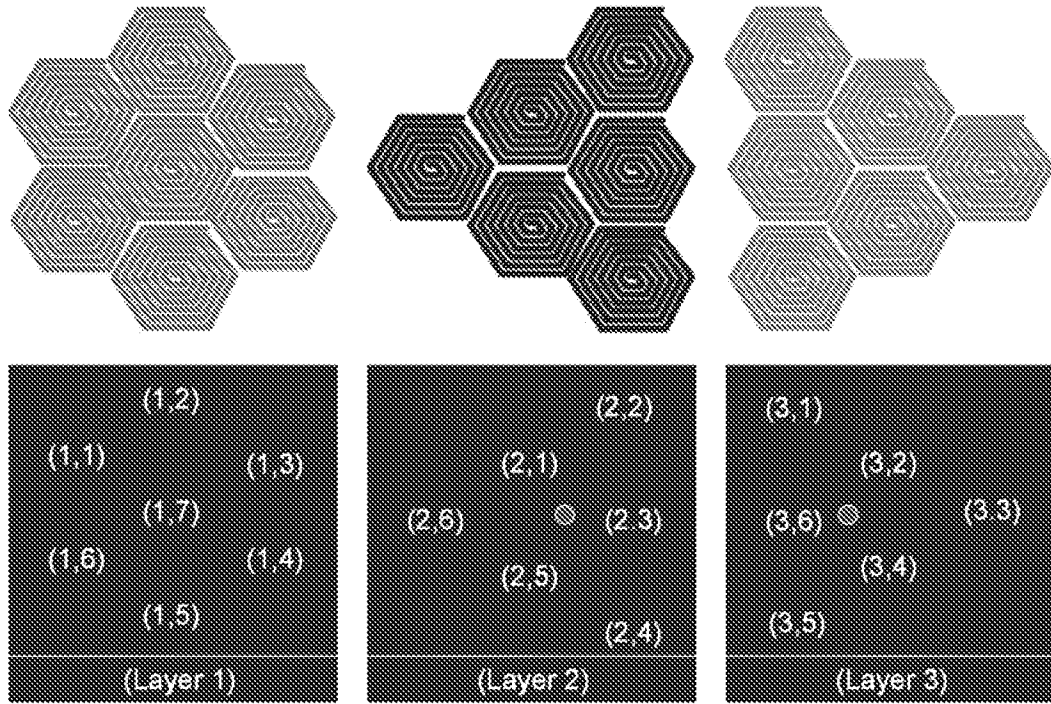


Fig. 38

790

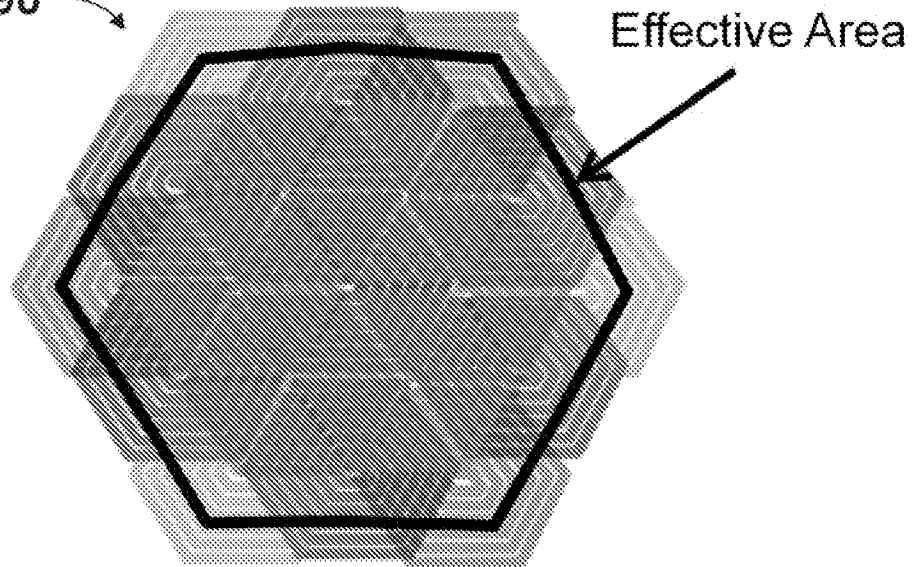


Fig. 39

792

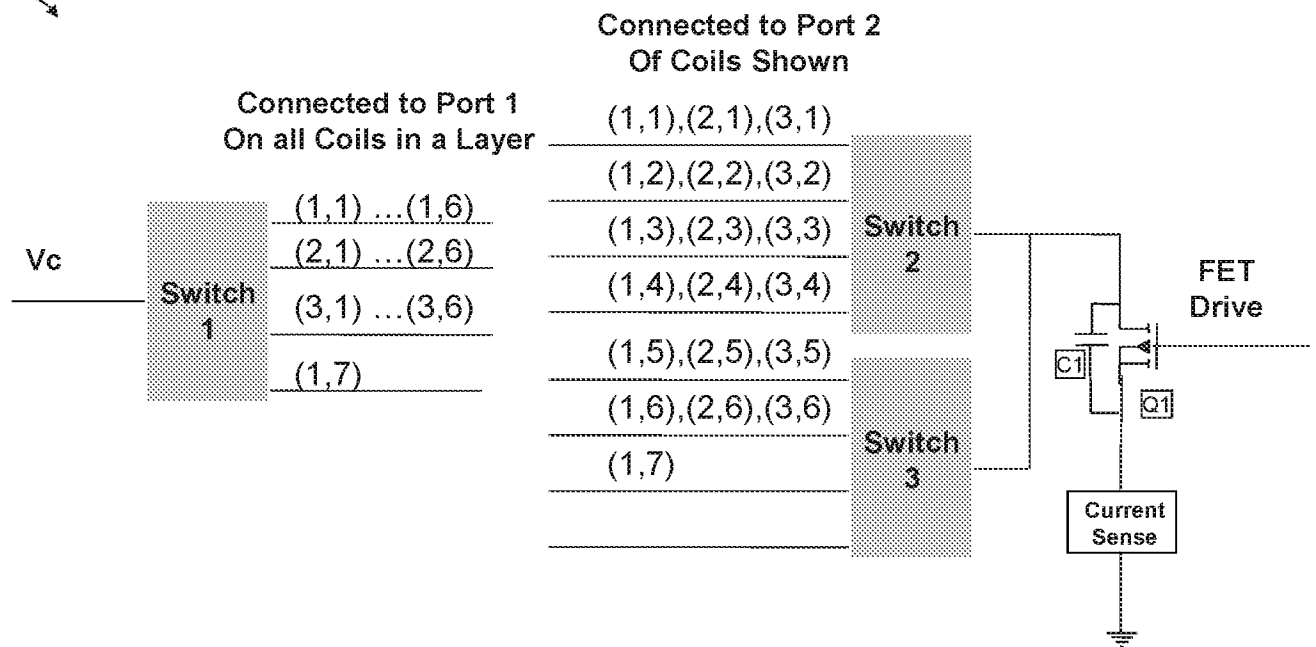


Fig. 40

796

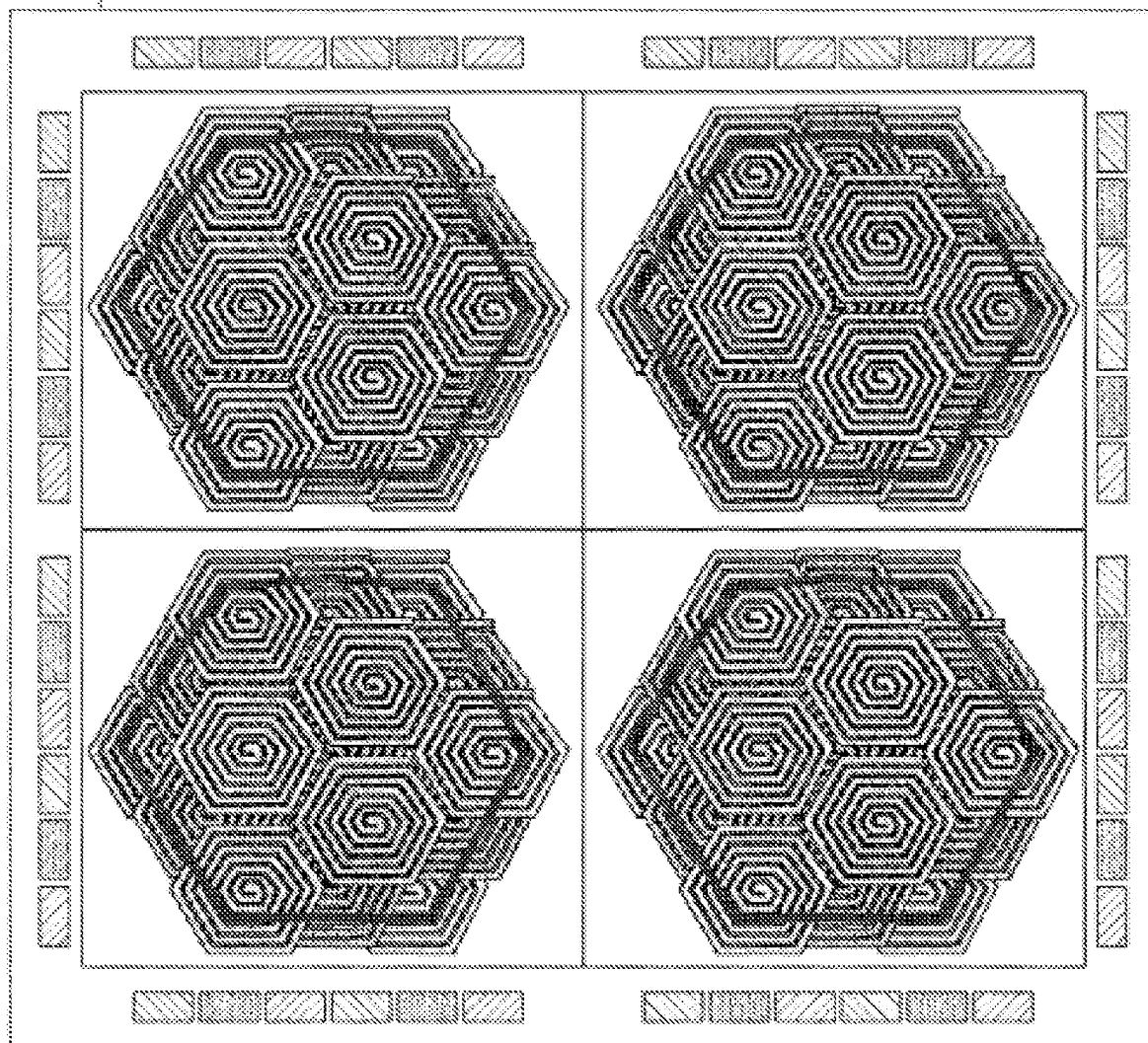


Fig. 41

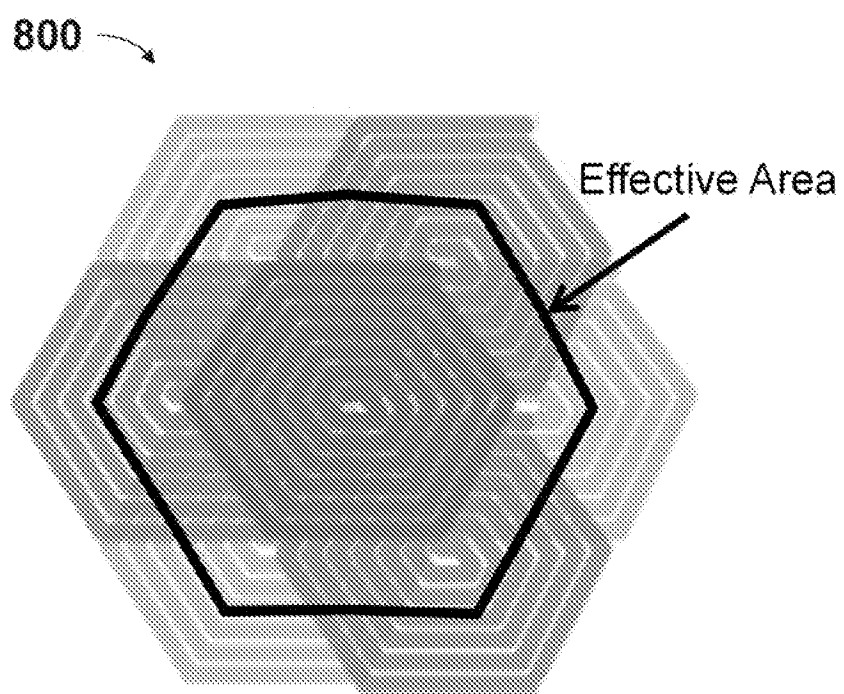


Fig. 42

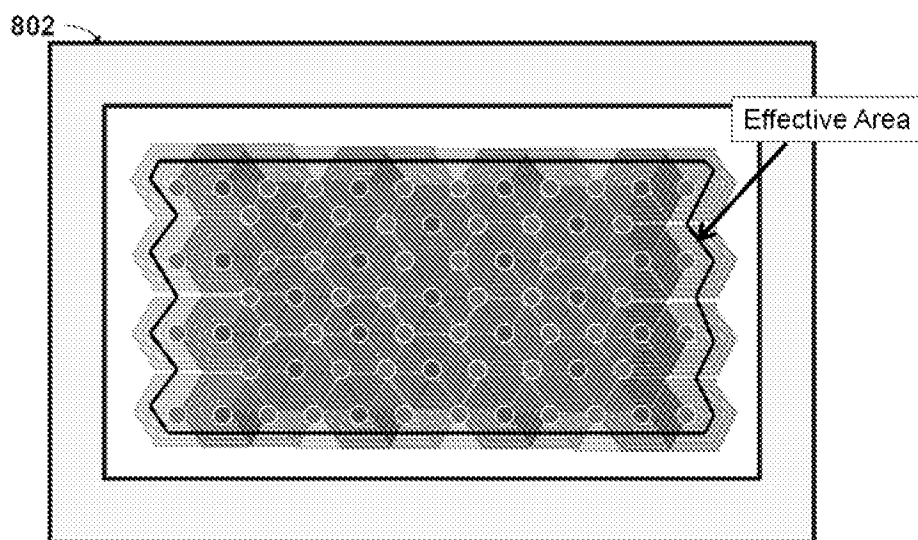


Fig. 43

REPLACEMENT SHEET

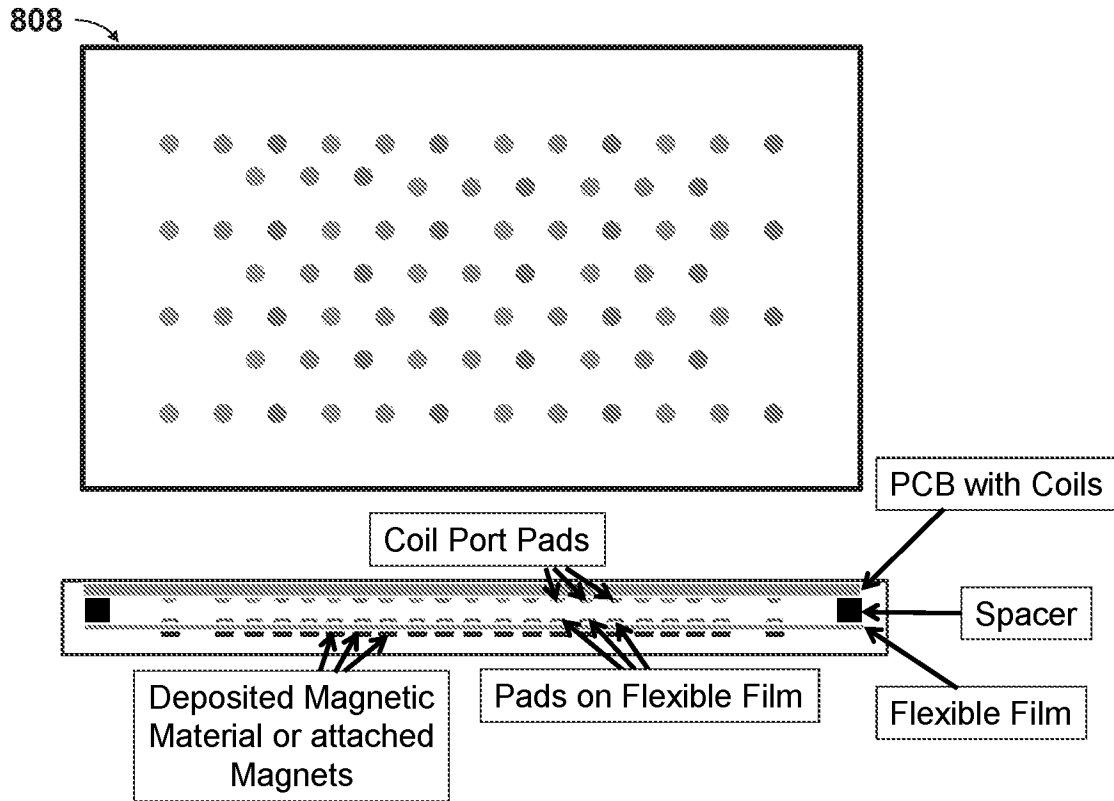


Fig. 44

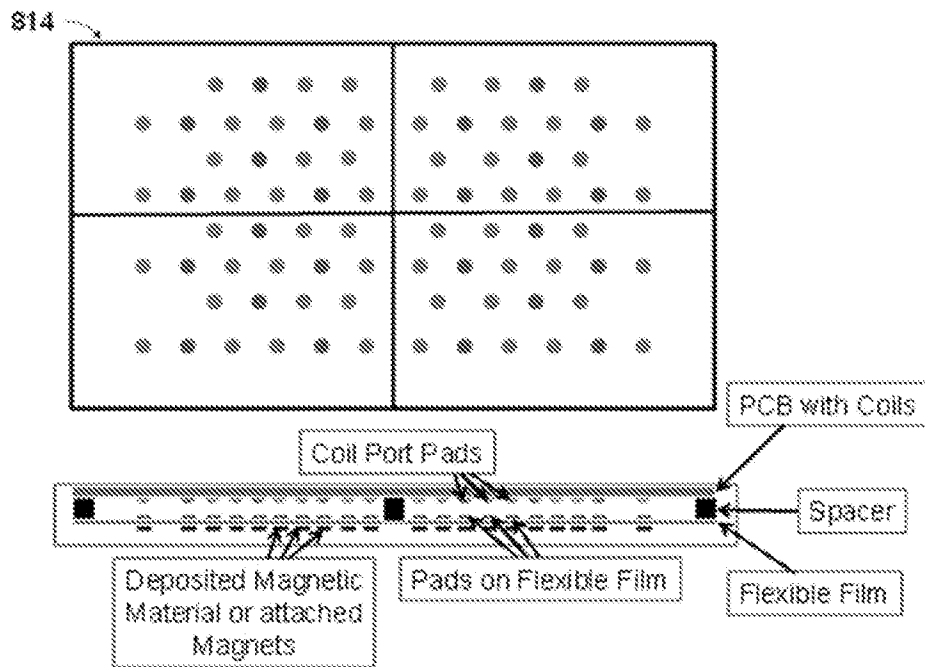


Fig. 45

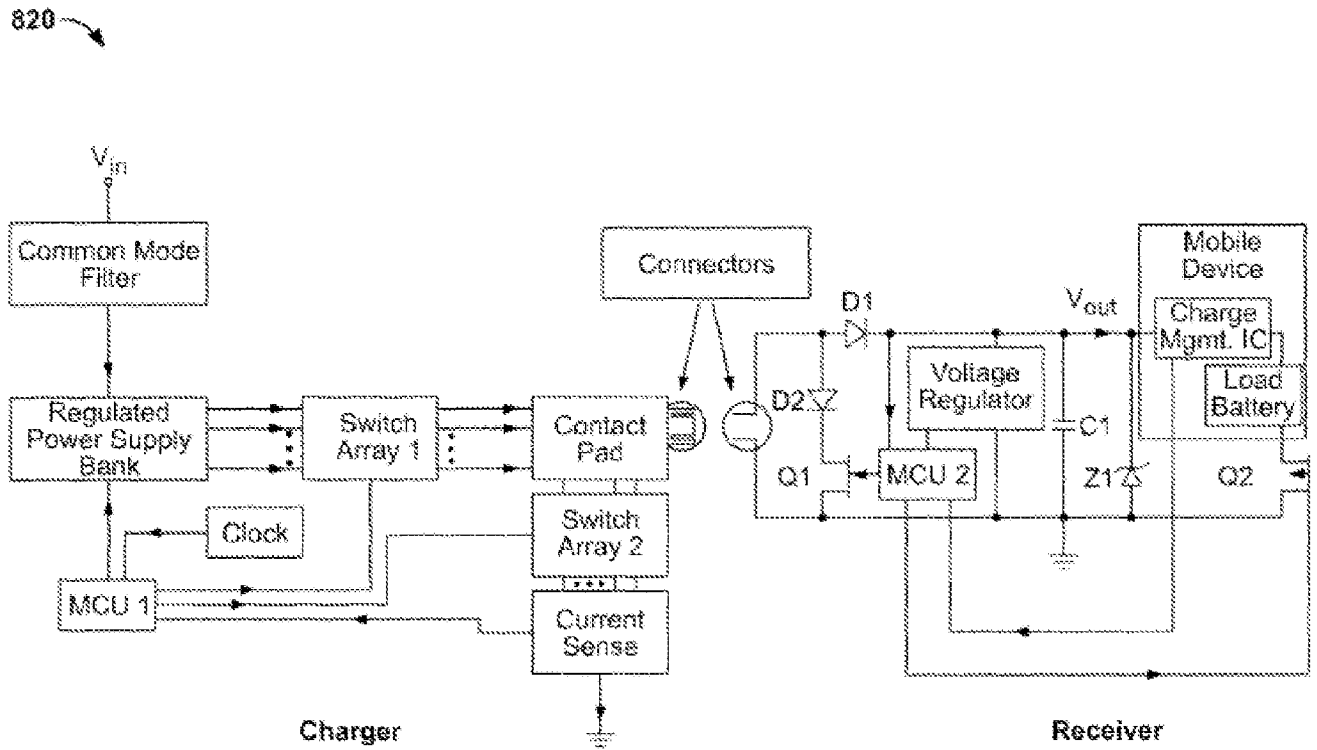


Fig. 46

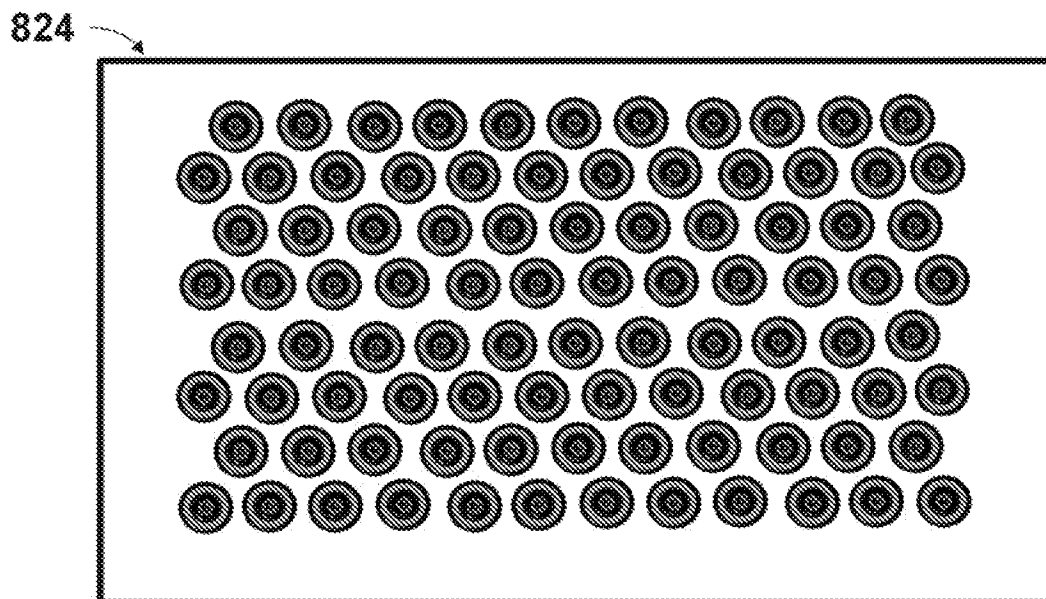


Fig. 47

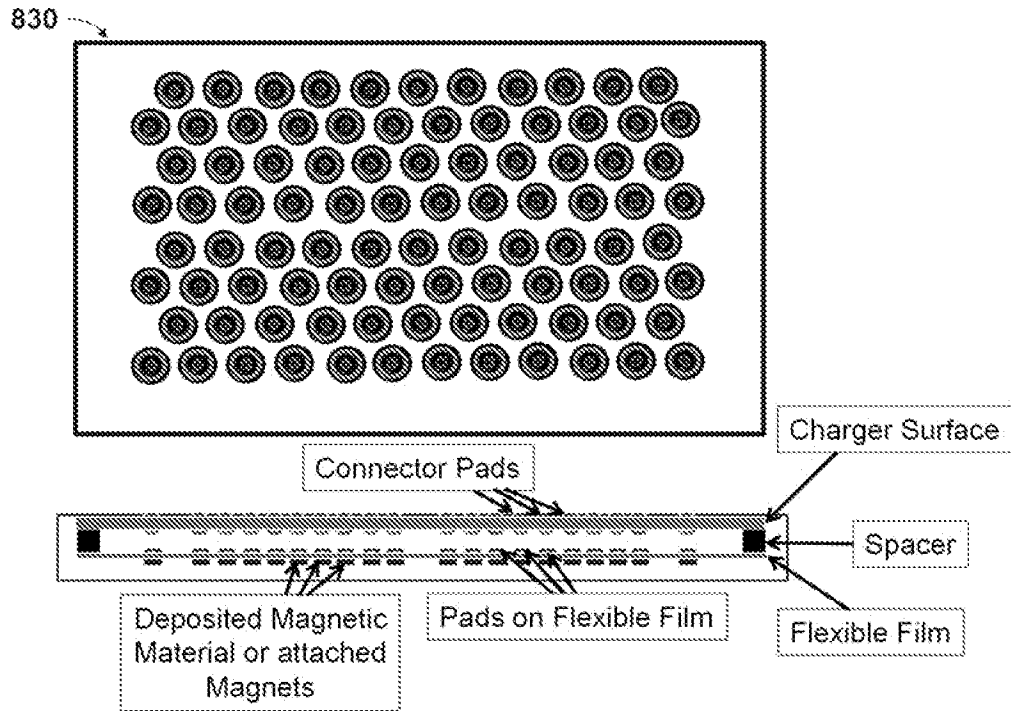


Fig. 48

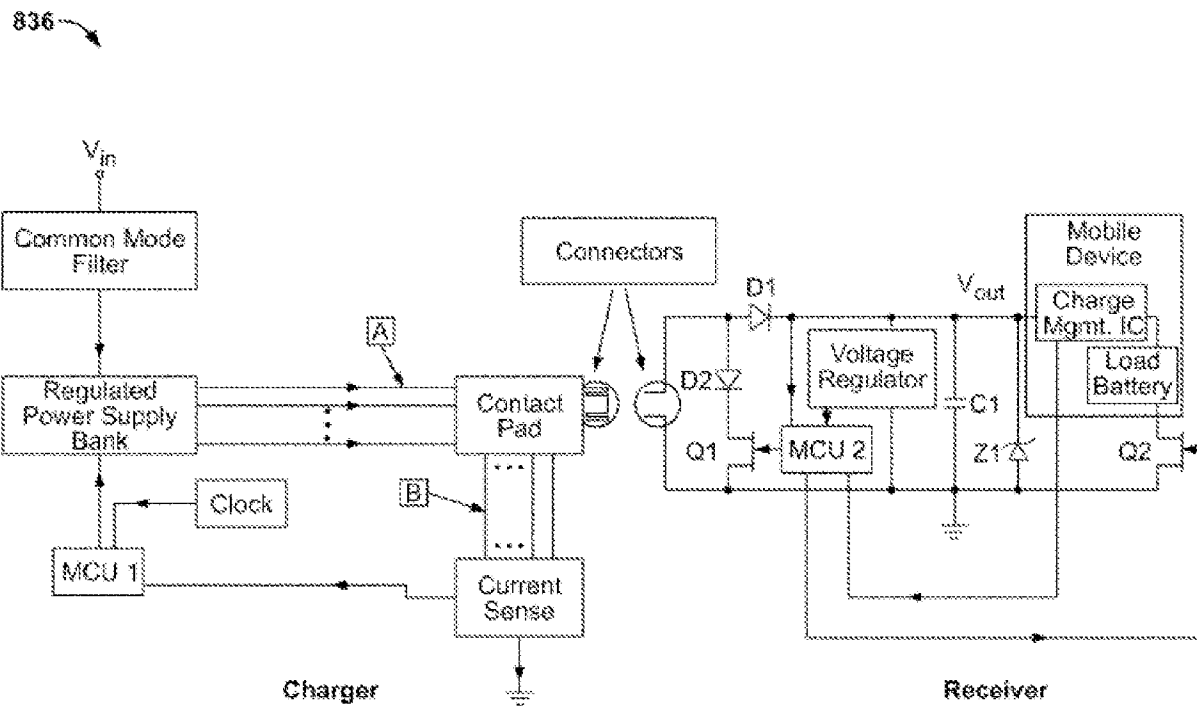


Fig. 49

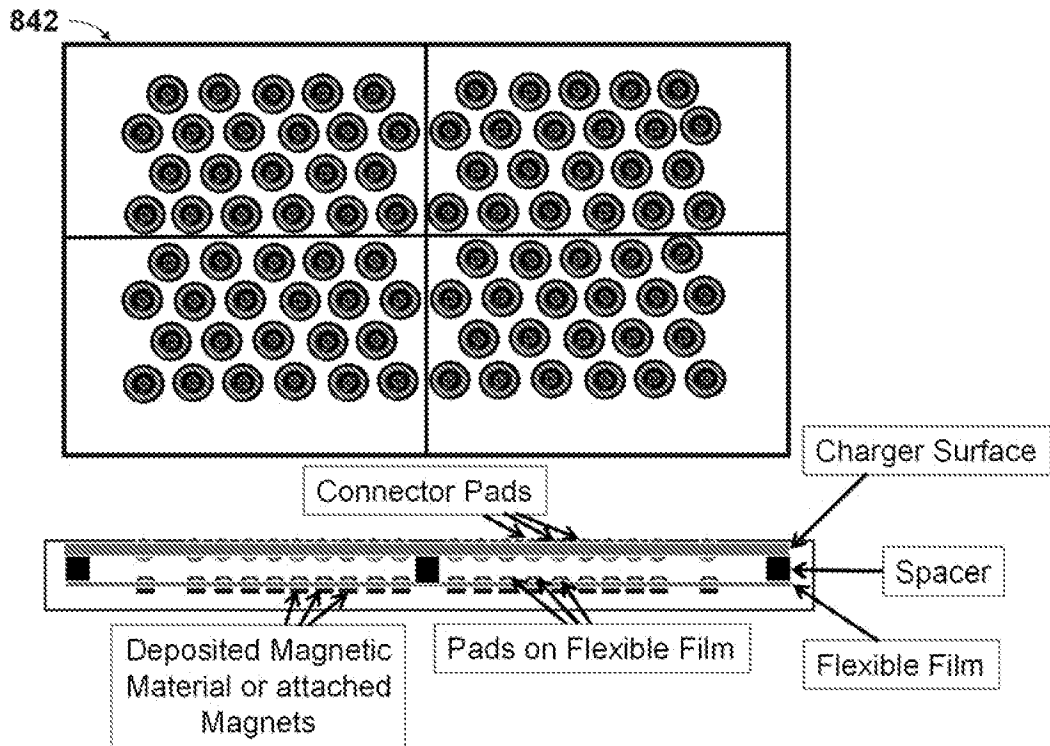


Fig. 50

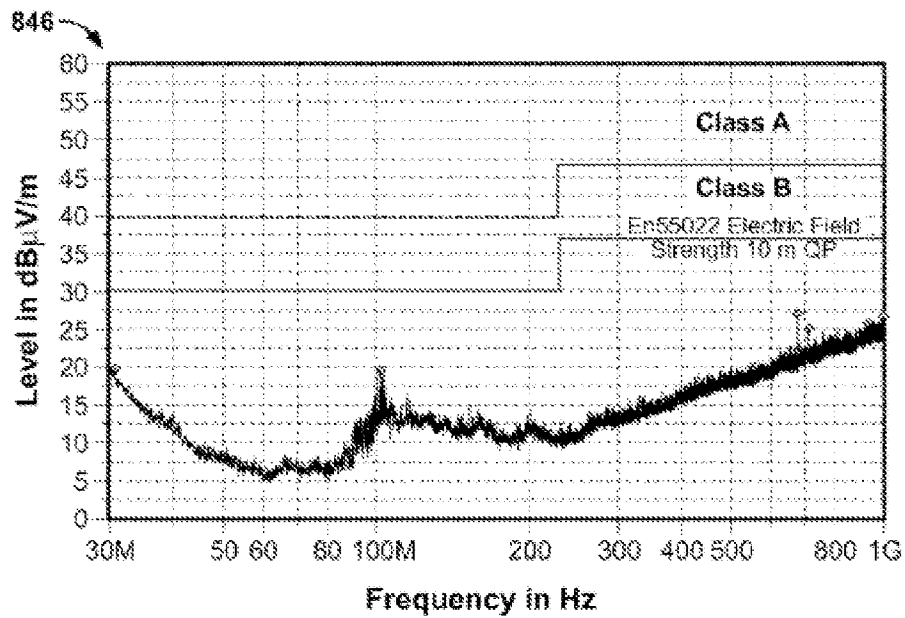
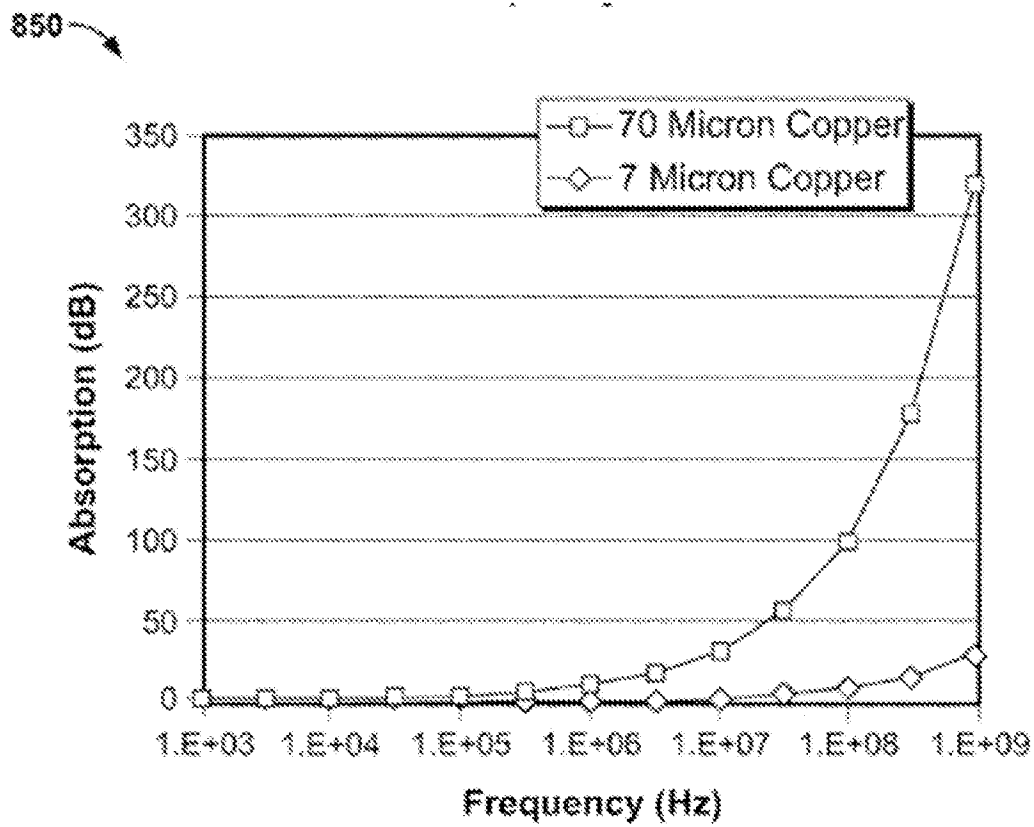


Fig. 51

**Fig. 52**

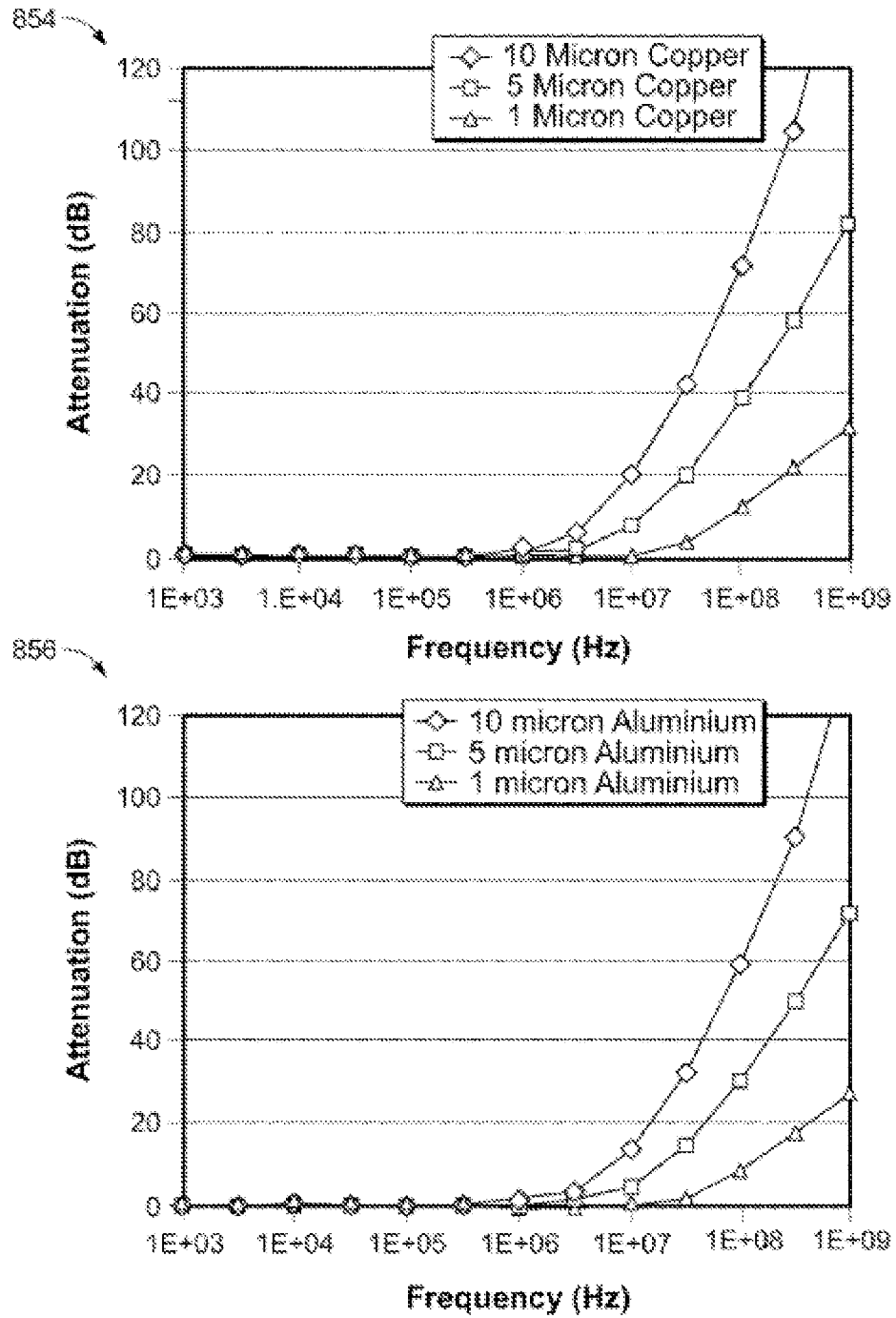


Fig. 53

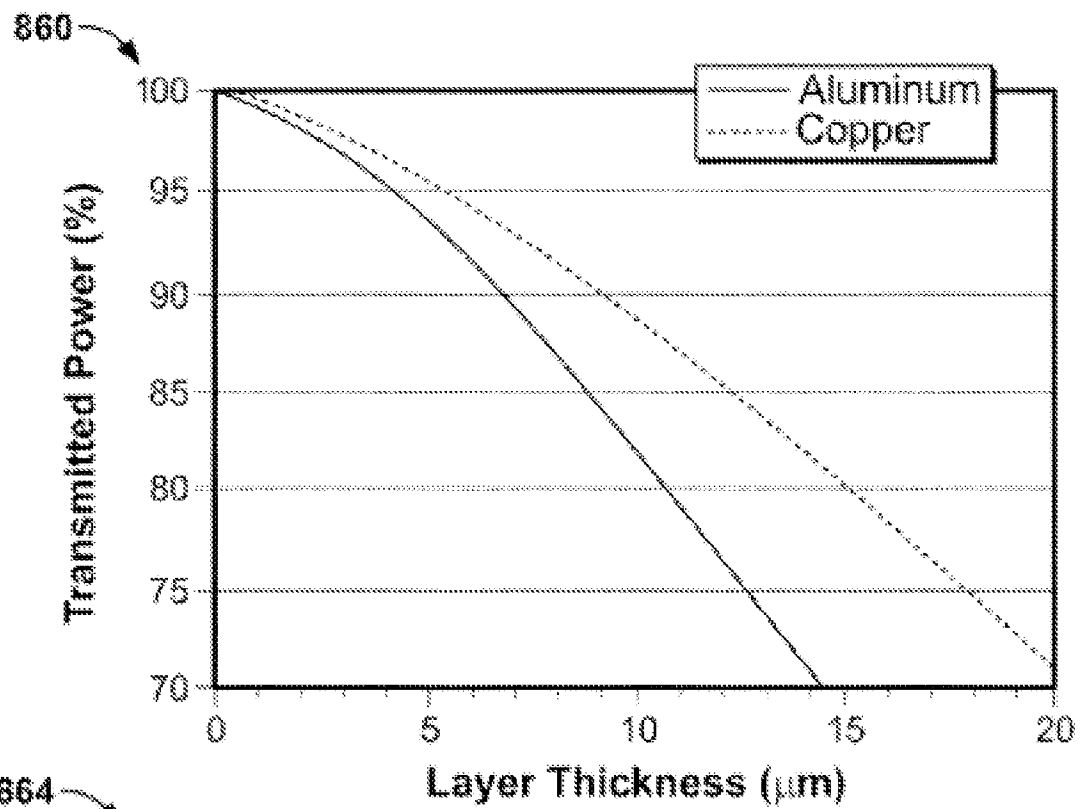


FIG. 54

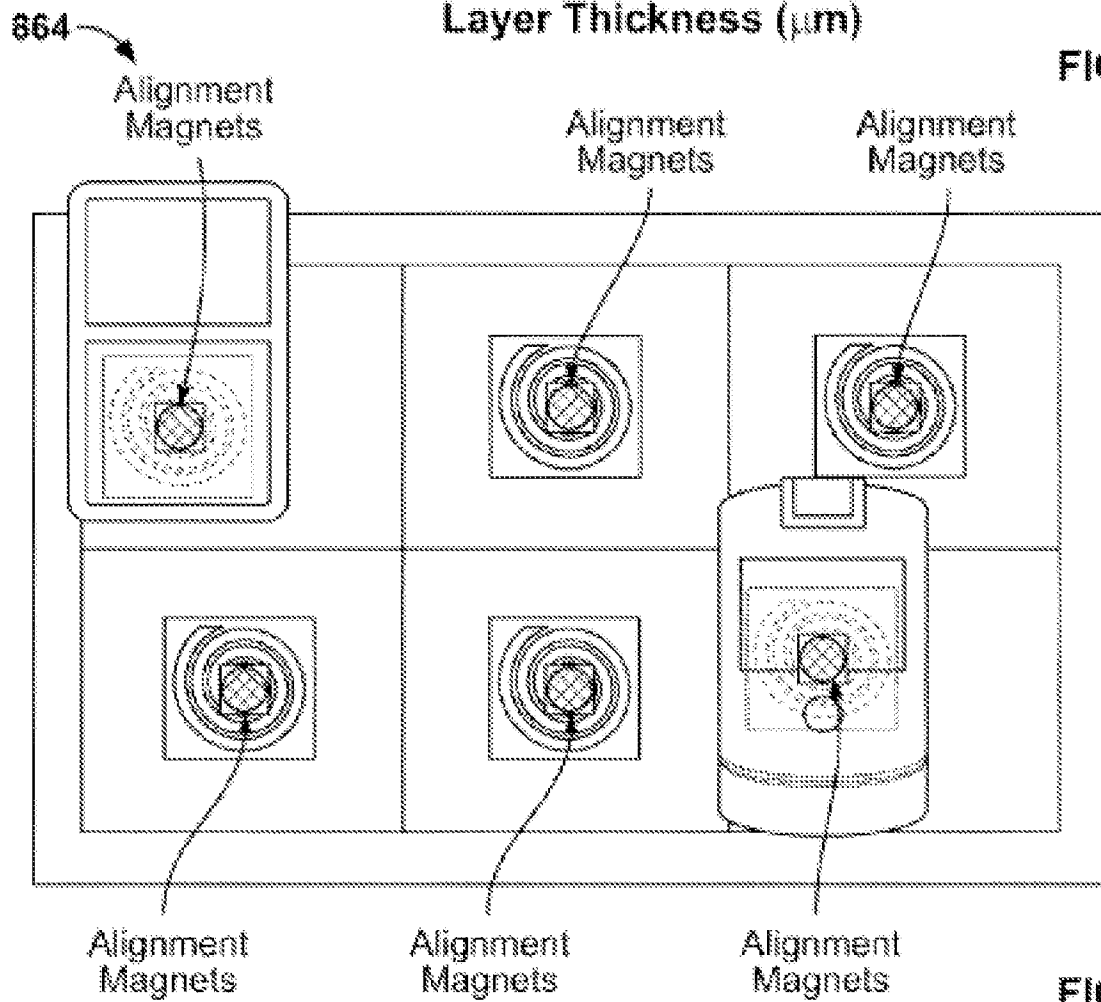


FIG. 55

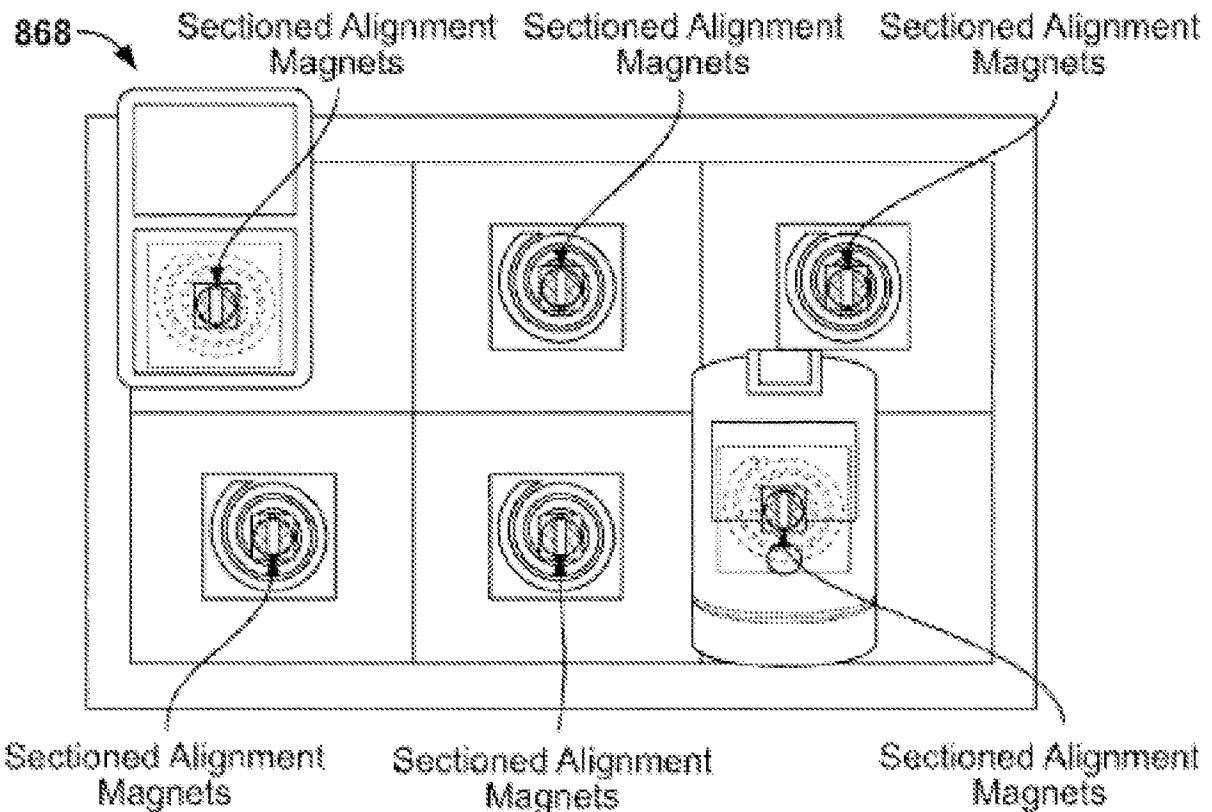


FIG. 56

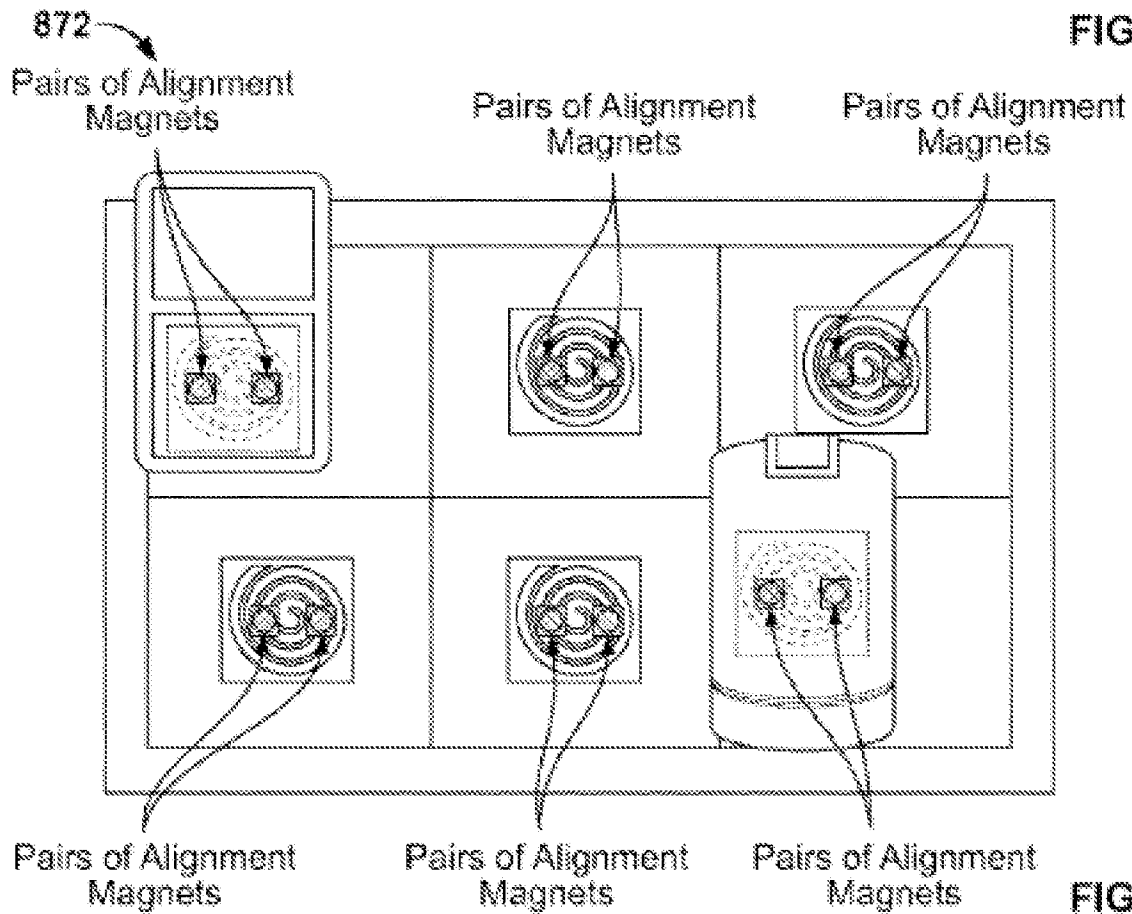


FIG. 57

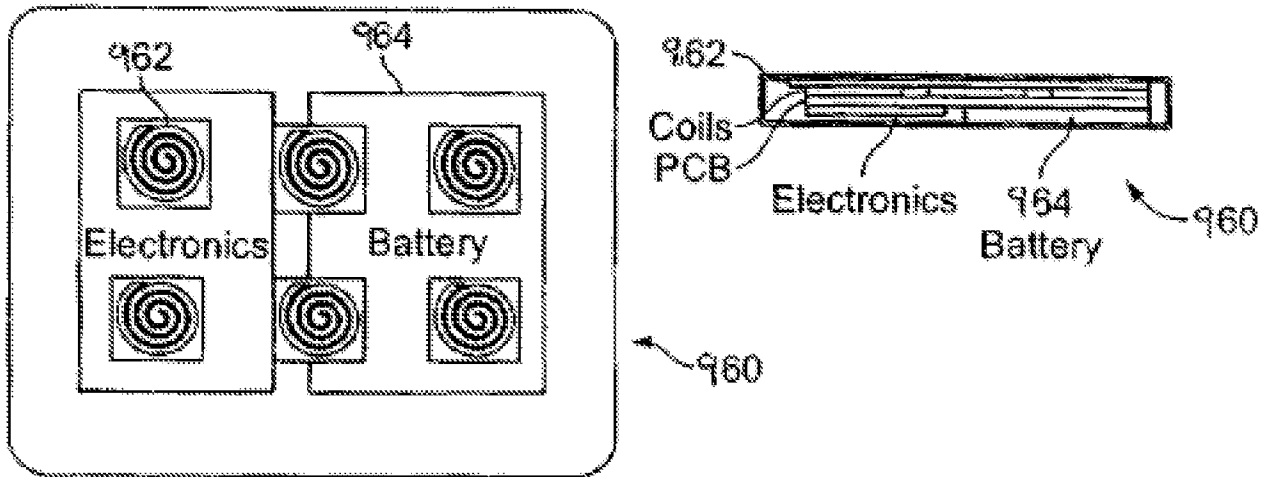


Fig. 58

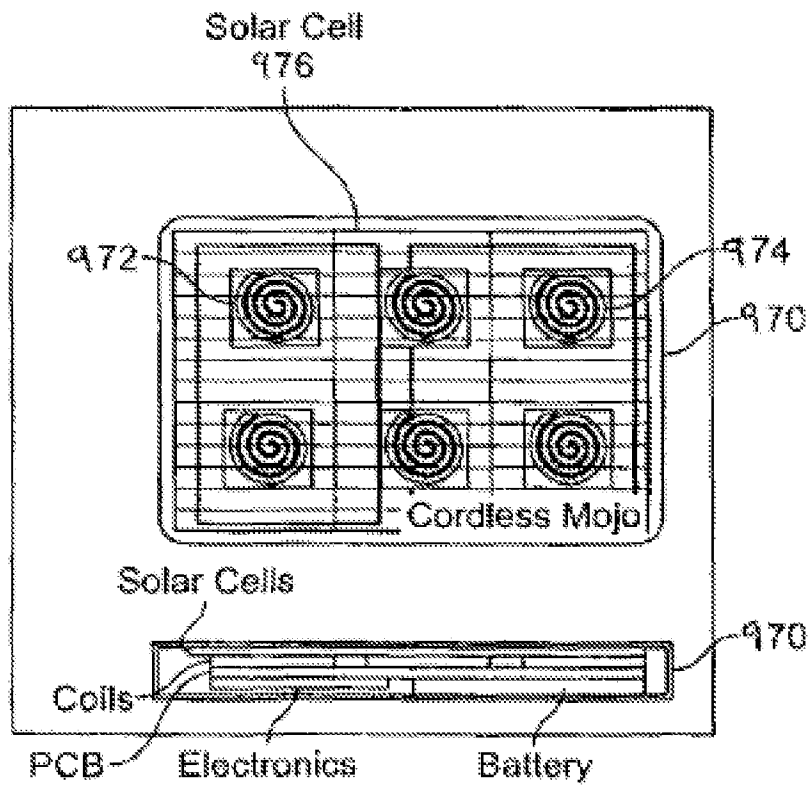


Fig. 59

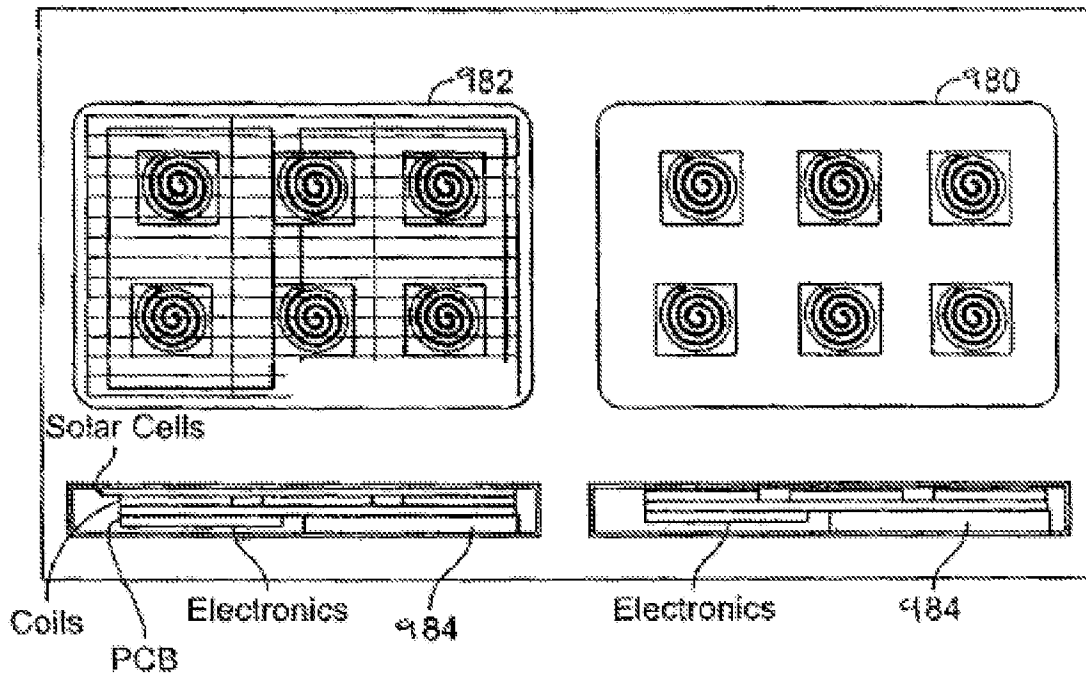


Fig. 60

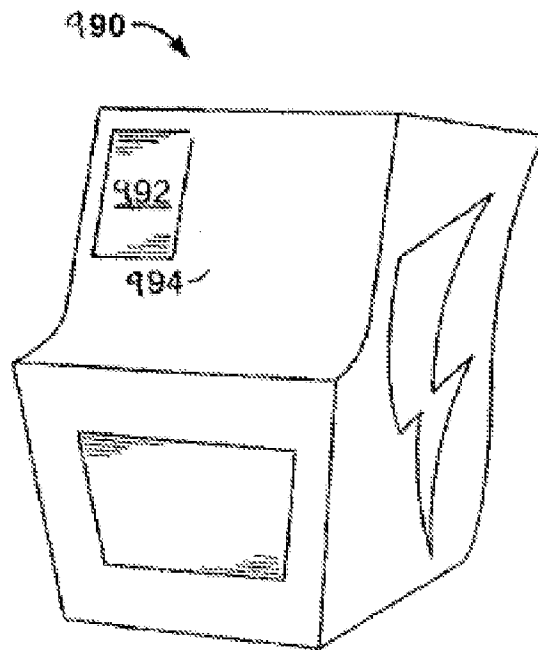


Fig. 61

REPLACEMENT SHEET

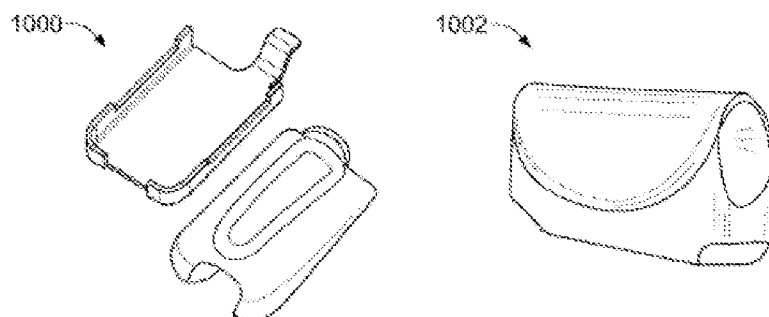


Fig. 62

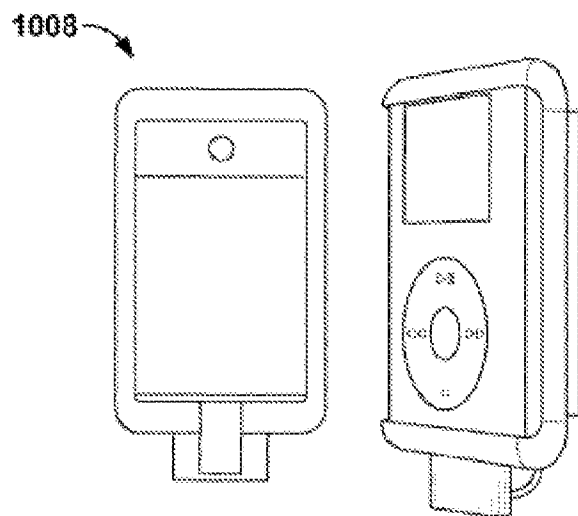


Fig. 63

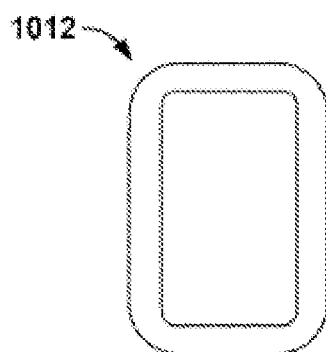


Fig. 64

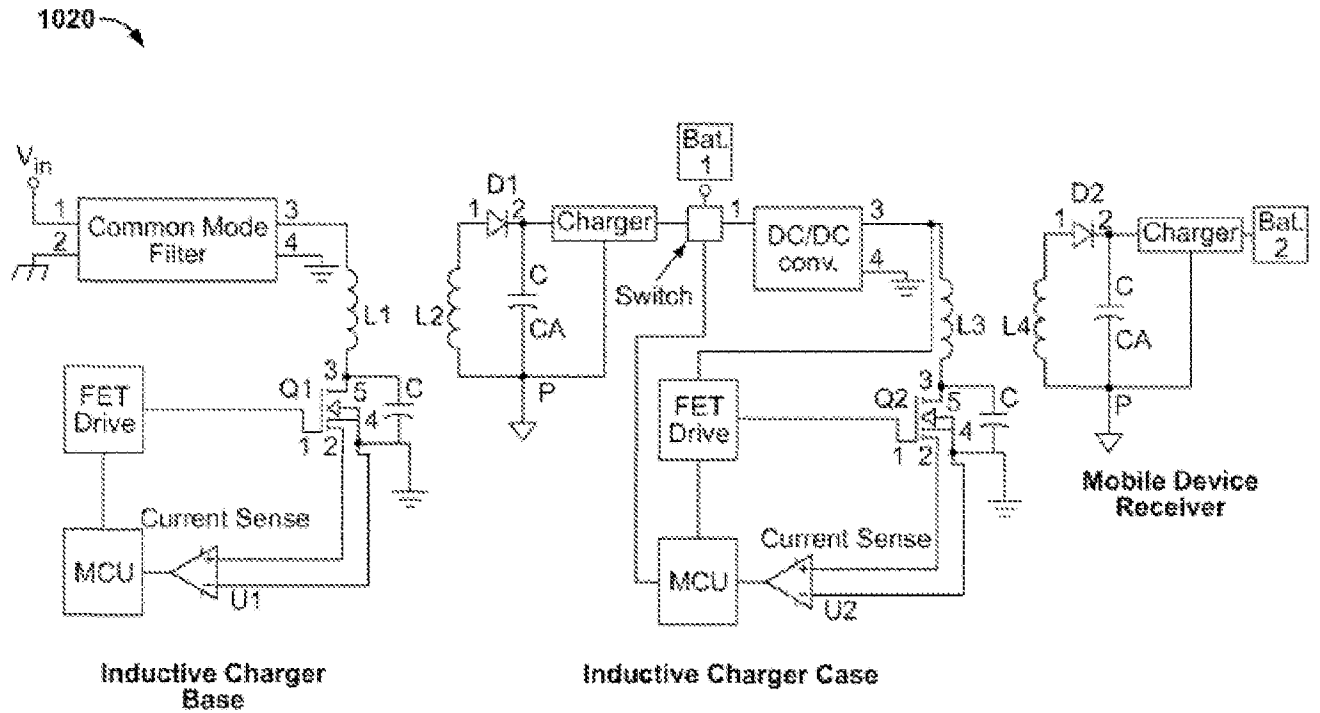


Fig. 65

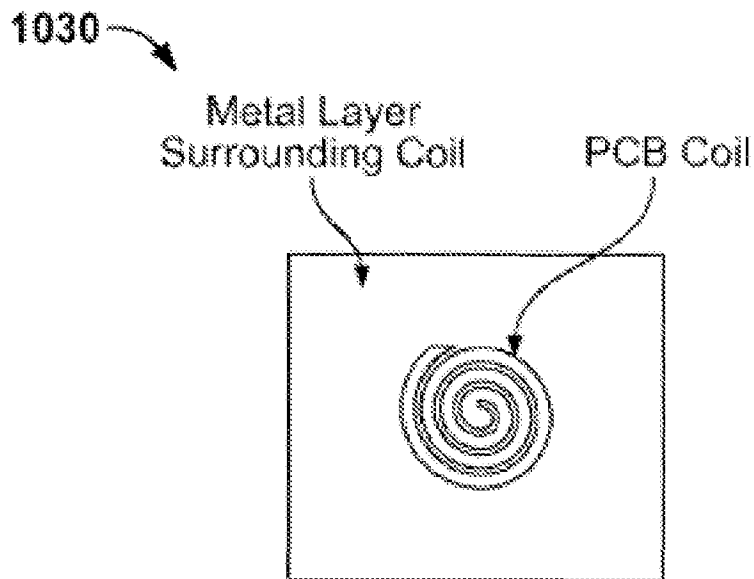


Fig. 66

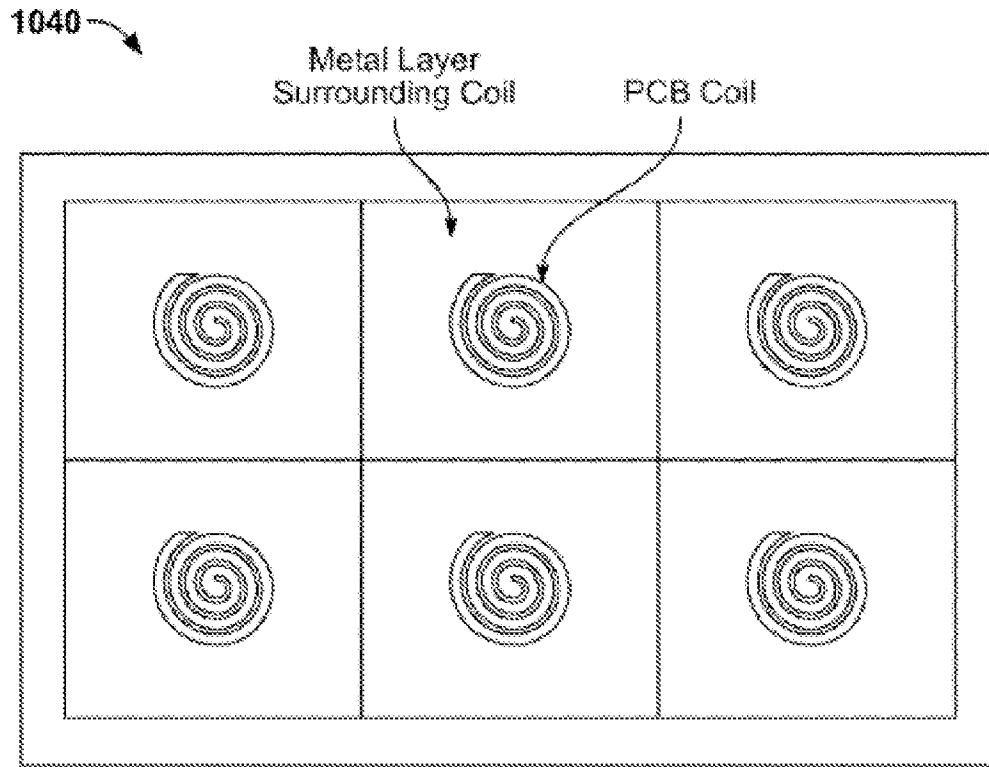


Fig. 67

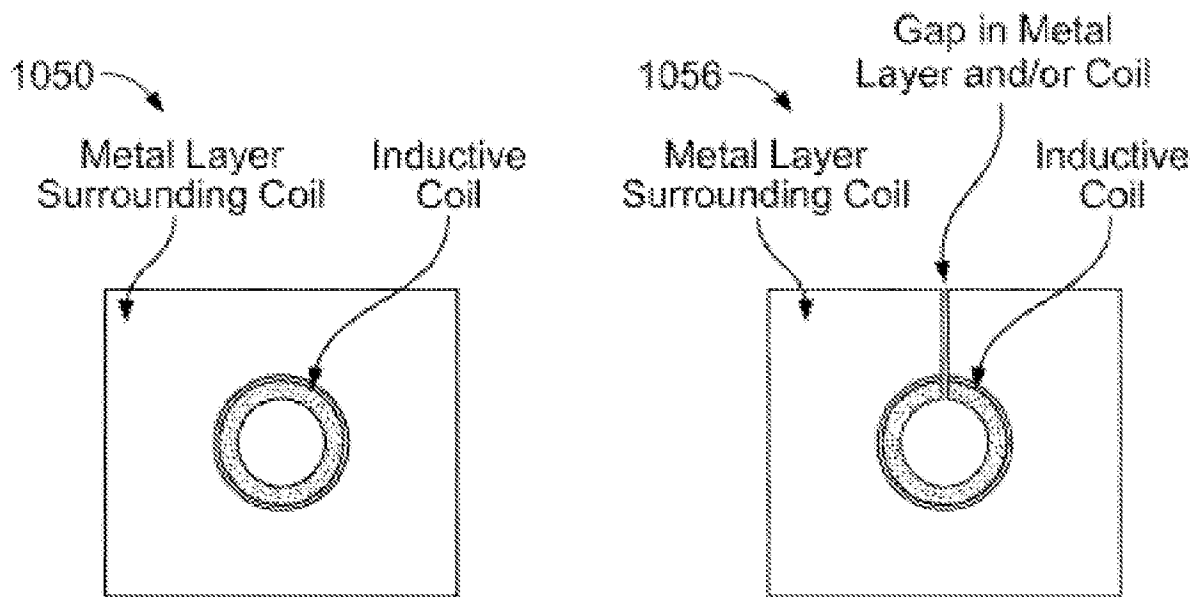


Fig. 68

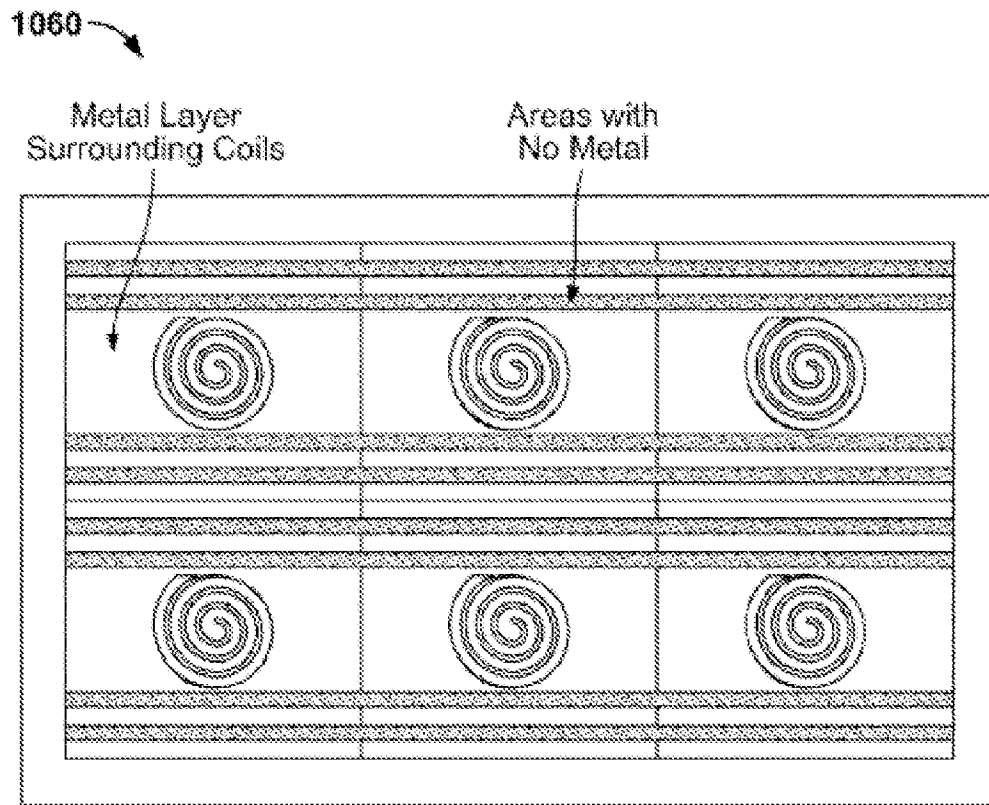


Fig. 69

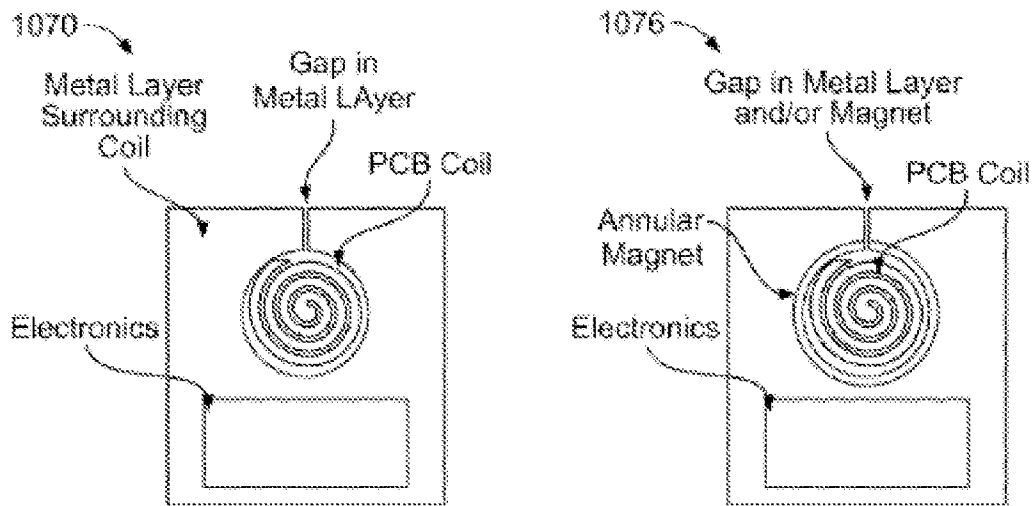


Fig. 70

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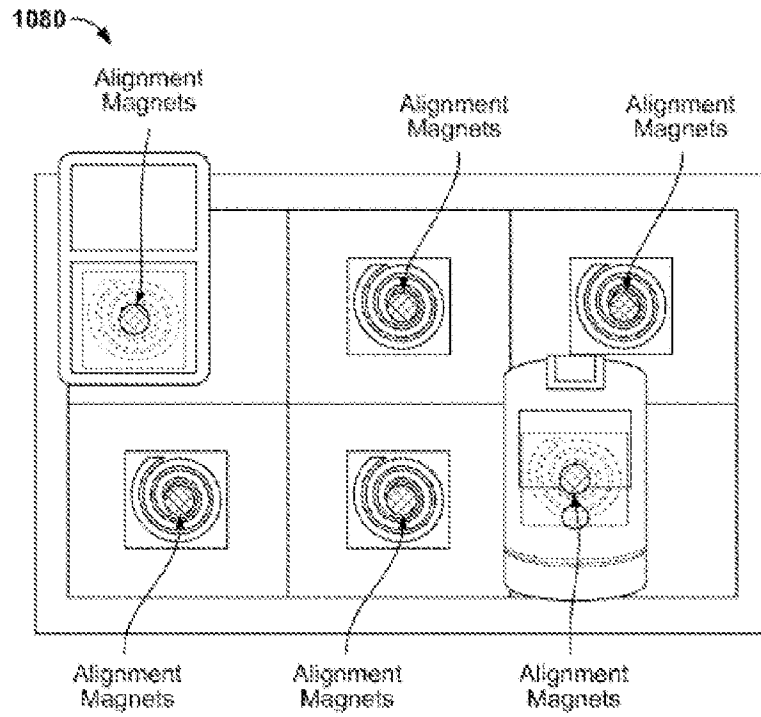


Fig. 71

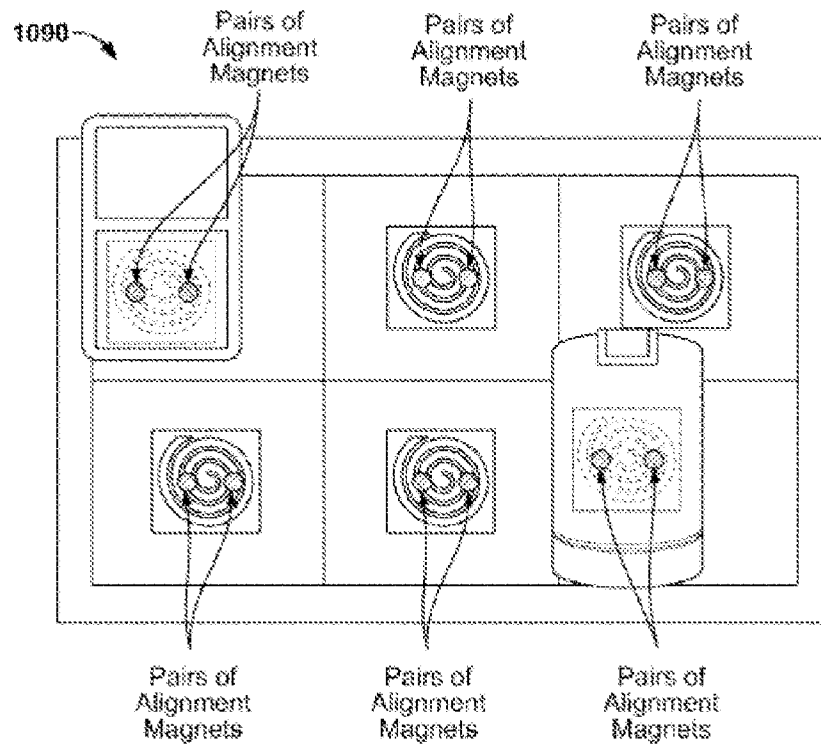
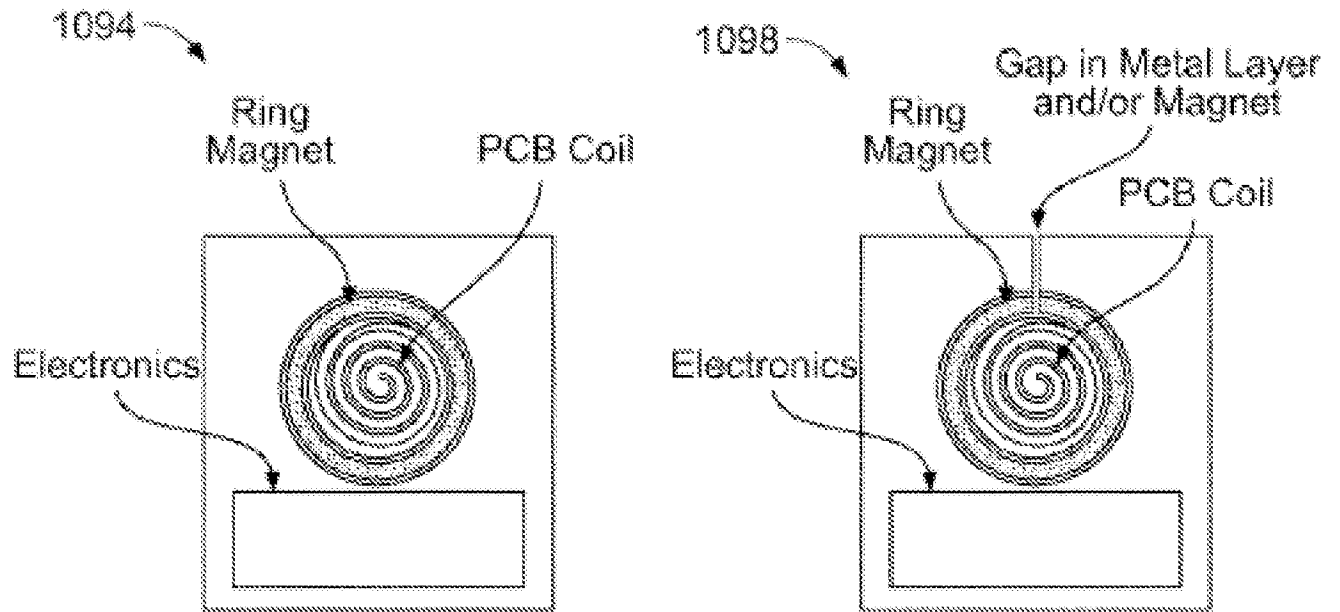
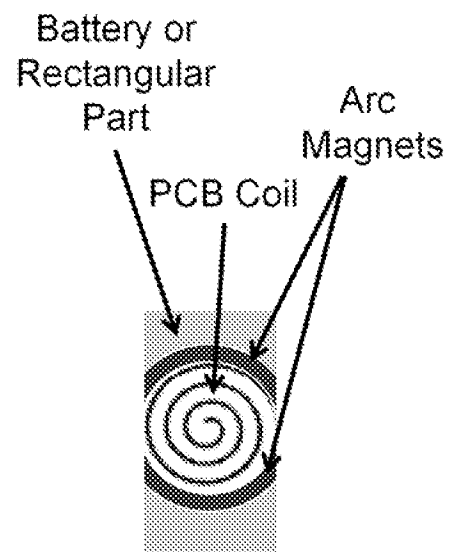


Fig. 72

REPLACEMENT SHEET

**Fig. 73****Fig. 74**

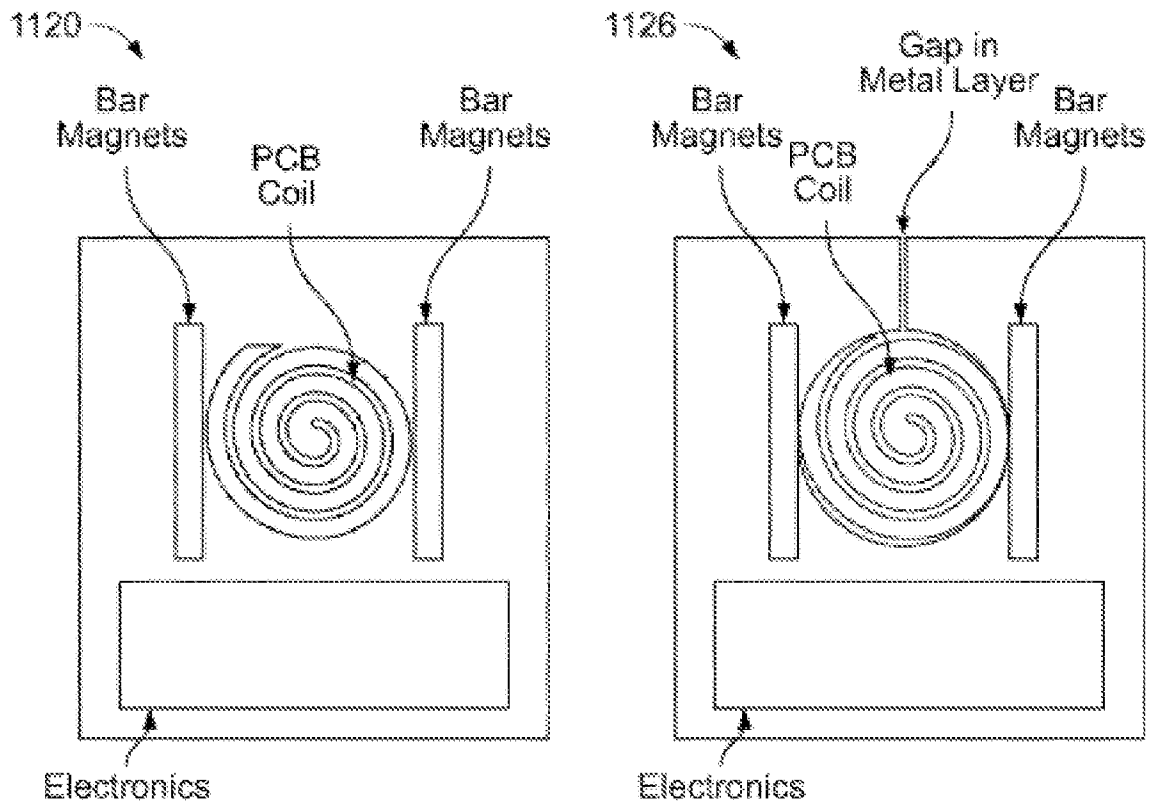


Fig. 75

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Afshin Partovi, Michael Sears
Applicant: Mojo Mobility, Inc.
Title: Efficiencies and Flexibilities in Inductive (Wireless) Charging
Application No.: 16/055,109 Filed: August 5, 2018
Confirmation No. 7571
Examiner: Zixuan Zhou Group Art Unit: 2859
Docket No.: AFPA-01013US6 Customer No.: 33438

ELECTRONICALLY FILED

Austin, Texas
October 5, 2021**AMENDMENT UNDER 37 C.F.R. §1.312**

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph 0012 as follows:

[0012] Systems and methods are provided for inductive powering and/or charging of electric or electronic devices or batteries. The system typically includes a base unit, such as a charger or power supply, which includes one or more primary coils generally having a planar or curved surface. Each of the one or more primary coils can be activated to generate a magnetic field in a direction substantially perpendicular to the planar or curved surface to provide power to one or more inductive power receiver coils of one or more receivers to power or charge one or more portable devices or batteries. The base unit is capable of detecting a wireless communication signal or a modulation communication signal in the one or more primary coils created by modulation of one or more receivers' impedance or impedances and is capable of using the wireless communication signal or the modulation communication signal to control output voltage, current or power from the one or more receivers.

Please amend paragraph 0260 as follows:

[0260] FIG. 26 shows a high level view of a flyback power supply geometry 580 in accordance with an embodiment. During the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary (receiver) coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred μ Henry are typical for 10's or 100's of Watts of power supply power.

Please amend paragraph 0264 as follows:

[0264] For example, for a coil of 10 turns, an outer radius of 15 mm, and inner radius of zero, then $L = 1 \mu\text{H}$. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor.

Please amend paragraph 0538 as follows:

[0538] FIG. 74 shows an embodiment 1100 in which magnetic arc shaped parts around a circular coil are used. This case may be combined with the matching magnet on the other coil having the same shape or a ring shape similar to FIG. 73. For example, in a mobile battery application where the battery with an integrated inductive receiver is charged by placement on an inductive charger pad, the size of the coil determines the received power and may require the width of the battery to be equal or similar to the receiver coil. To allow attachment of alignment magnets, two arcs as shown in FIG. 74 can be attached to the coil. In this case, the magnets can be placed in between the battery and the coil PCB to allow the coil to be on the top surface and therefore closest to the charger coil. The matching magnet in the charger can be a ring or a similar set of arcs or another shape or size to facilitate alignment. If a ring is used behind the charger coil, then central symmetry between the two parts is retained and the parts can be rotated with respect to each other while keeping alignment for optimum operation.

Electronic Acknowledgement Receipt

EFS ID:	43952074
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Kent Bryan Chambers
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	05-OCT-2021
Filing Date:	05-AUG-2018
Time Stamp:	15:09:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings-only black and white line drawings	AFPA-01013US_Figures_Replacement-Sheets_2021-10-05.pdf	1919452 91502027911ffe50a3a4af5c7407b9597344841b	no	41

Warnings:

Information:					
2	Amendment after Notice of Allowance (Rule 312)	AFPA-01013US_1-312_Amd_20 21-10-05.pdf	170694 b90fe12aa83b507d24e8411982fc79342ea9 9e1b	no	18
Warnings:					
Information:					
Total Files Size (in bytes):			2090146		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

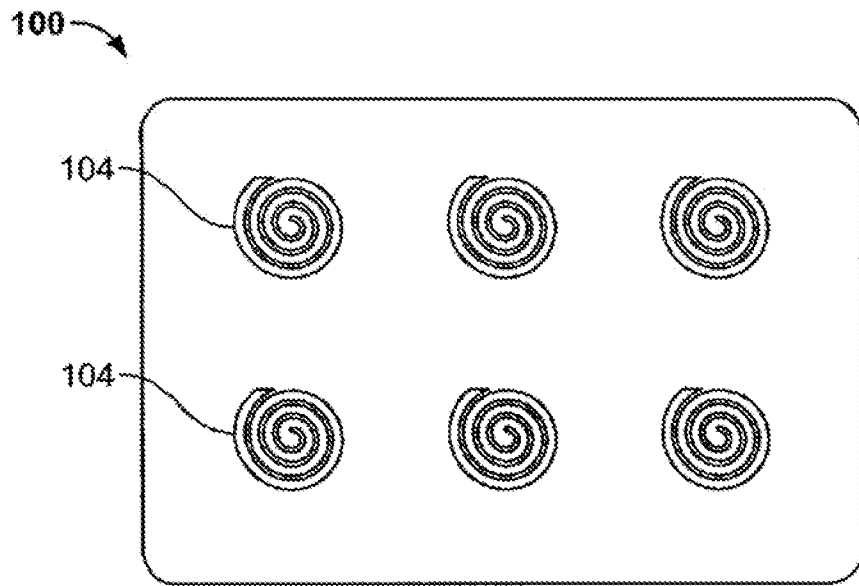


FIG. 1

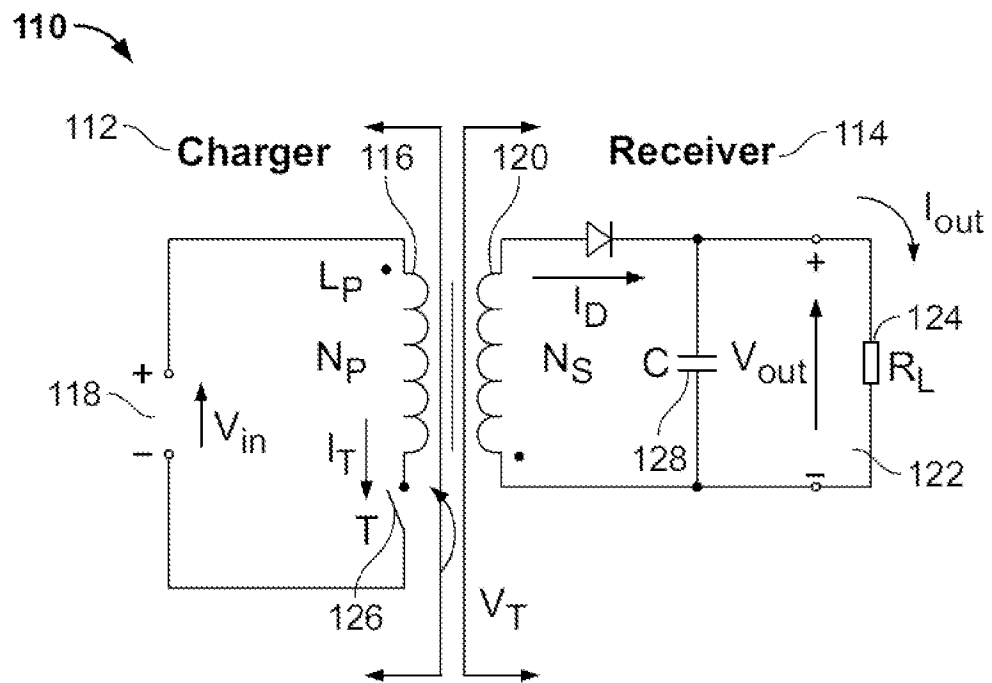


FIG. 2

REPLACEMENT SHEET

140

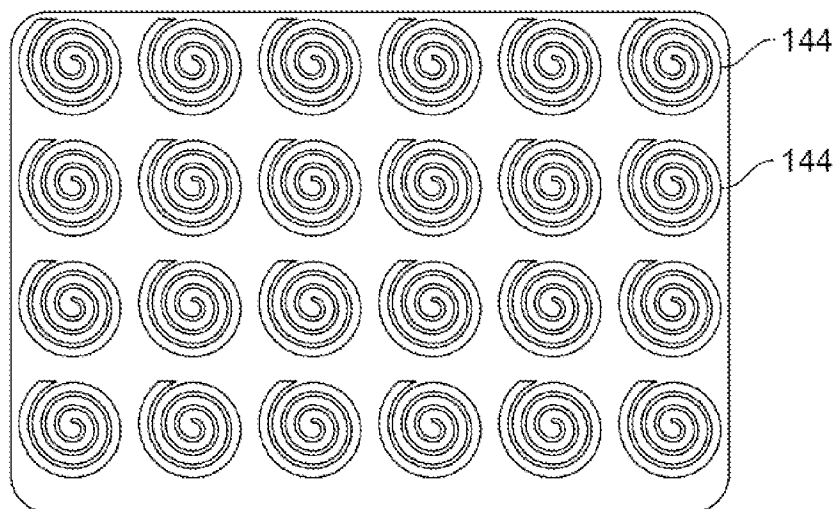


FIG. 3

150

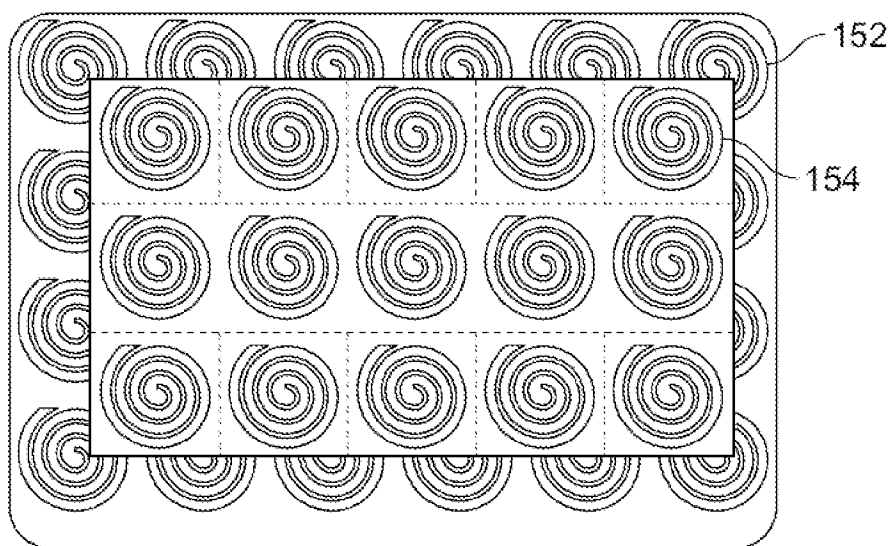


FIG. 4

REPLACEMENT SHEET

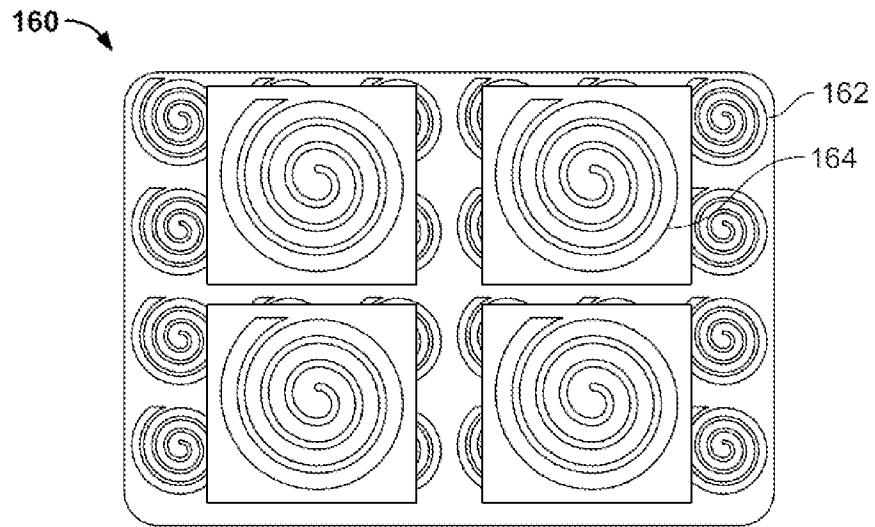


FIG. 5

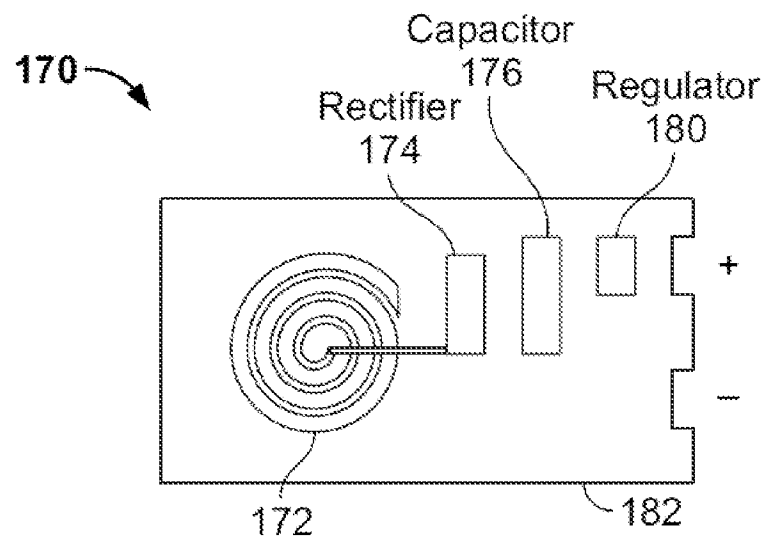


Fig. 6

REPLACEMENT SHEET

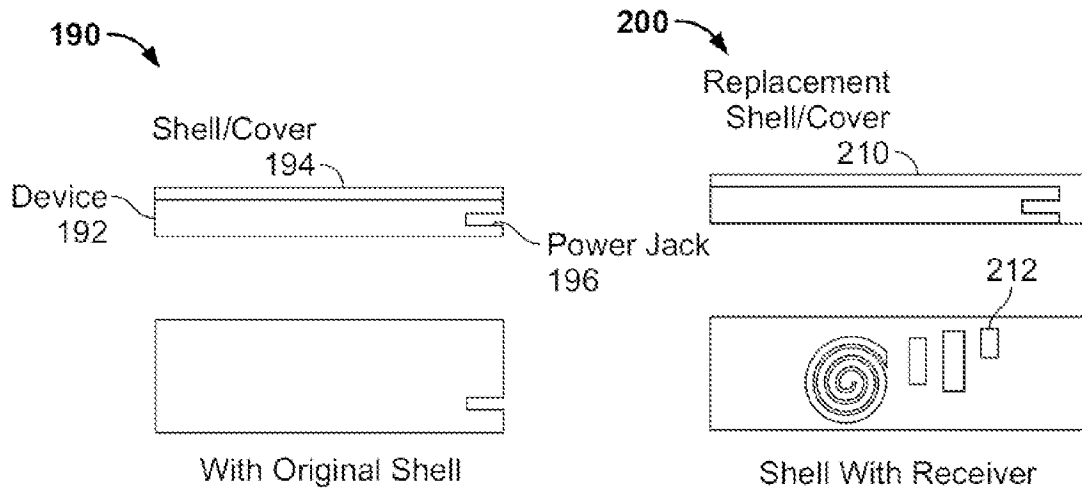


Fig. 7

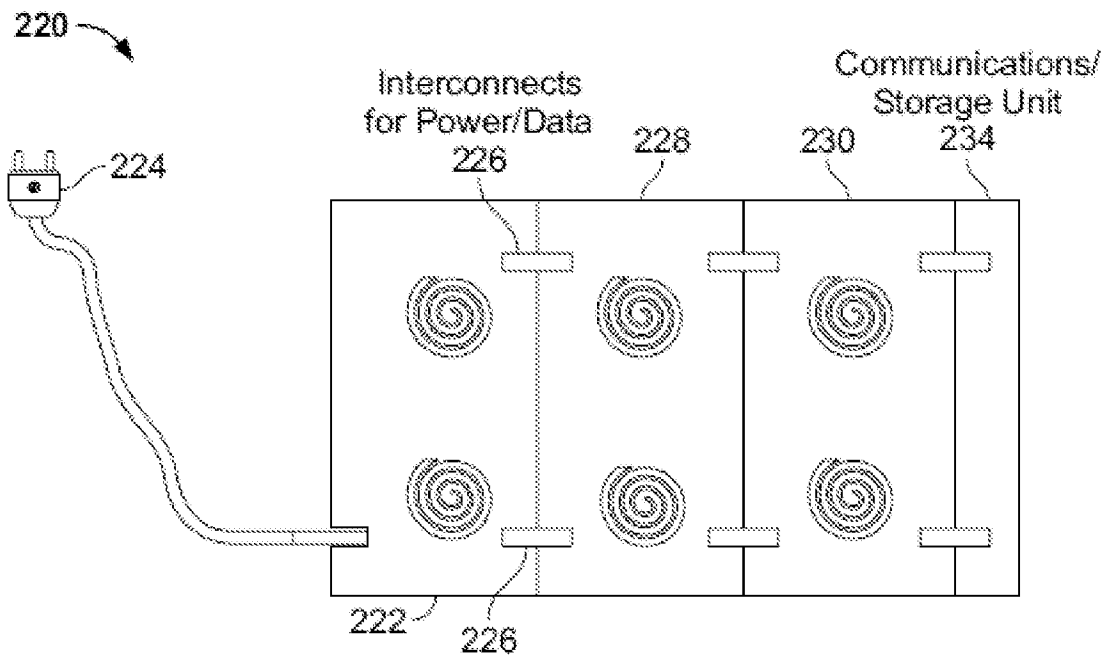


Fig. 8

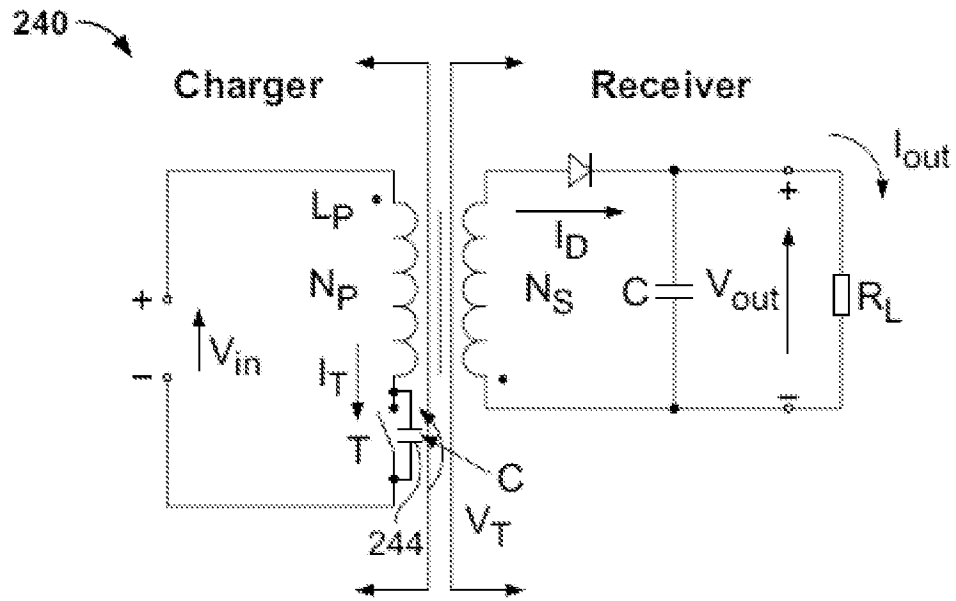


Fig. 9

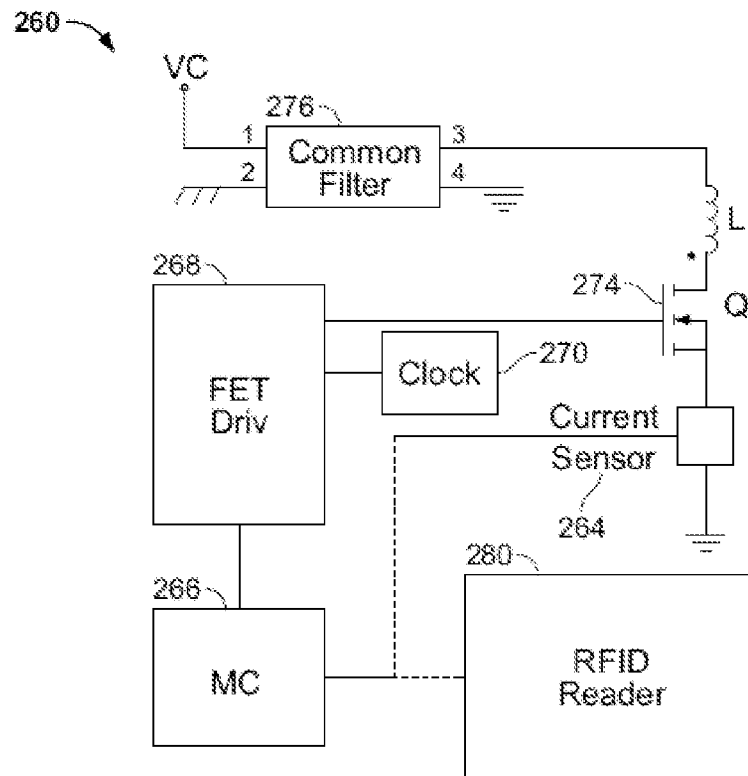


Fig. 10

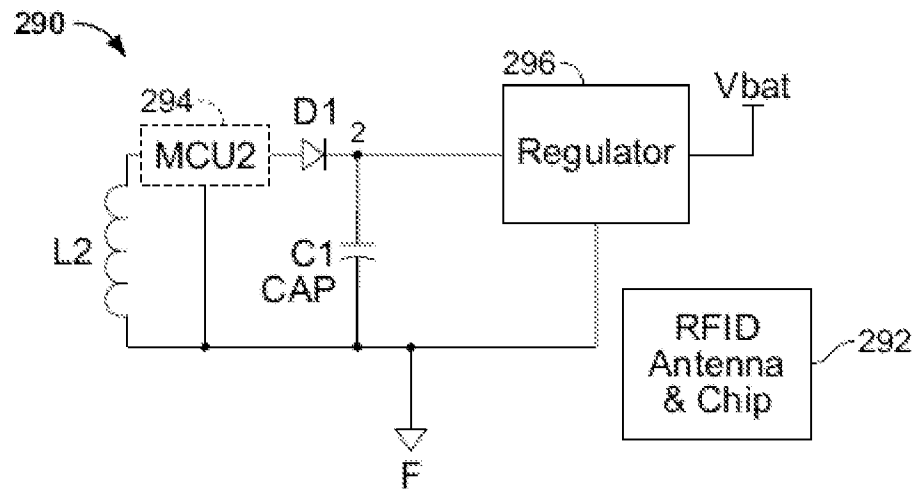


Fig. 11

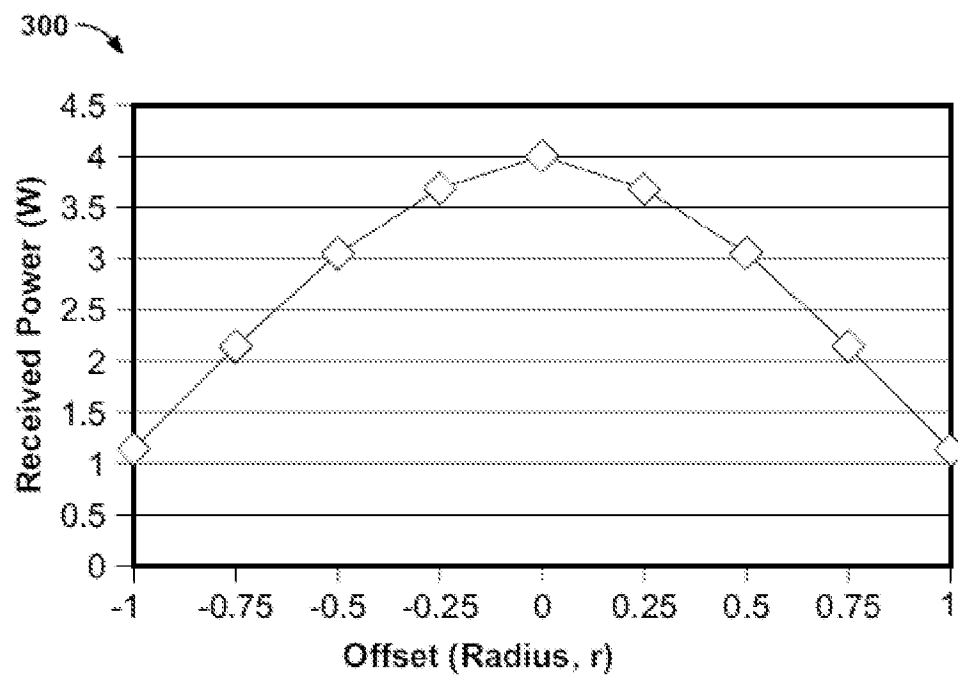


Fig. 12

REPLACEMENT SHEET

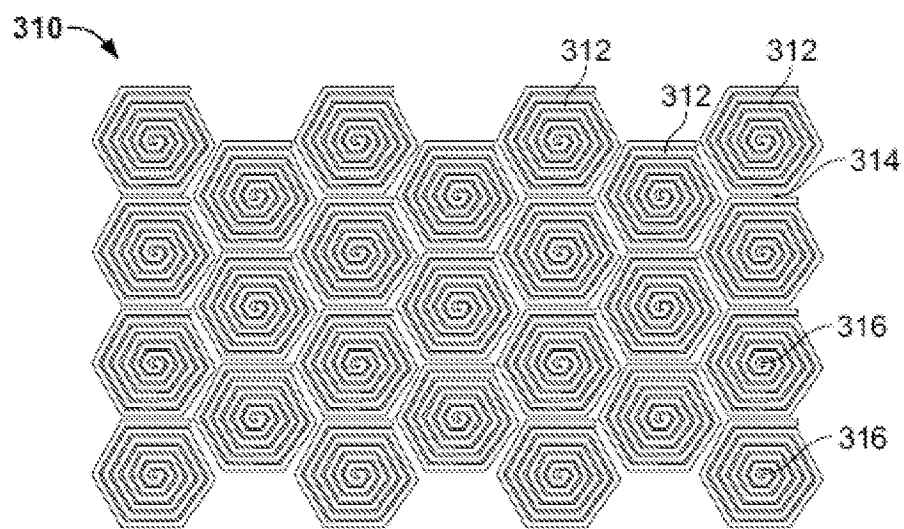


Fig. 13

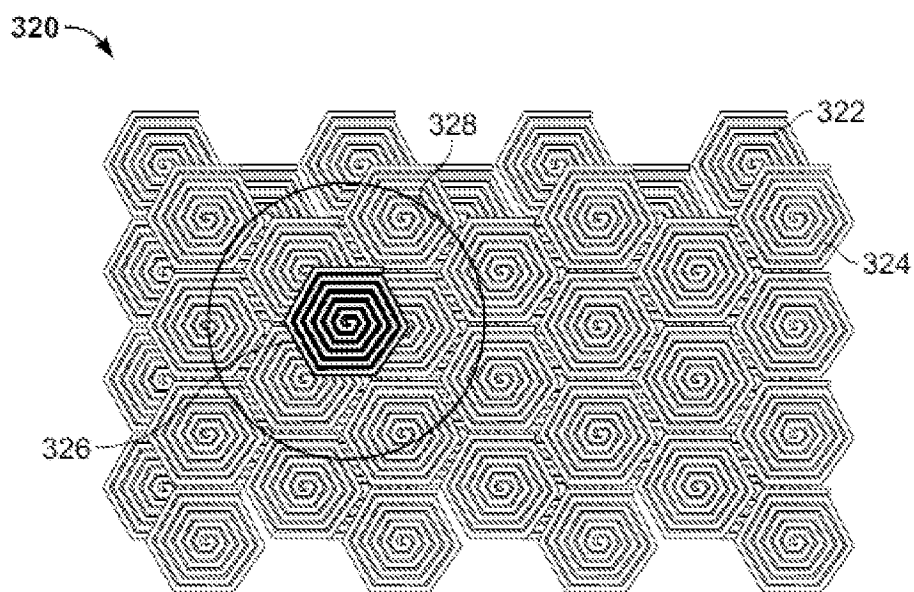


Fig. 14

REPLACEMENT SHEET

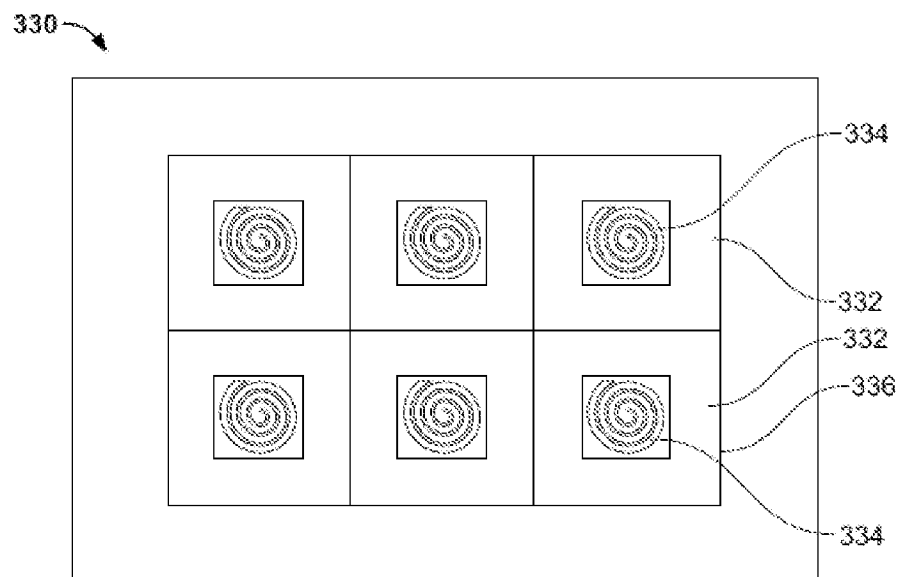


Fig. 15

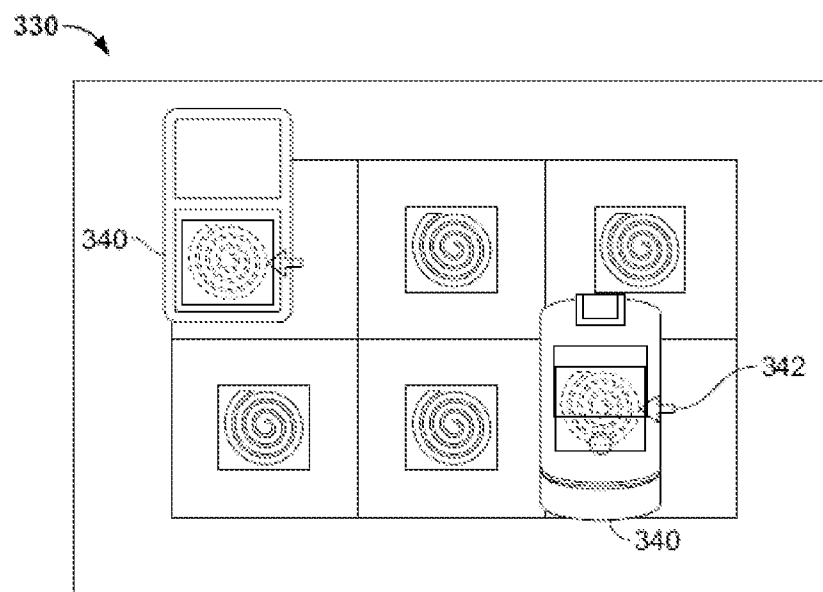


Fig. 16

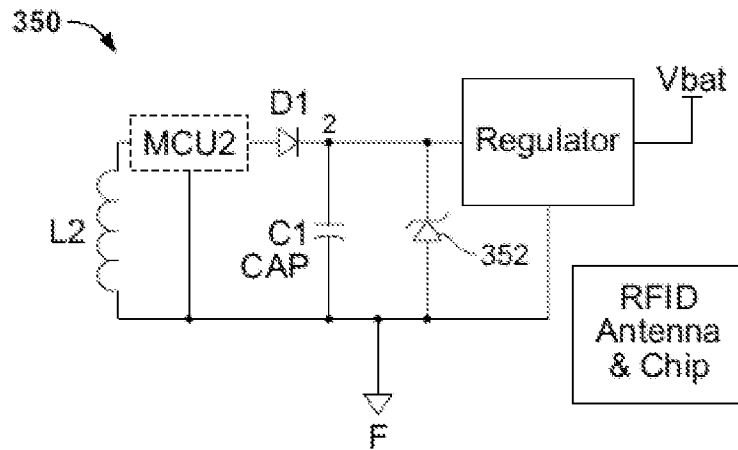


Fig. 17

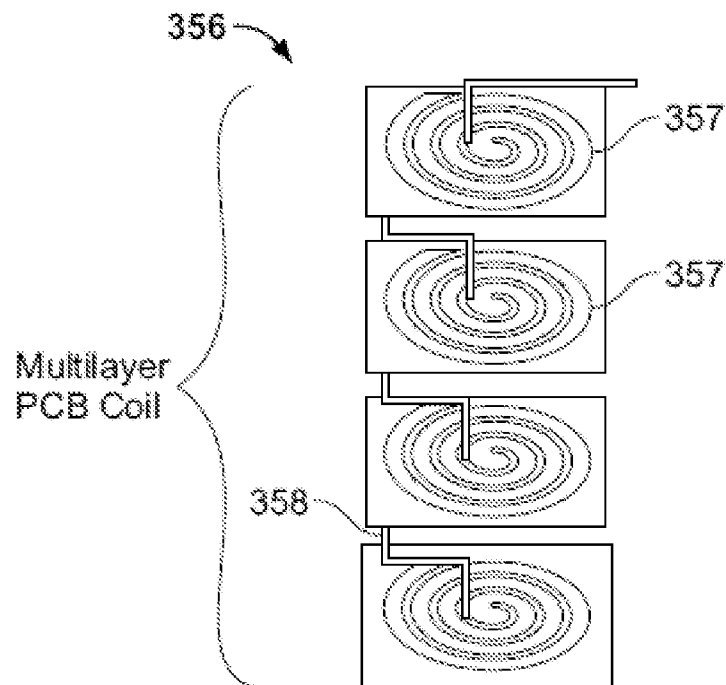


Fig. 18

REPLACEMENT SHEET

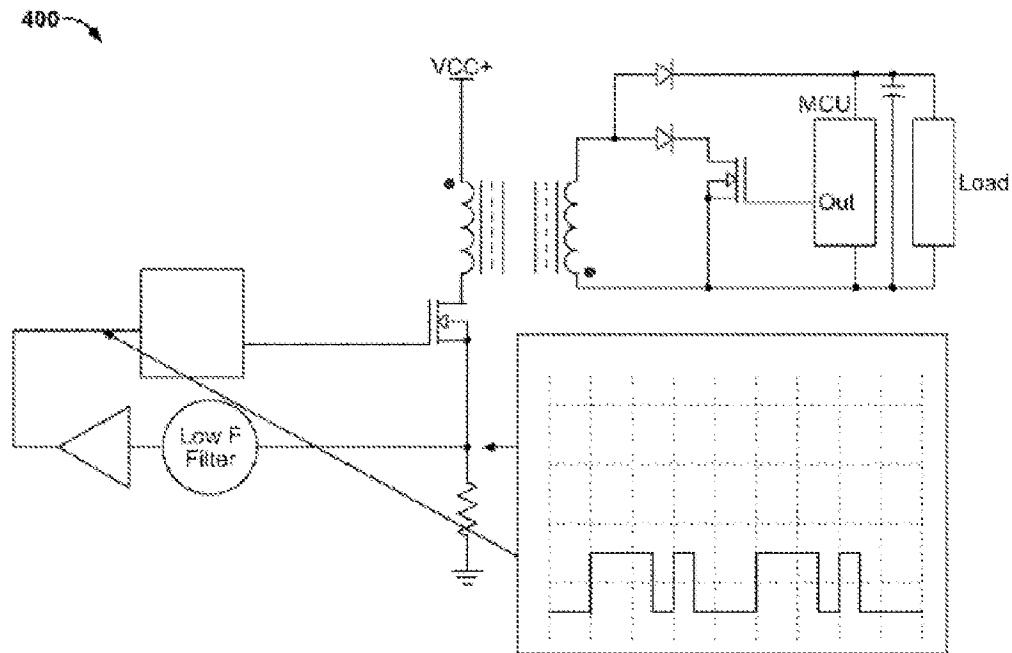


Fig. 19

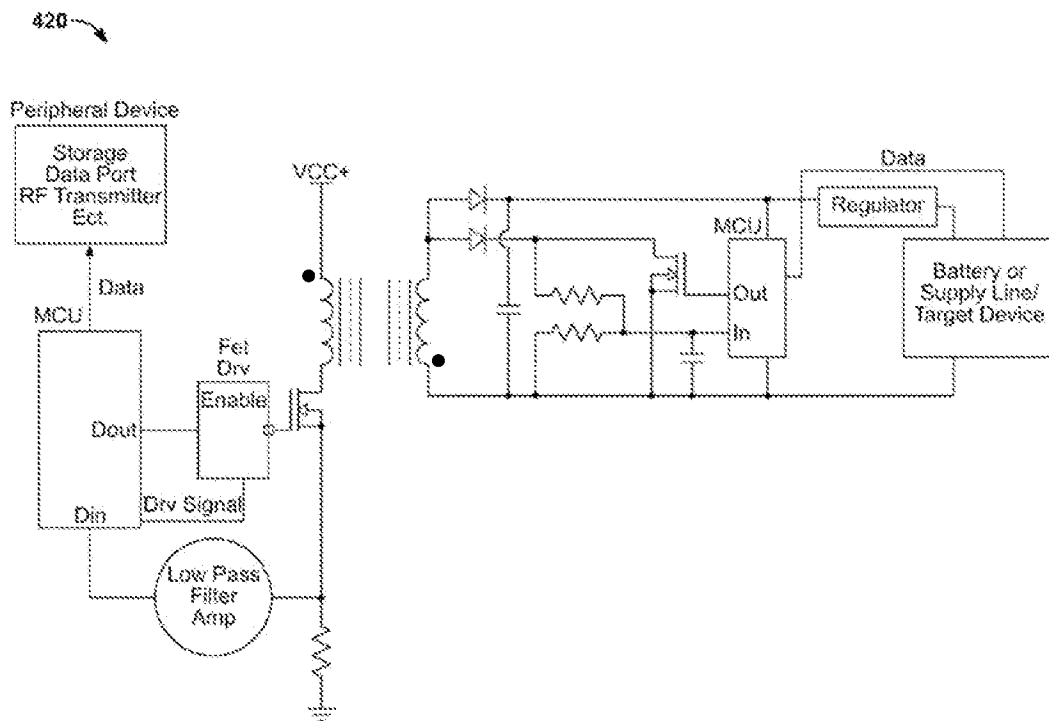


Fig. 20

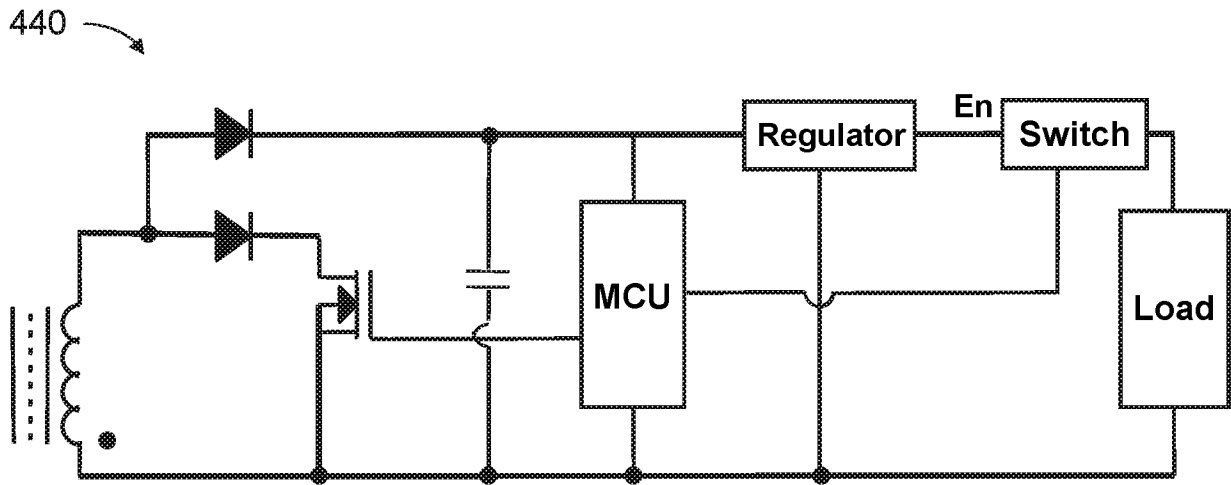


Fig. 21

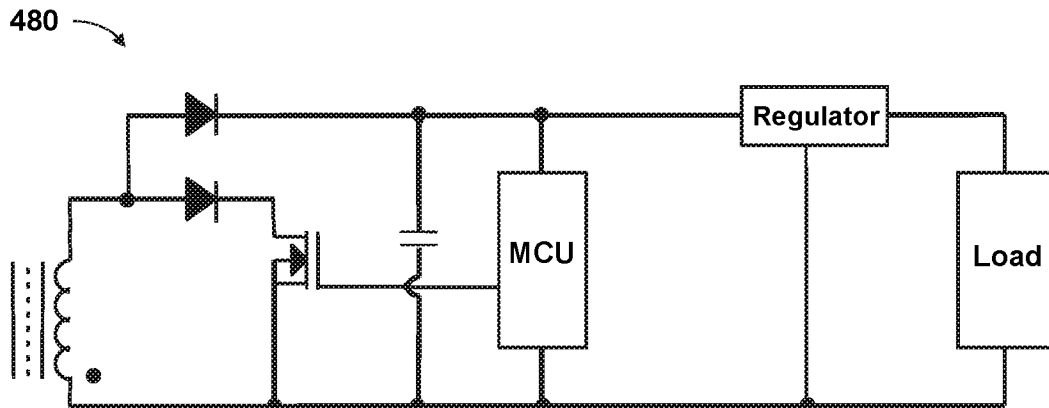


Fig. 22

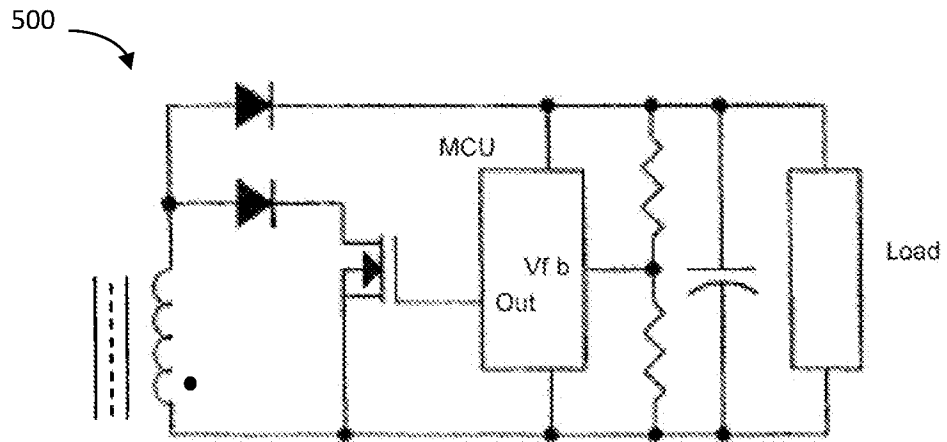


Fig. 23

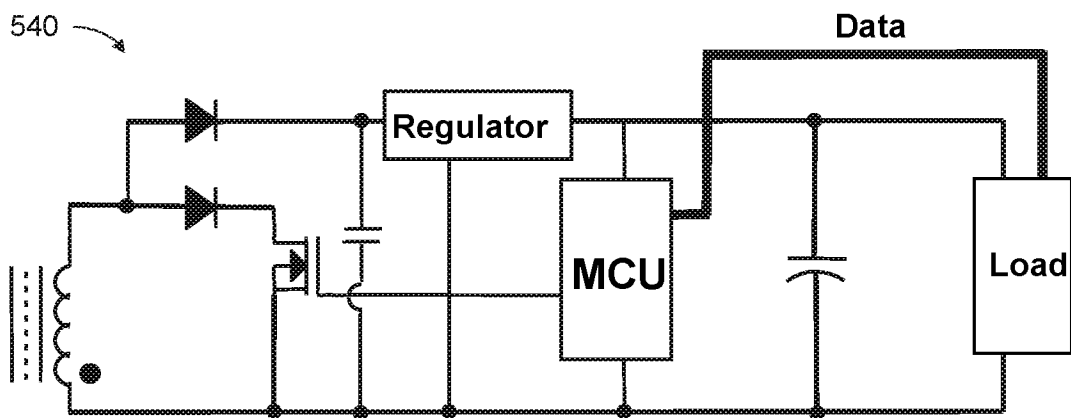
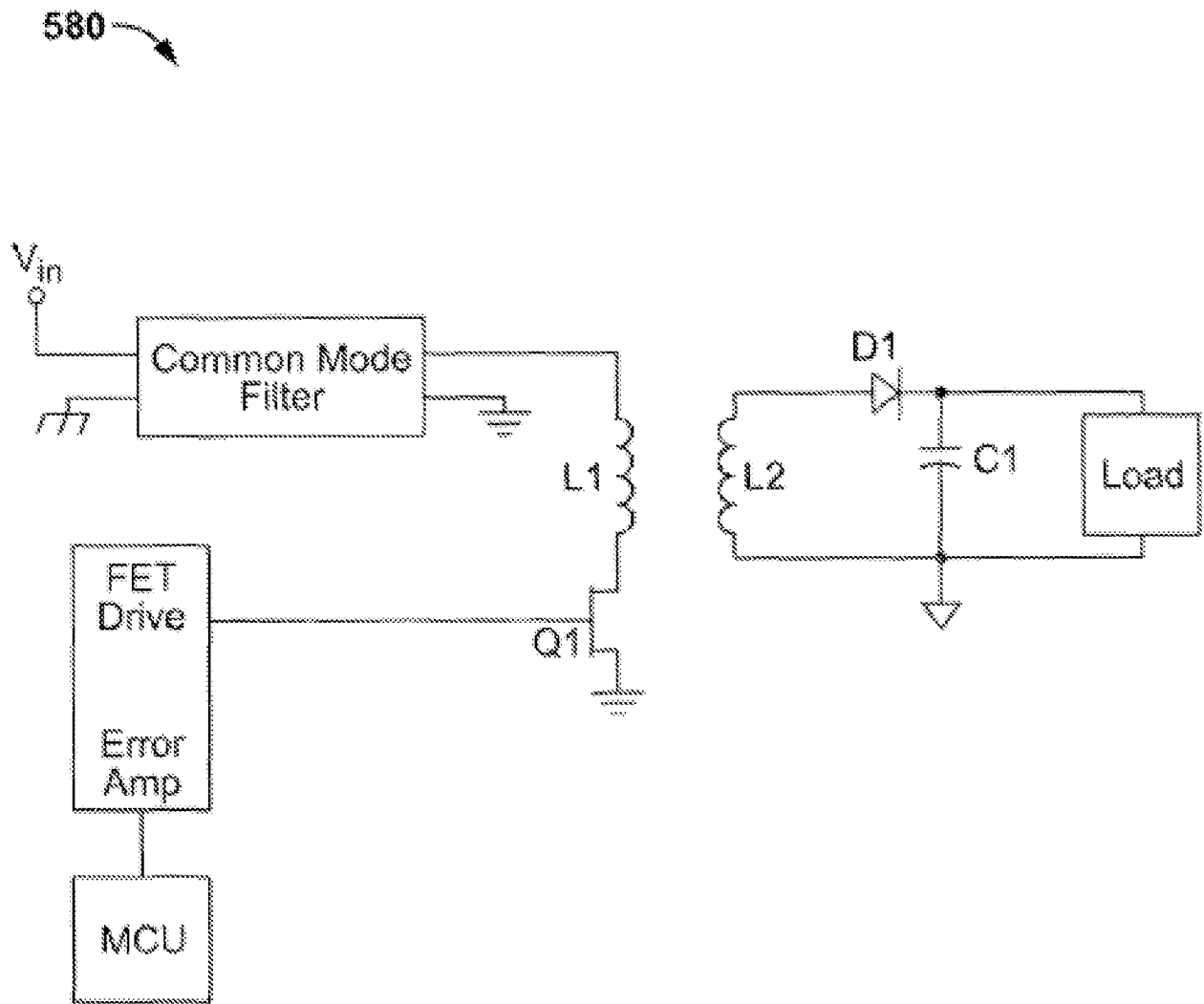


Fig. 24

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**Fig. 26**

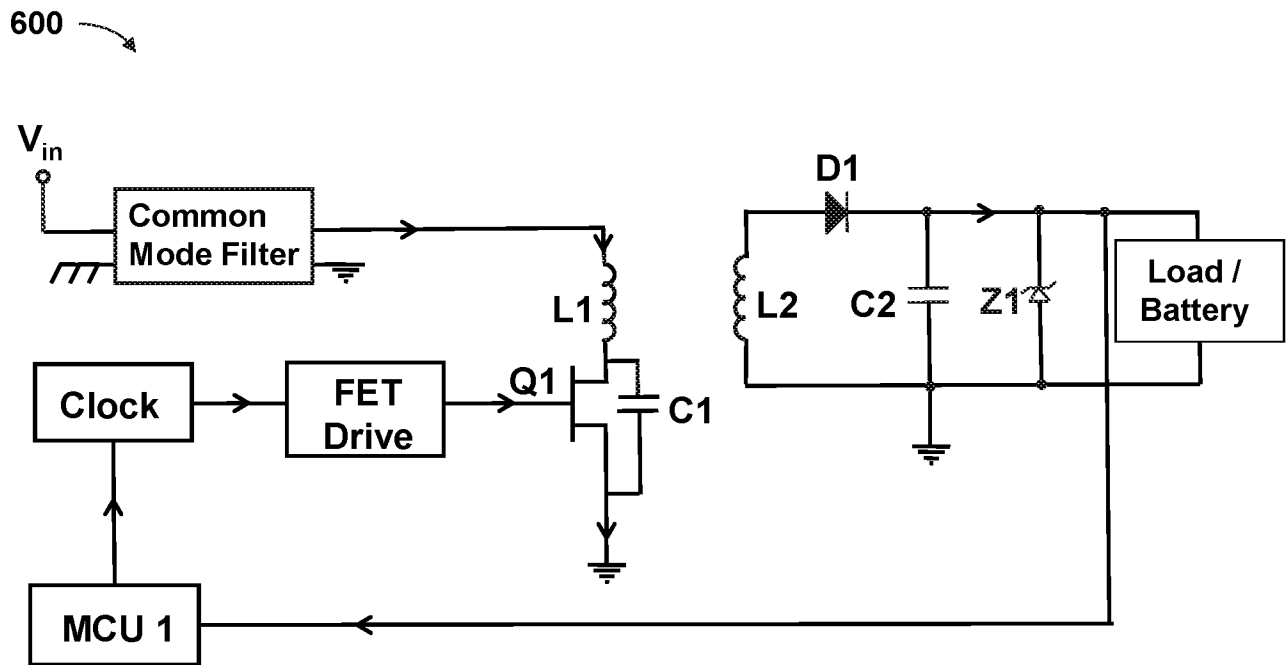


Fig. 27

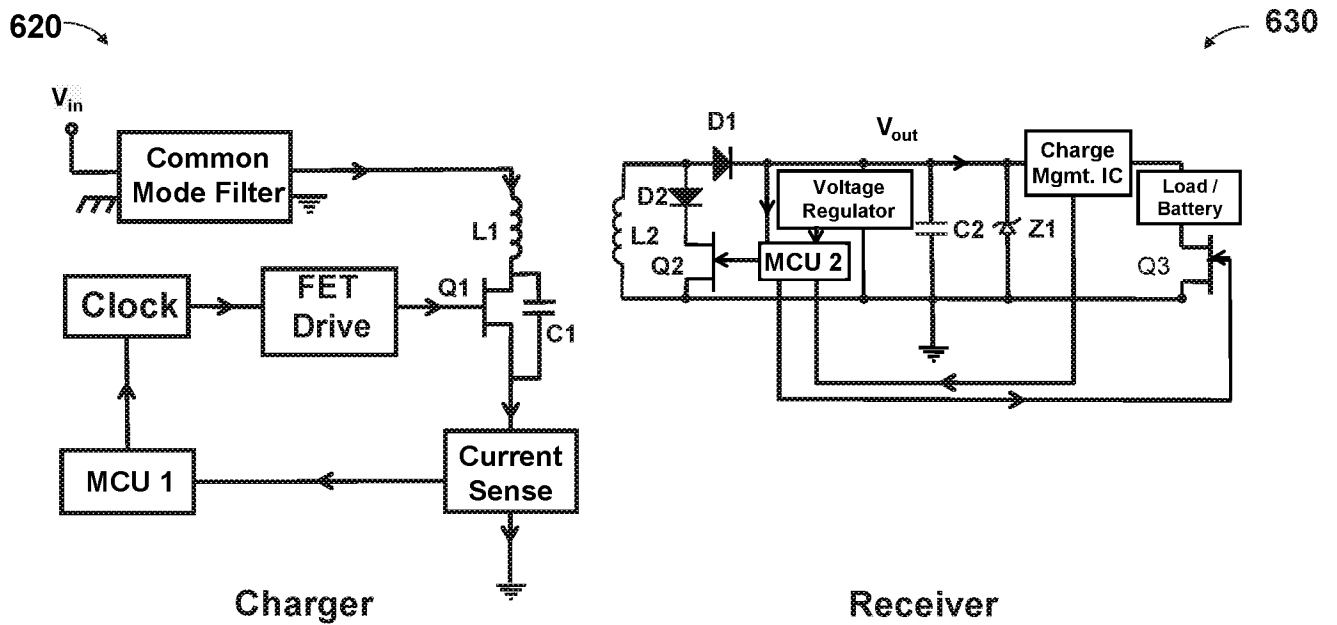


Fig. 28

REPLACEMENT SHEET

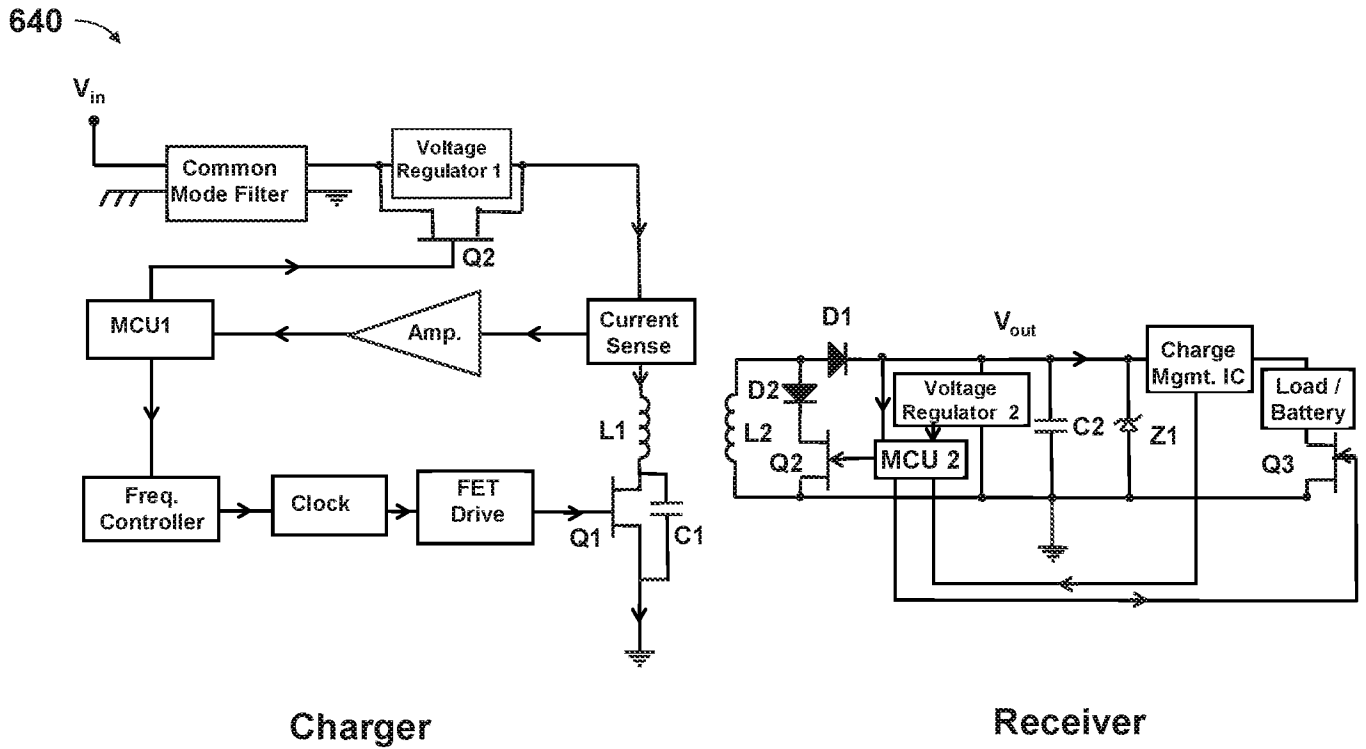


Fig. 29

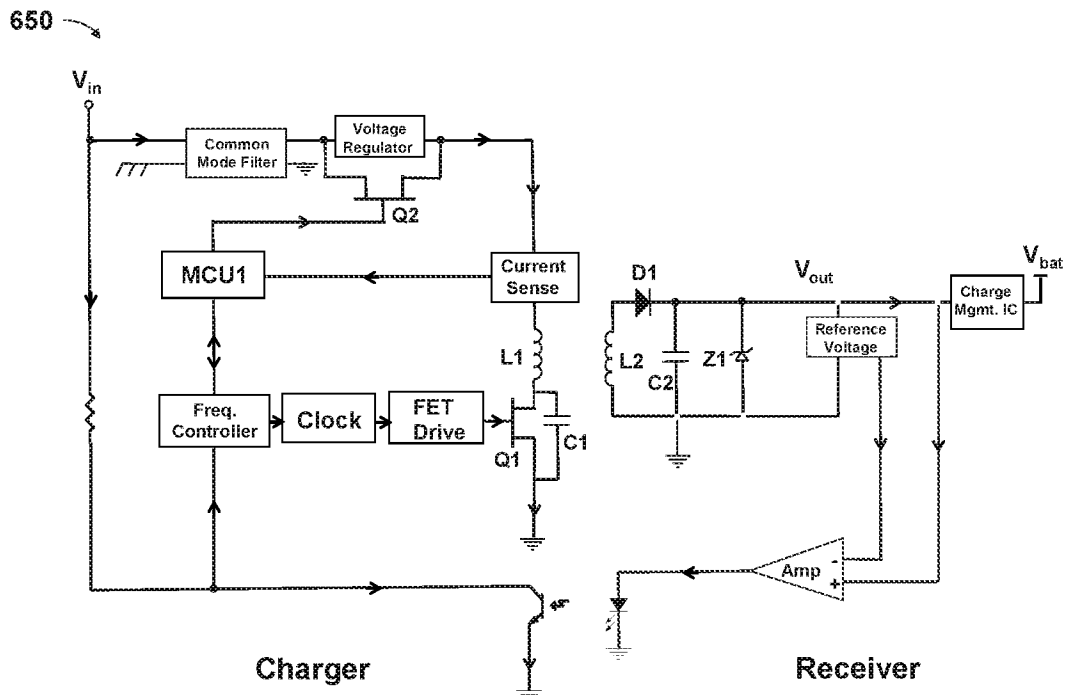


Fig. 30

REPLACEMENT SHEET

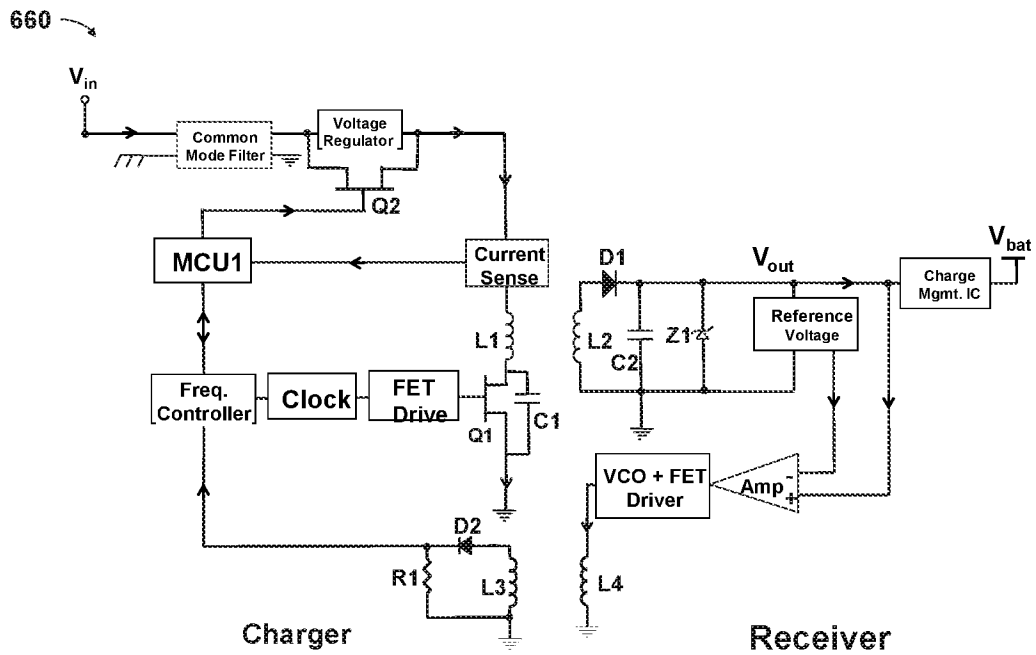


Fig. 31

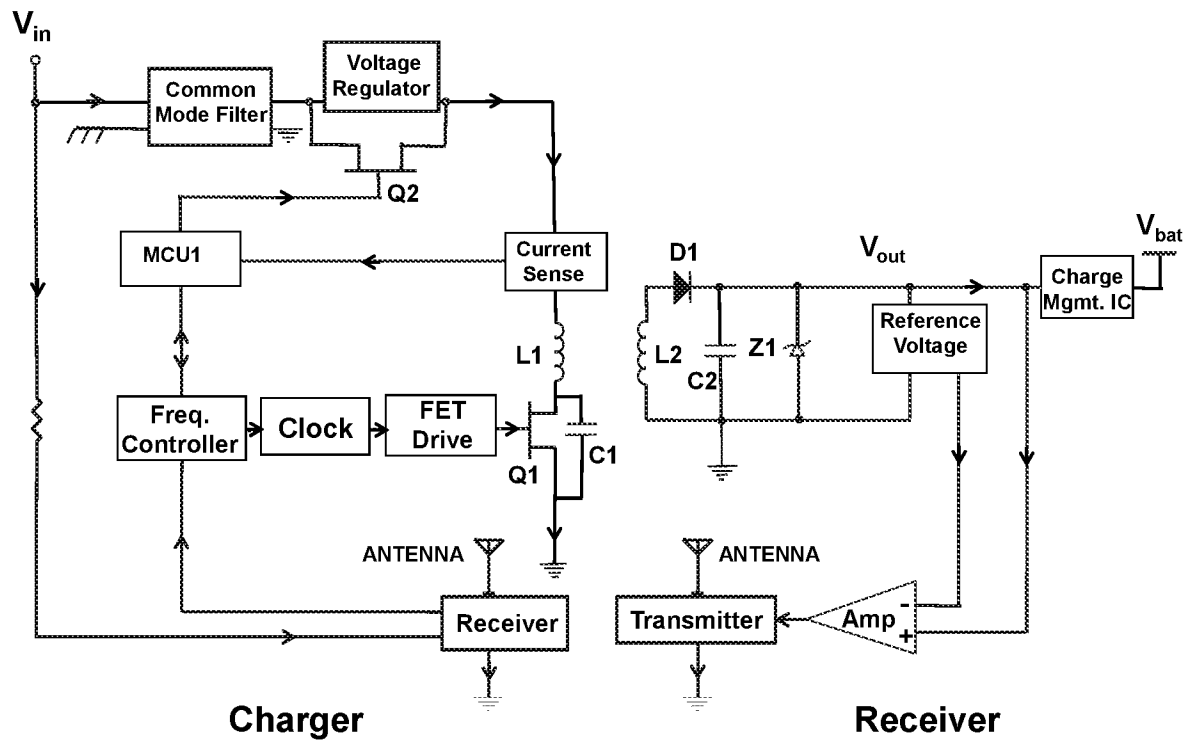


Fig. 32

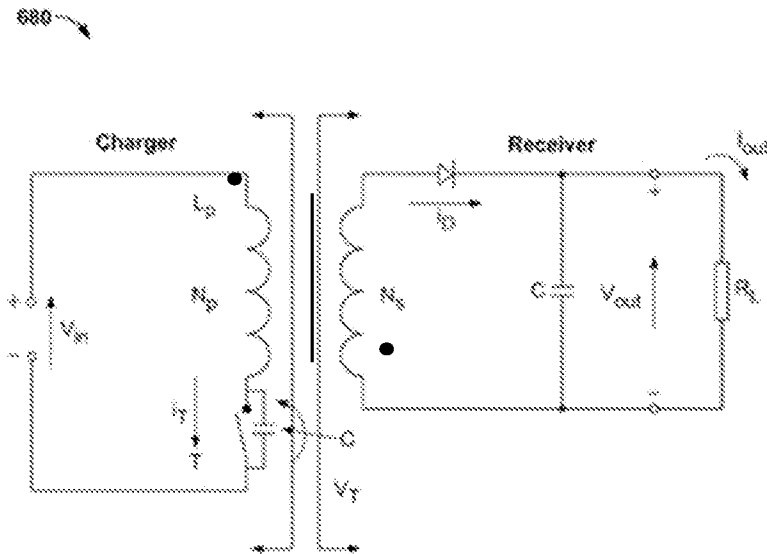


Fig. 33

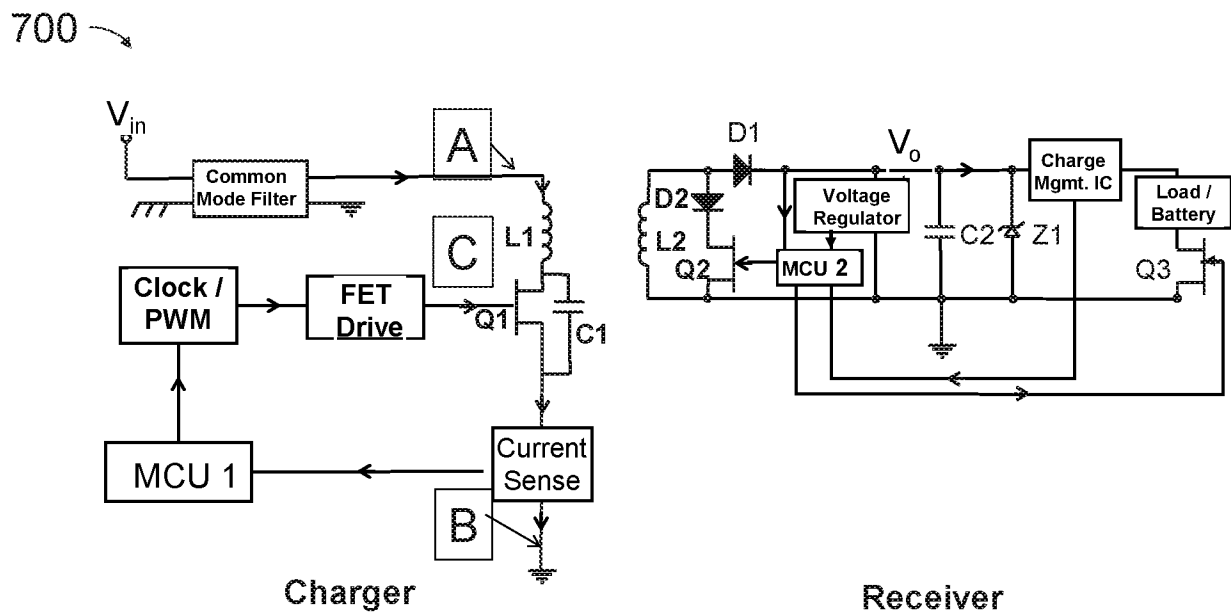


Fig. 34

720

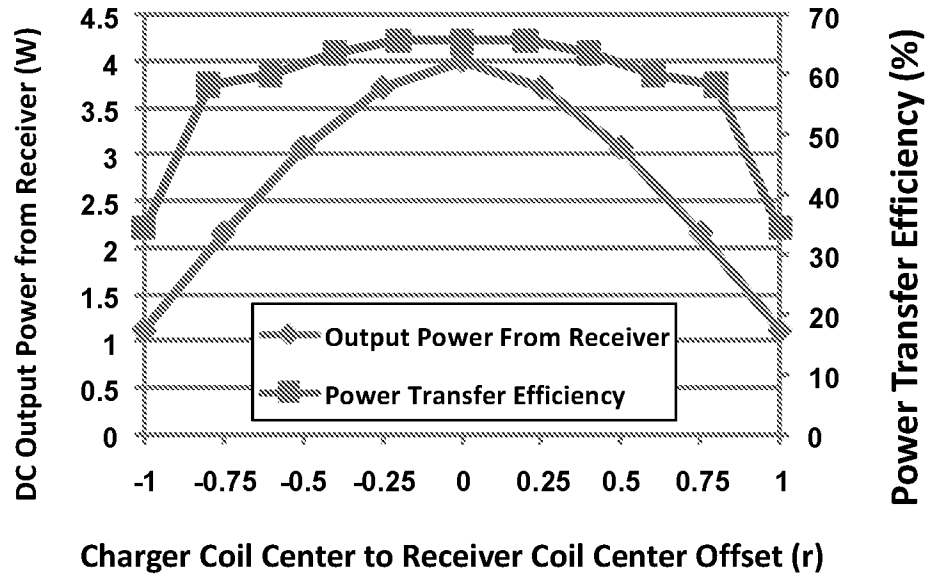


Fig. 35

740

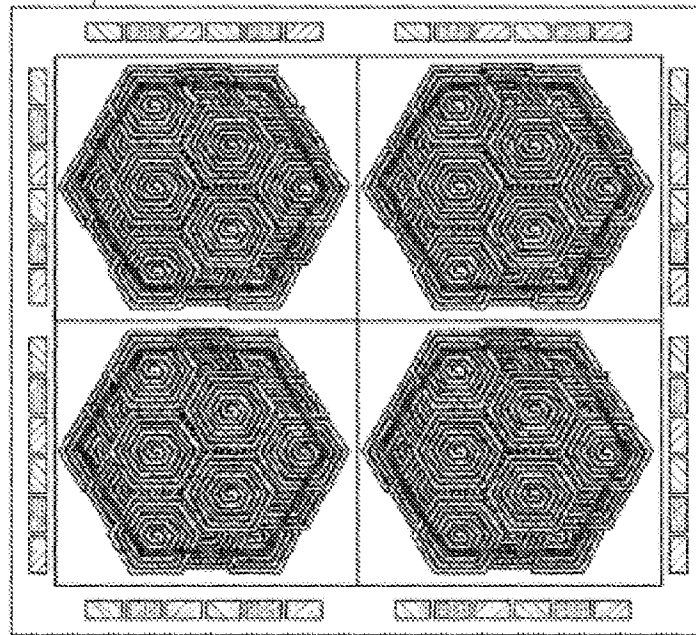
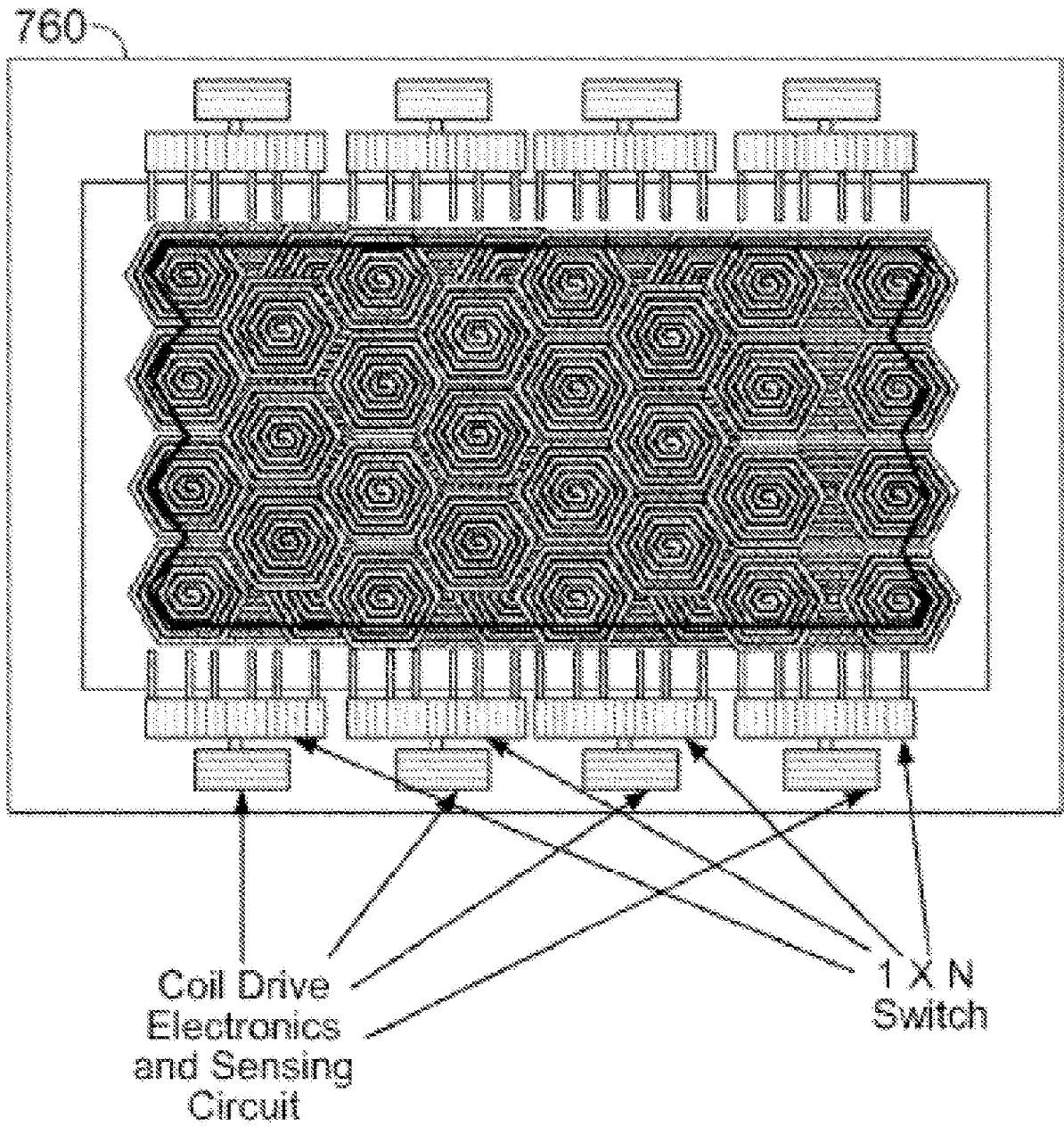


Fig. 36

**Fig. 37**

780

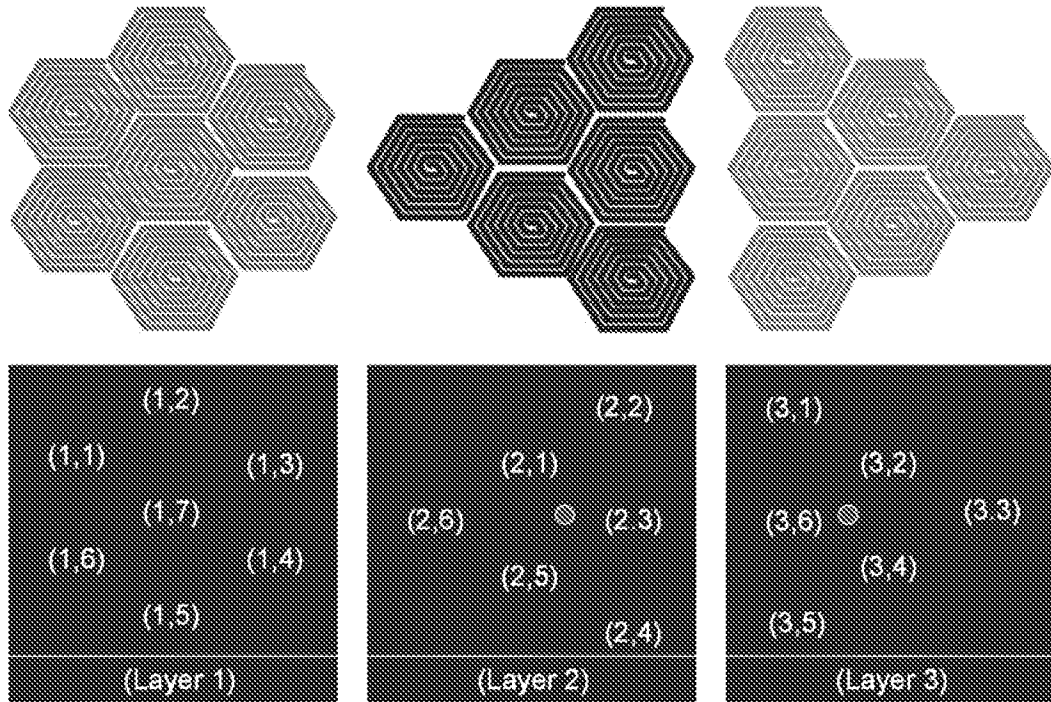


Fig. 38

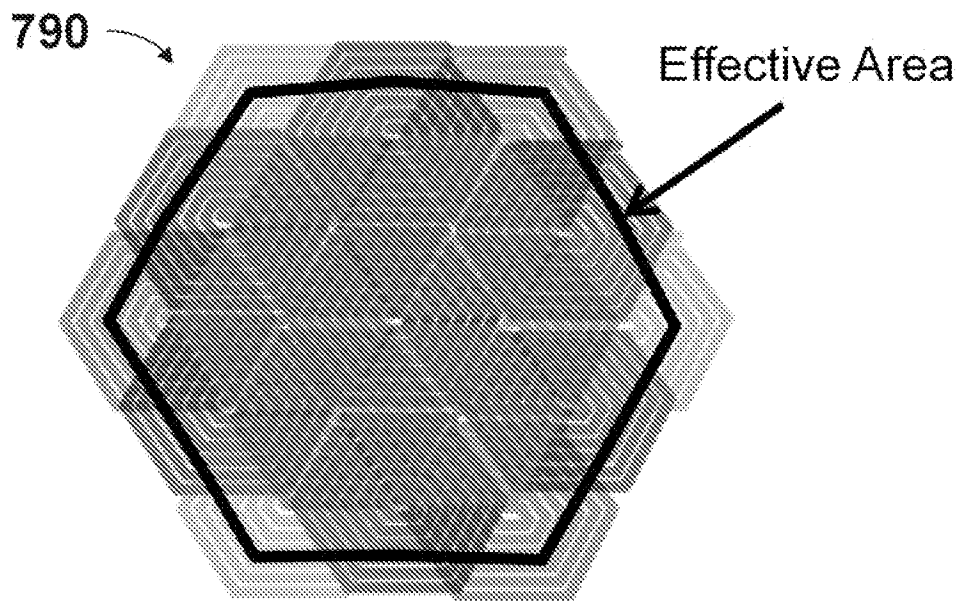


Fig. 39

792 →

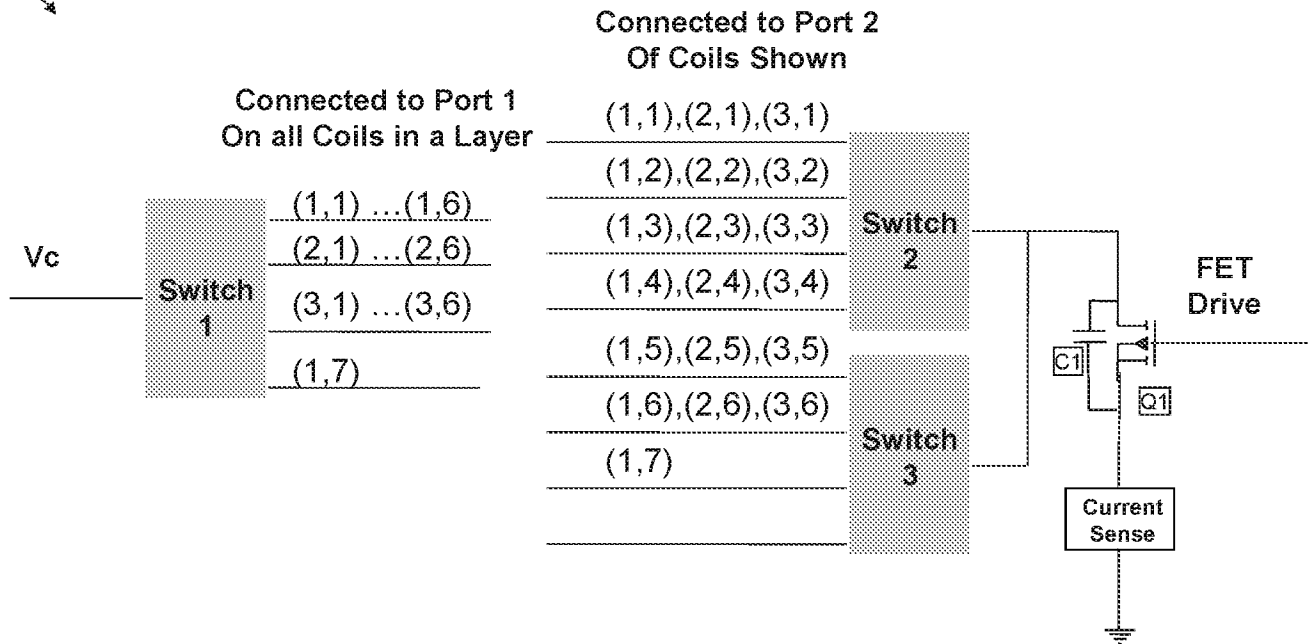


Fig. 40

796

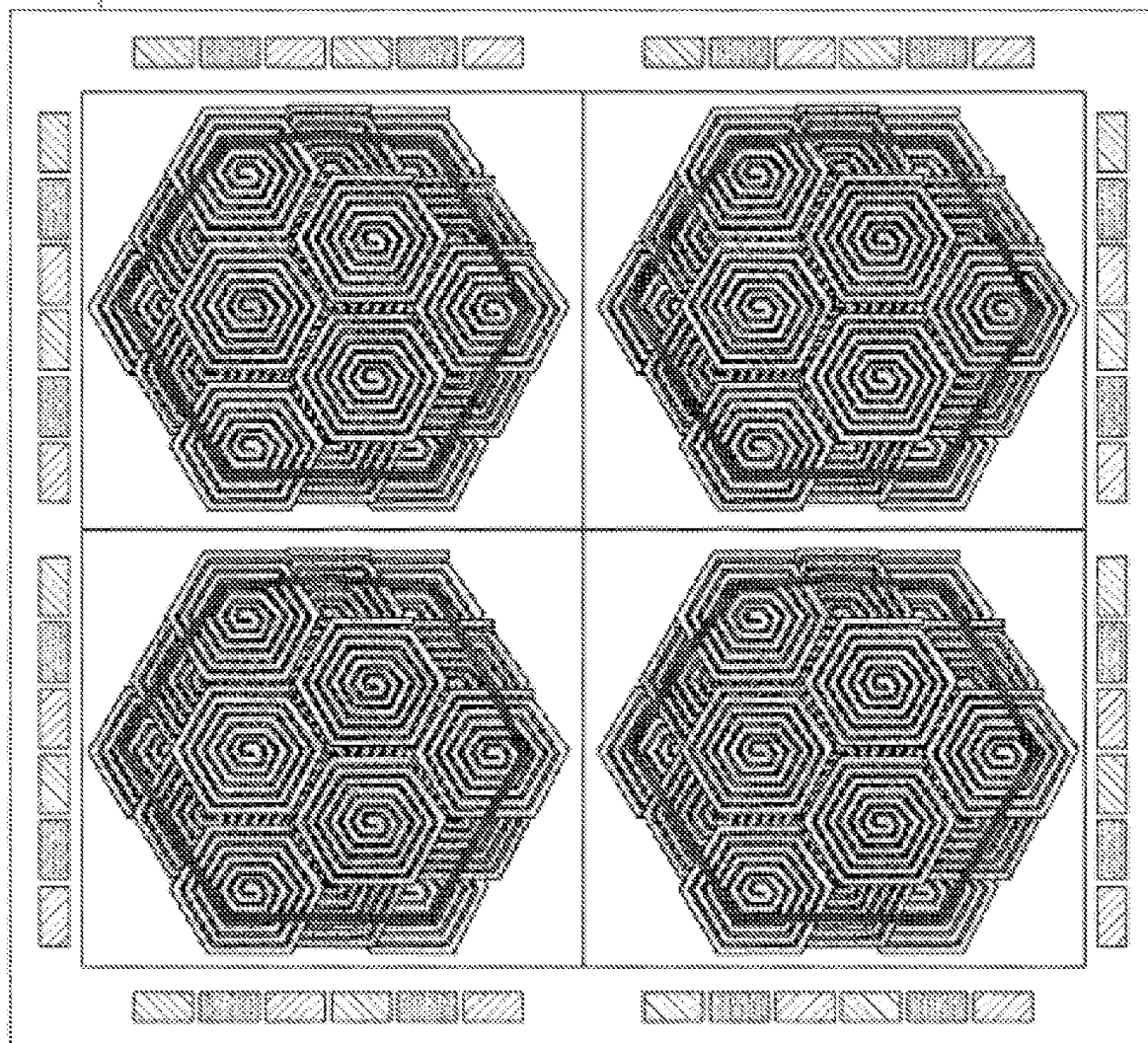


Fig. 41

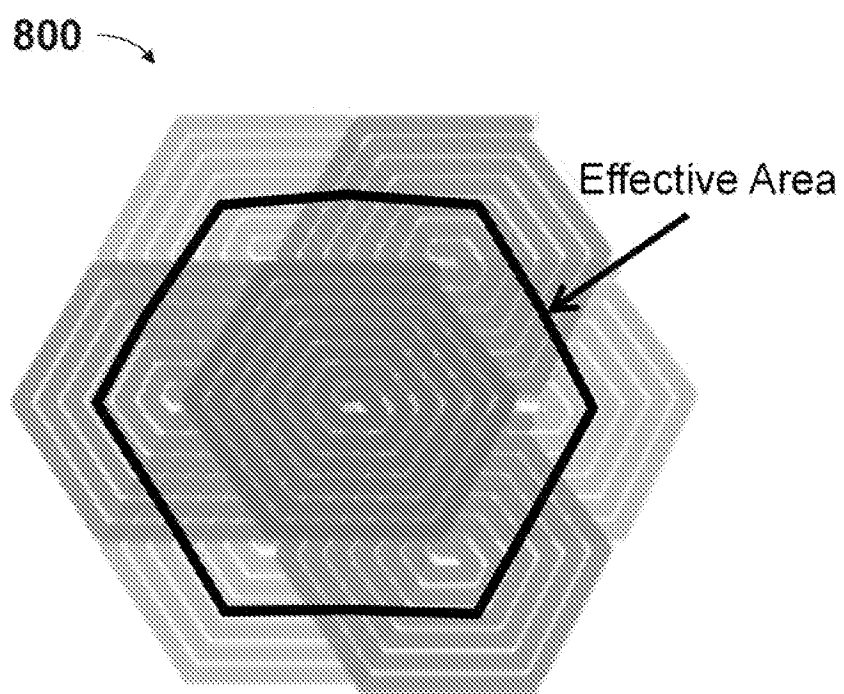


Fig. 42

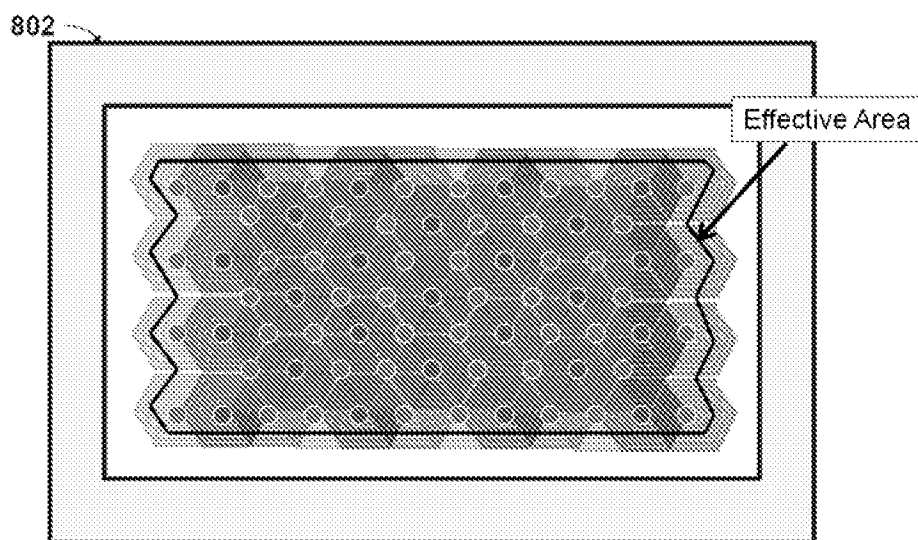


Fig. 43

REPLACEMENT SHEET

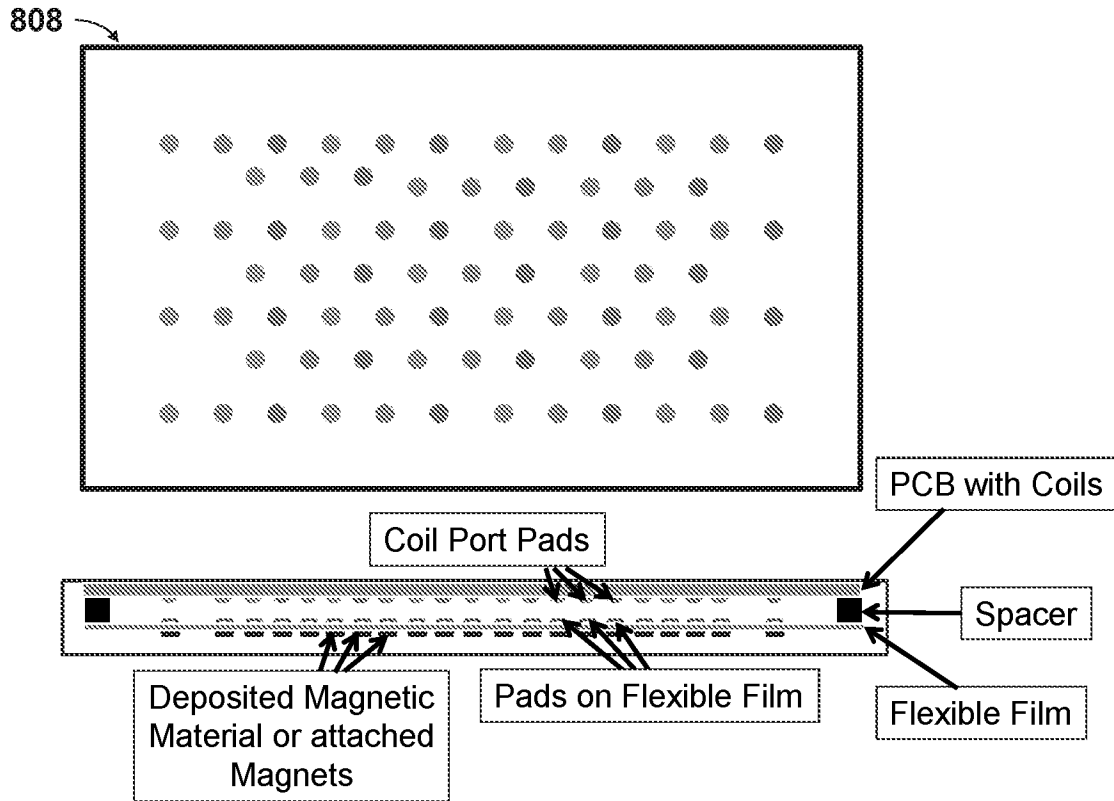


Fig. 44

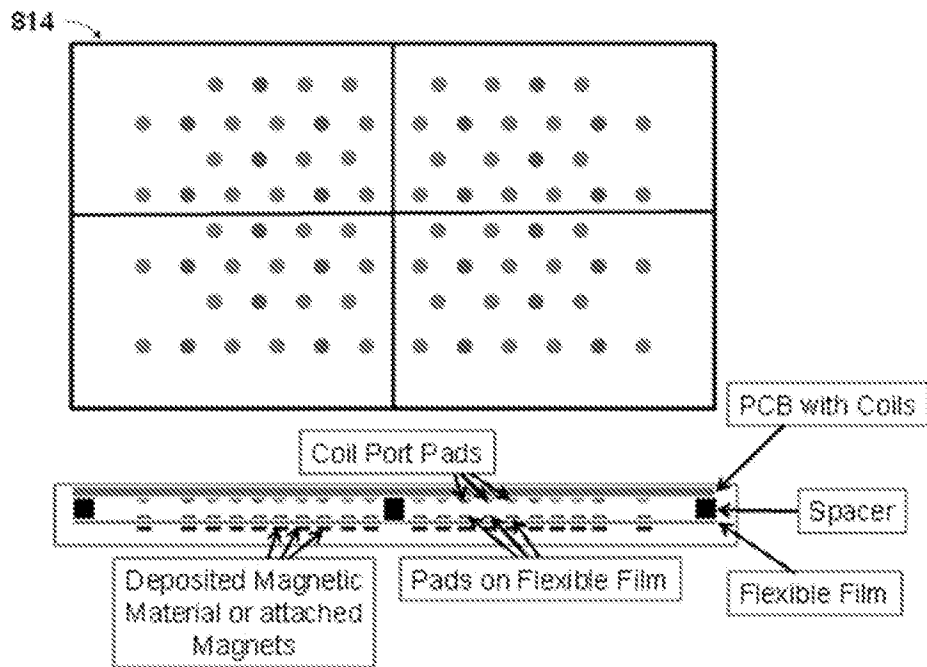


Fig. 45

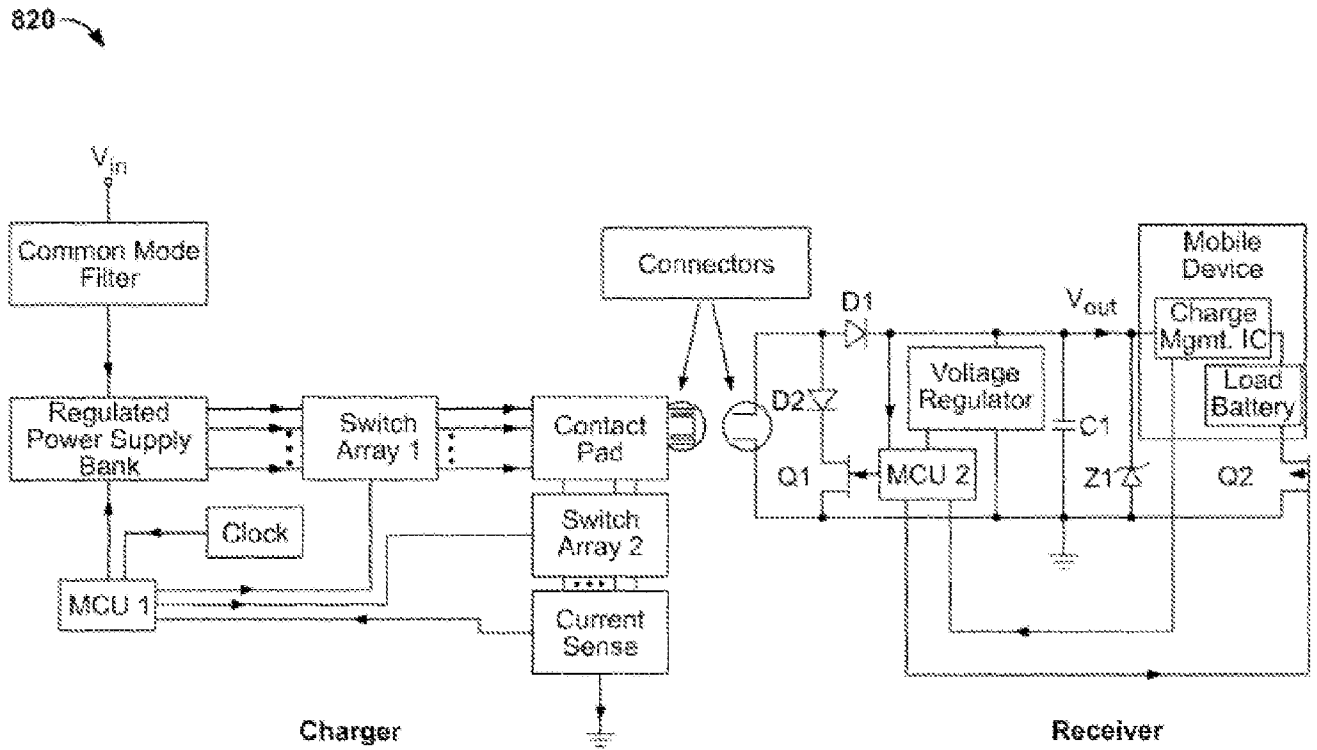


Fig. 46

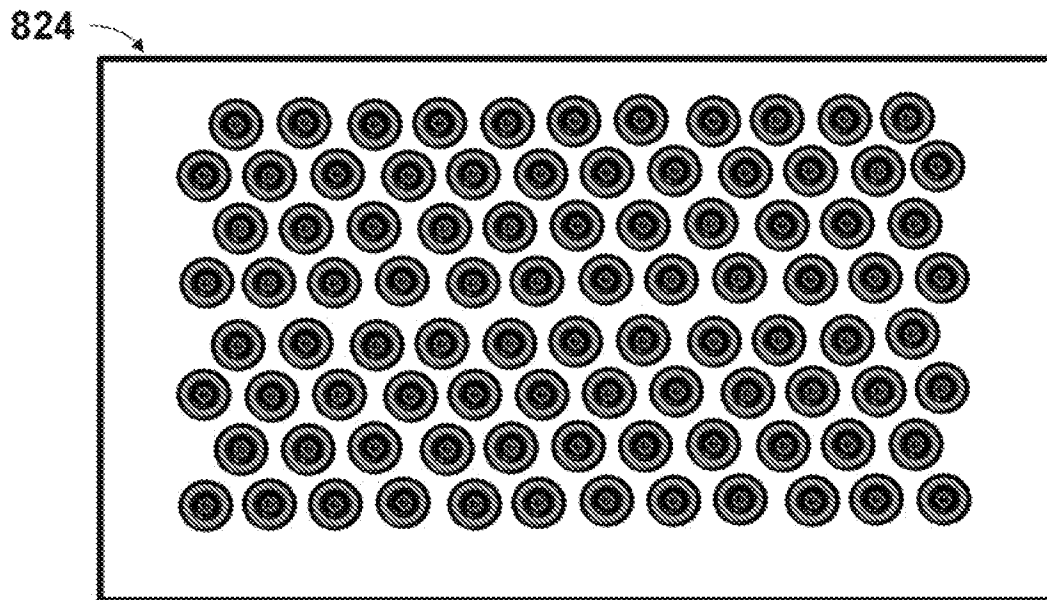


Fig. 47

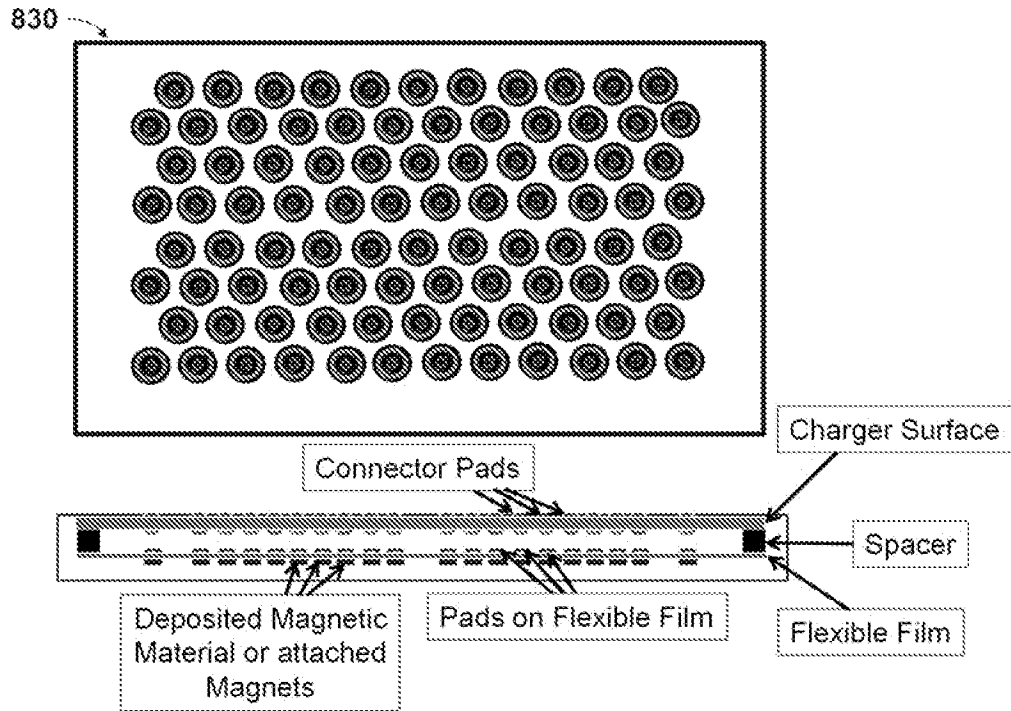


Fig. 48

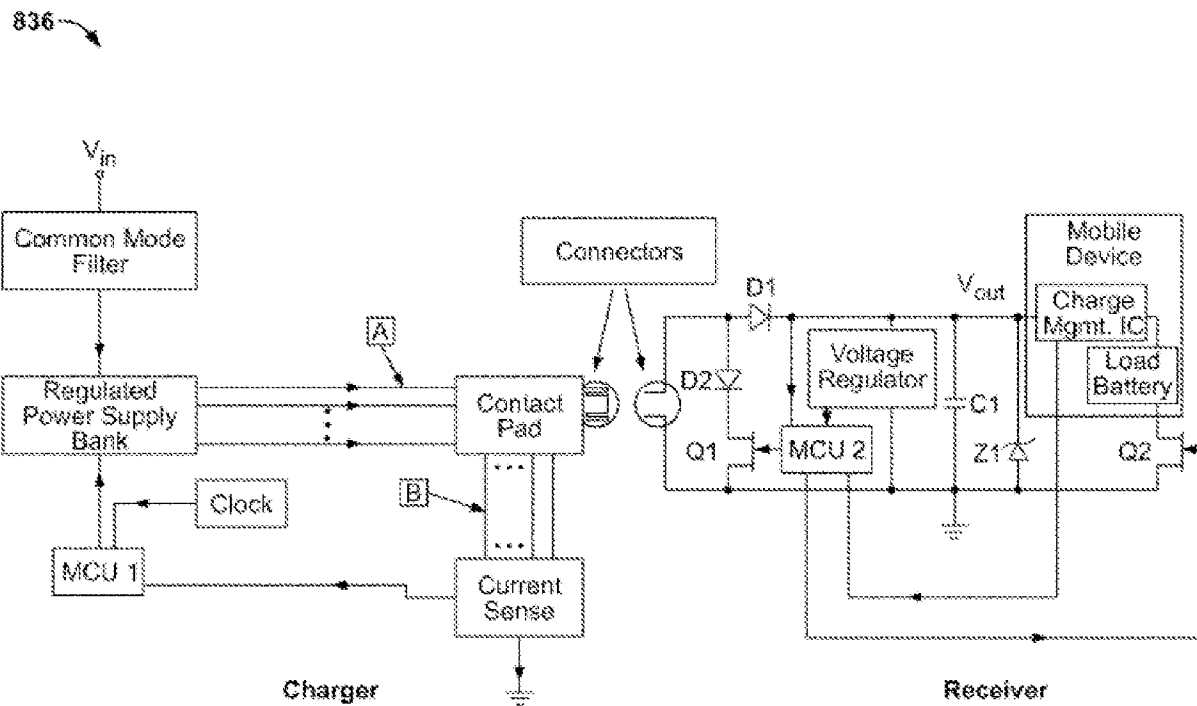


Fig. 49

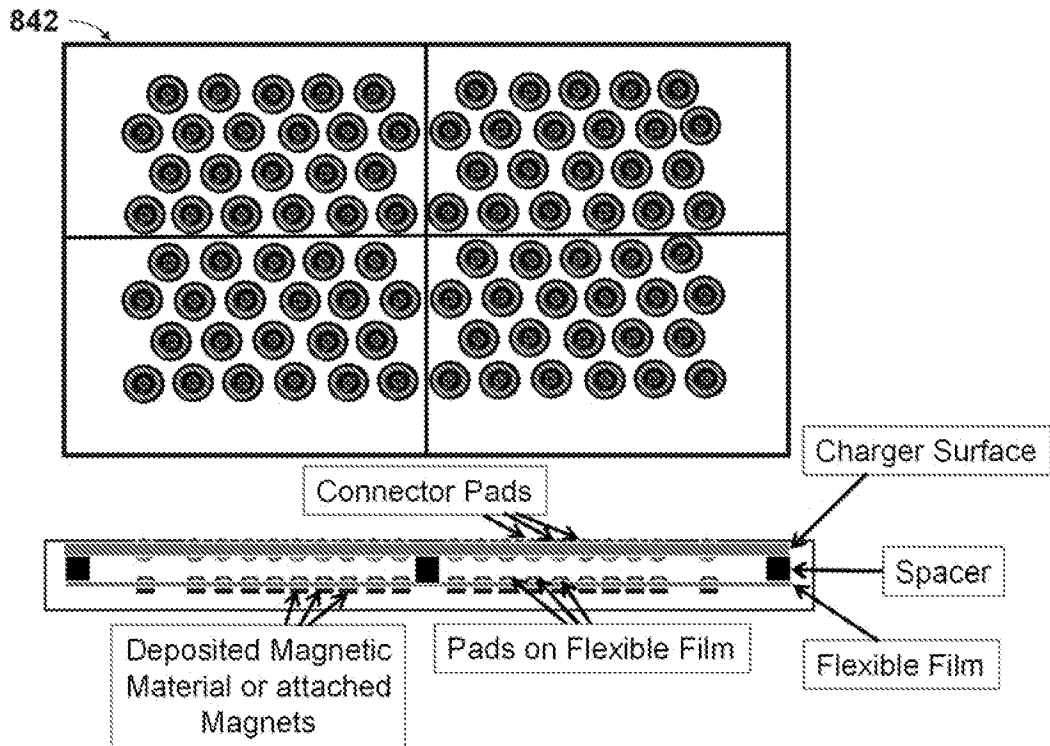


Fig. 50

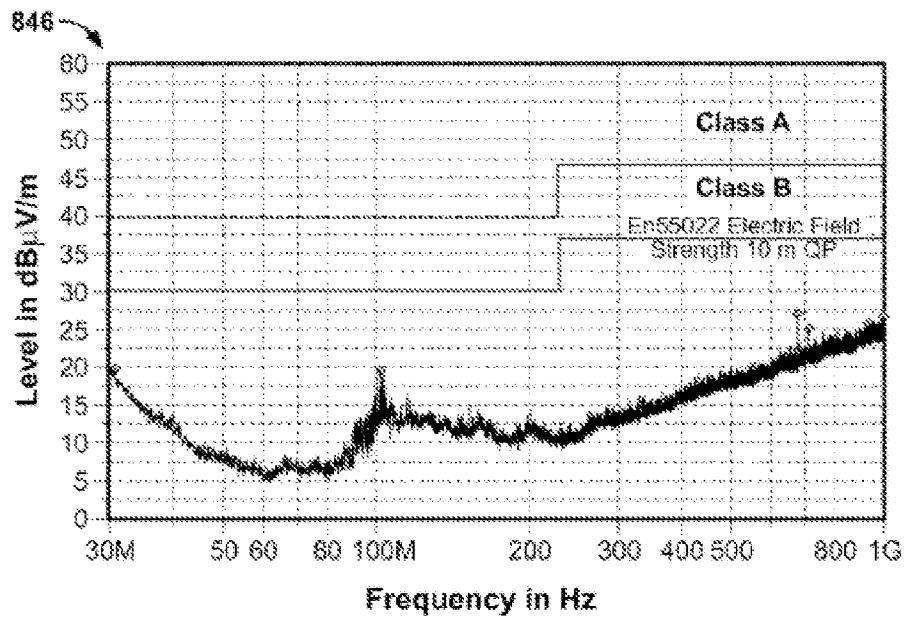
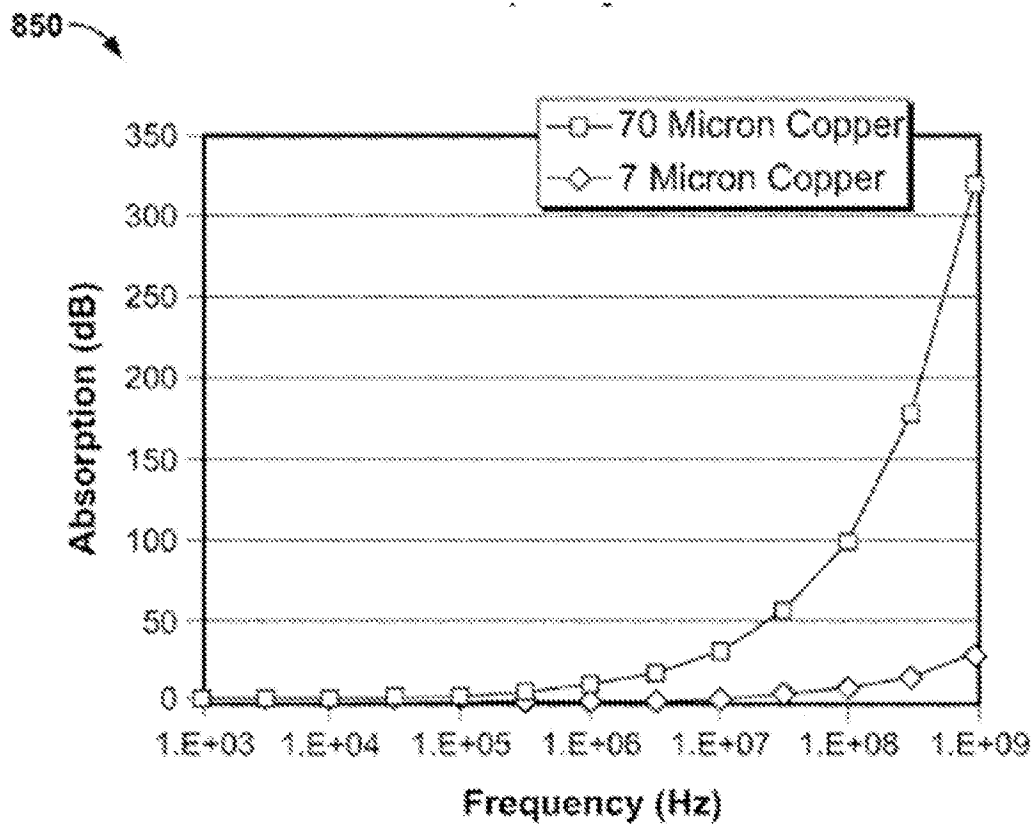


Fig. 51

**Fig. 52**

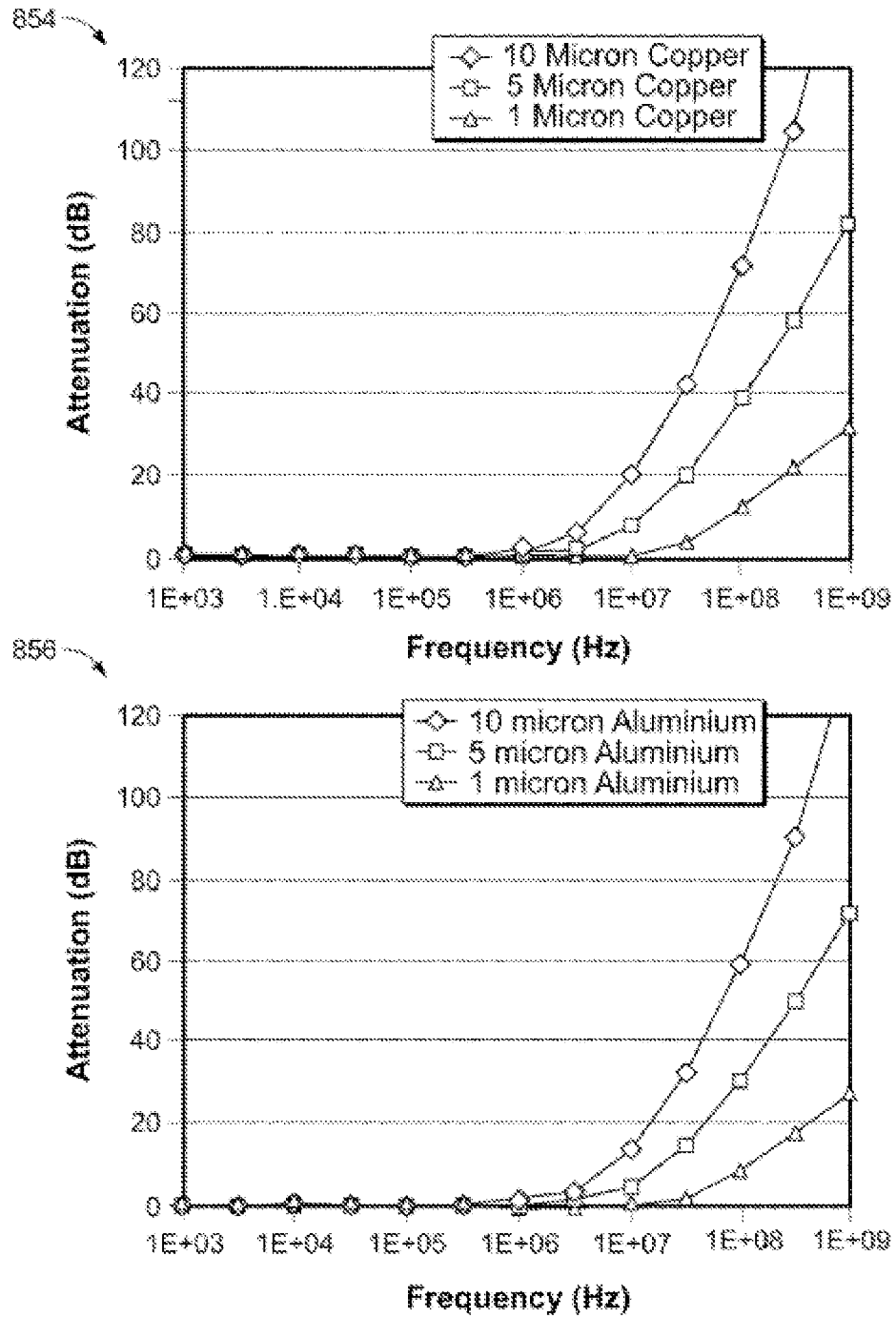


Fig. 53

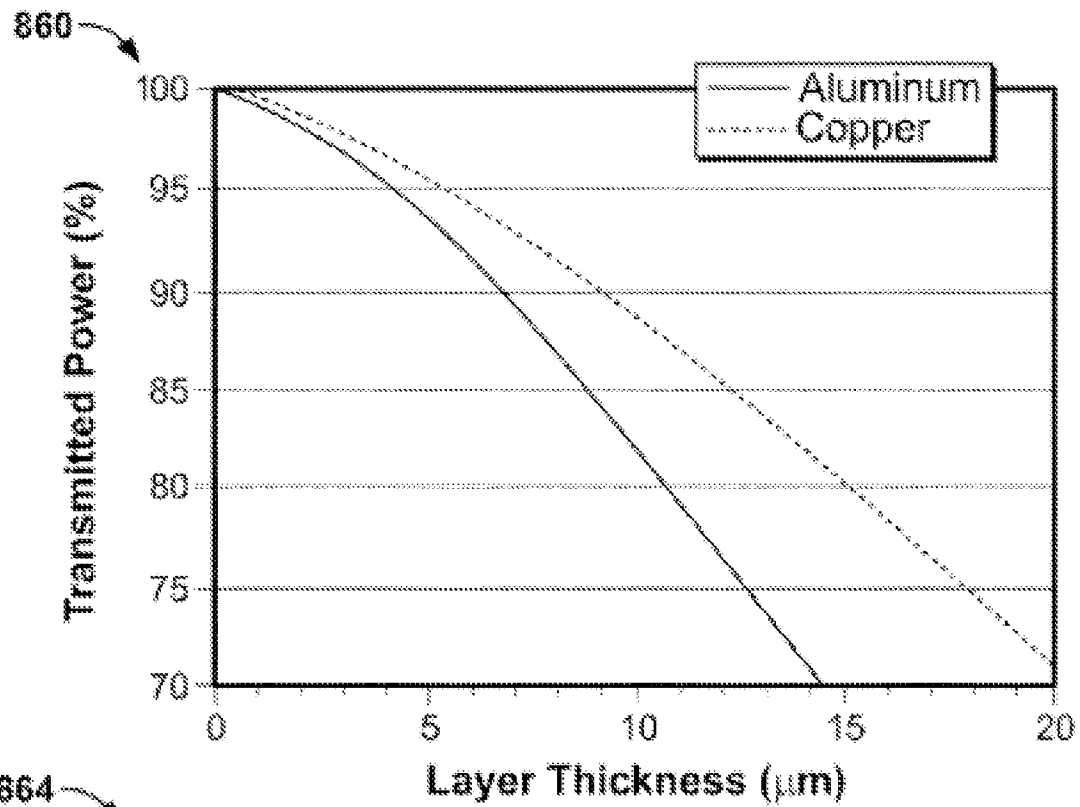


FIG. 54

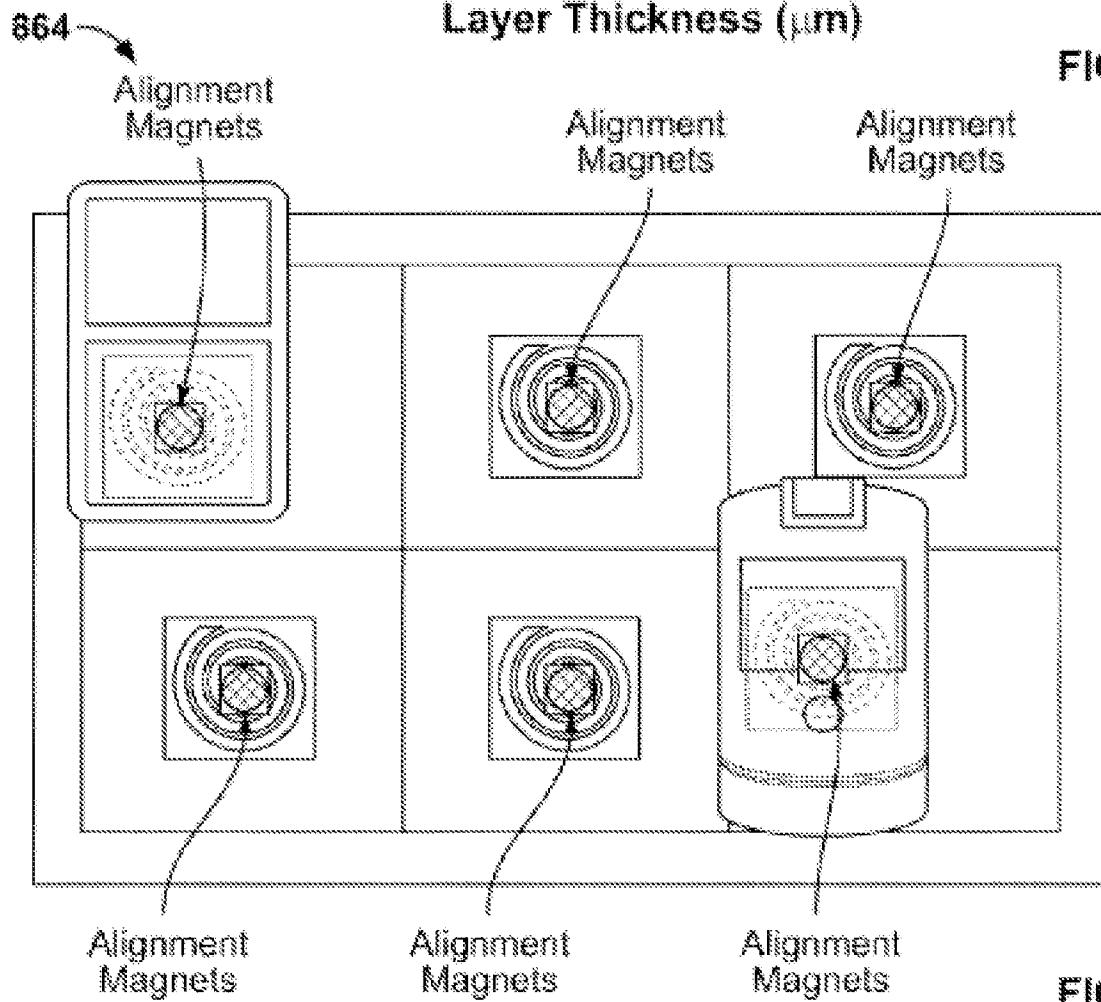


FIG. 55

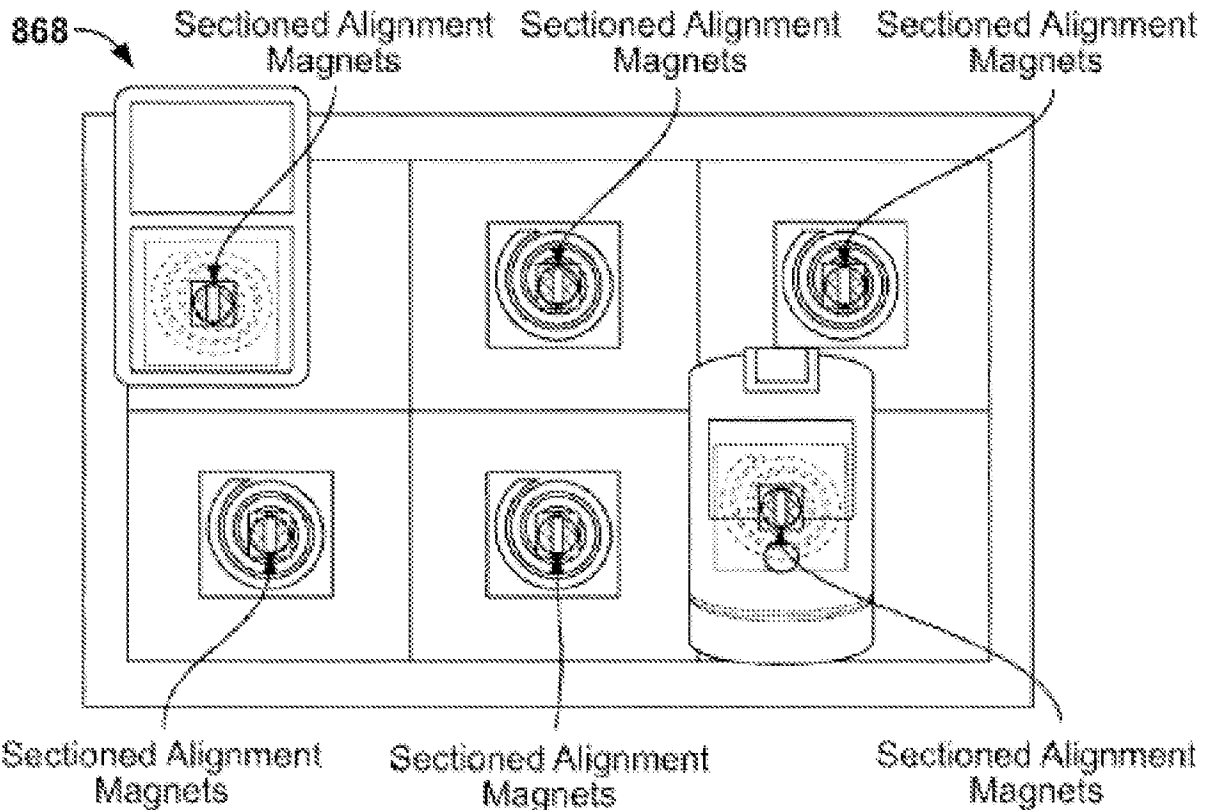


FIG. 56

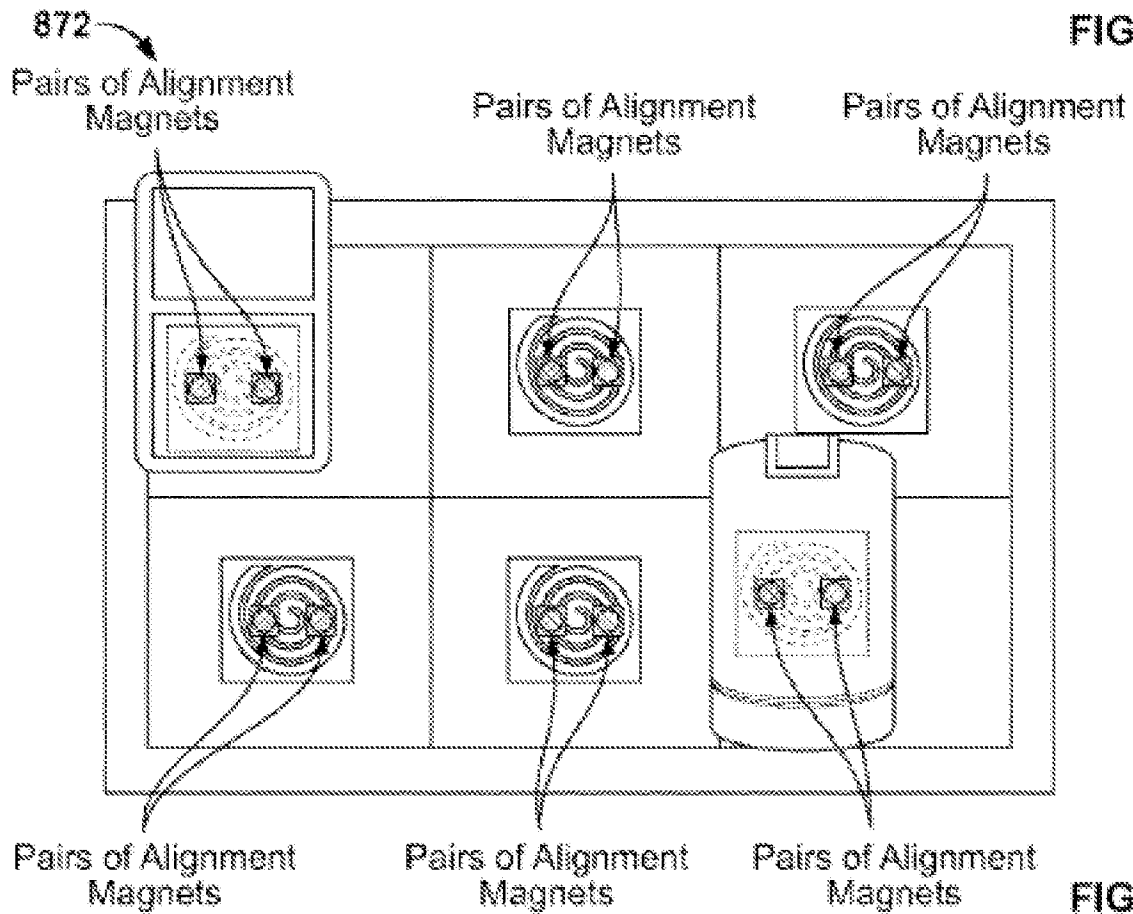


FIG. 57

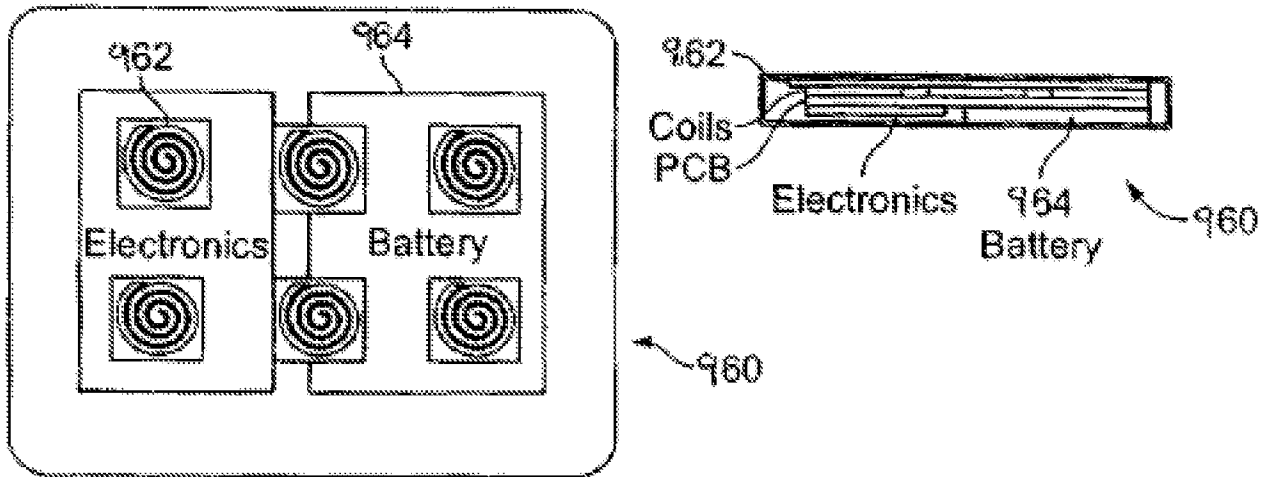


Fig. 58

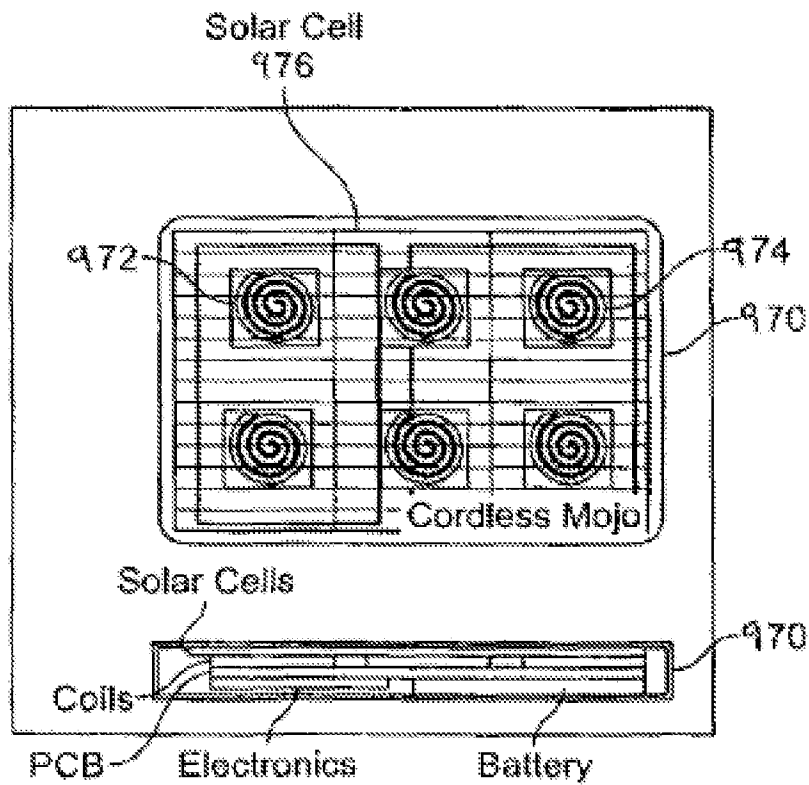


Fig. 59

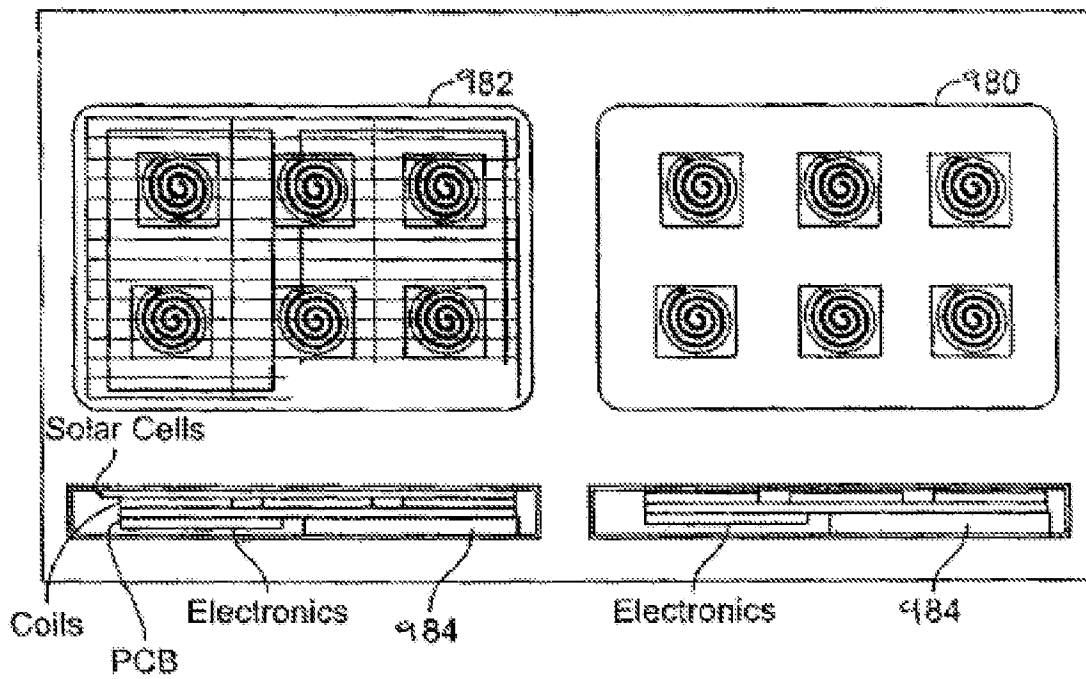


Fig. 60

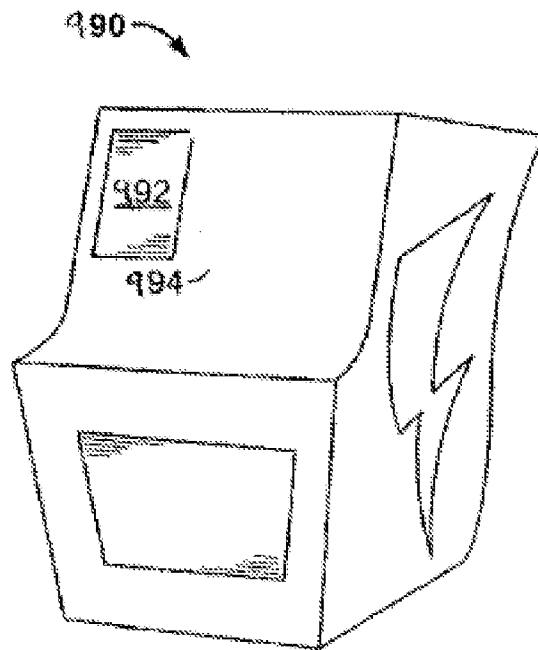


Fig. 61

REPLACEMENT SHEET

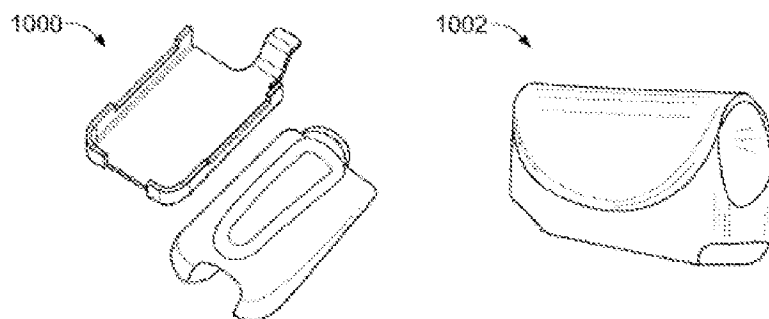


Fig. 62

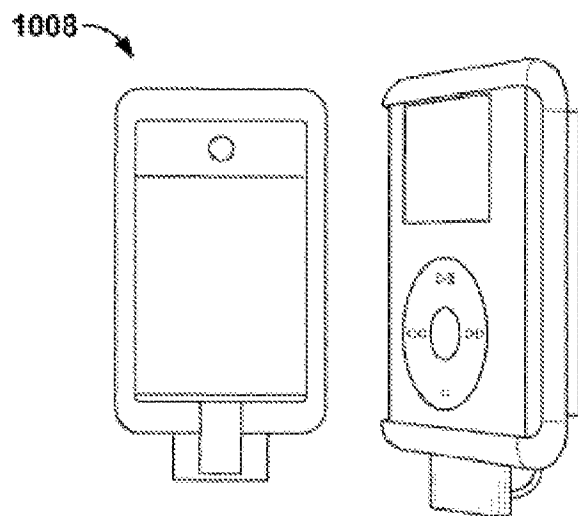


Fig. 63

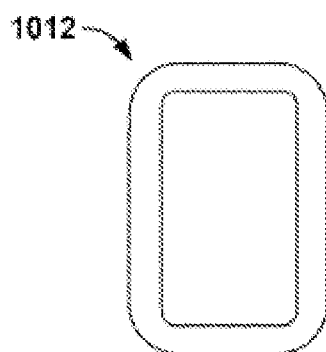


Fig. 64

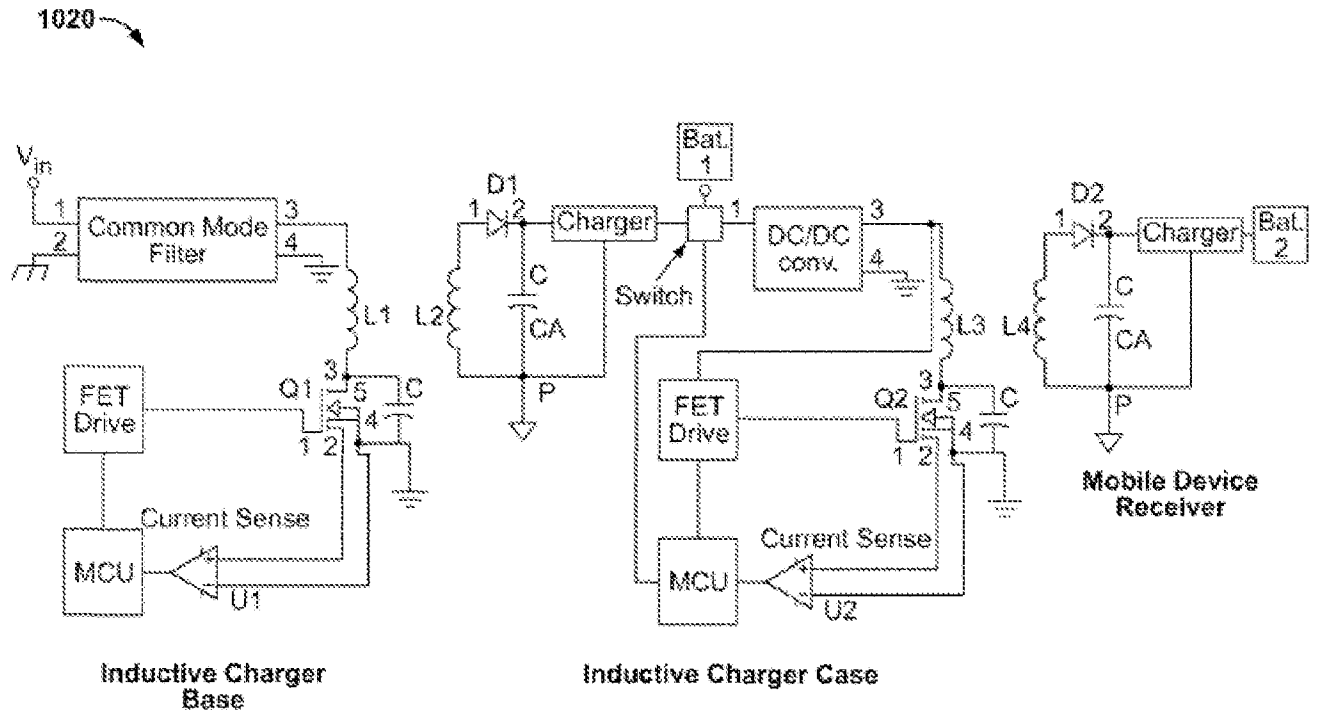


Fig. 65

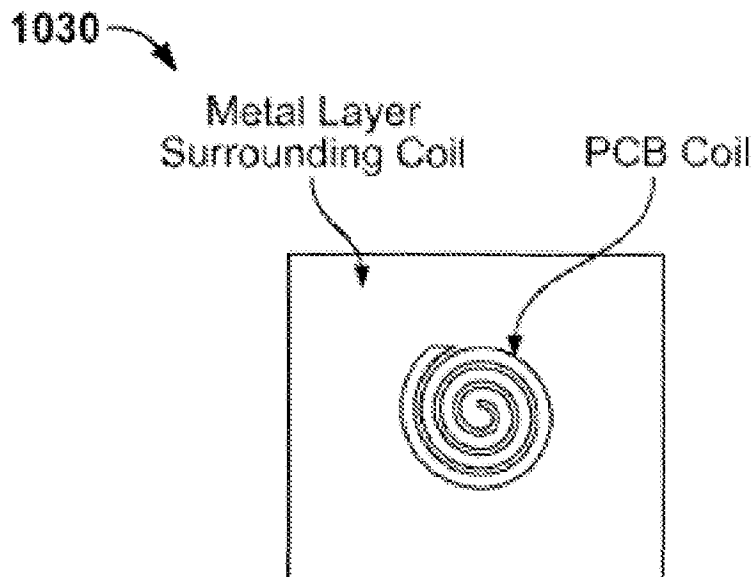


Fig. 66

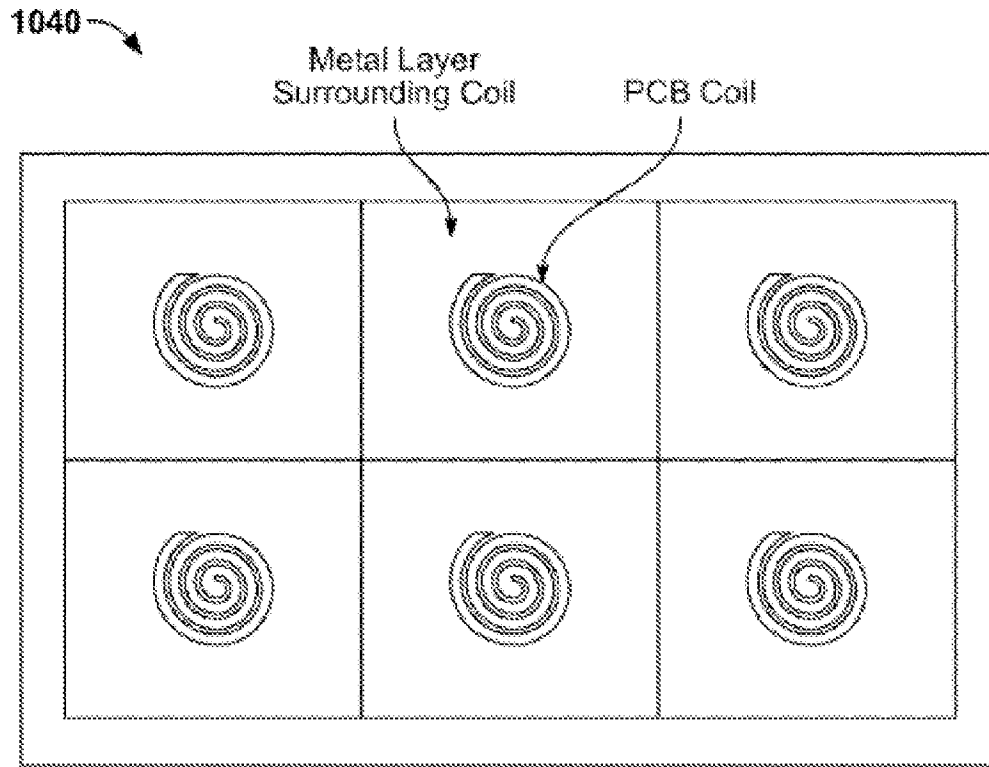


Fig. 67

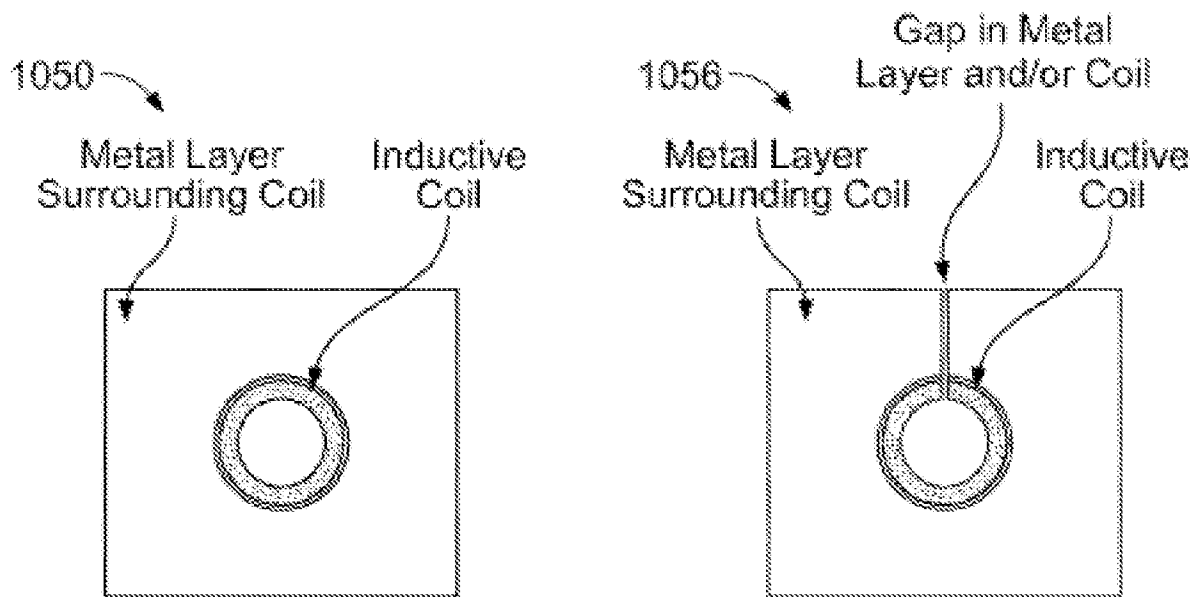


Fig. 68

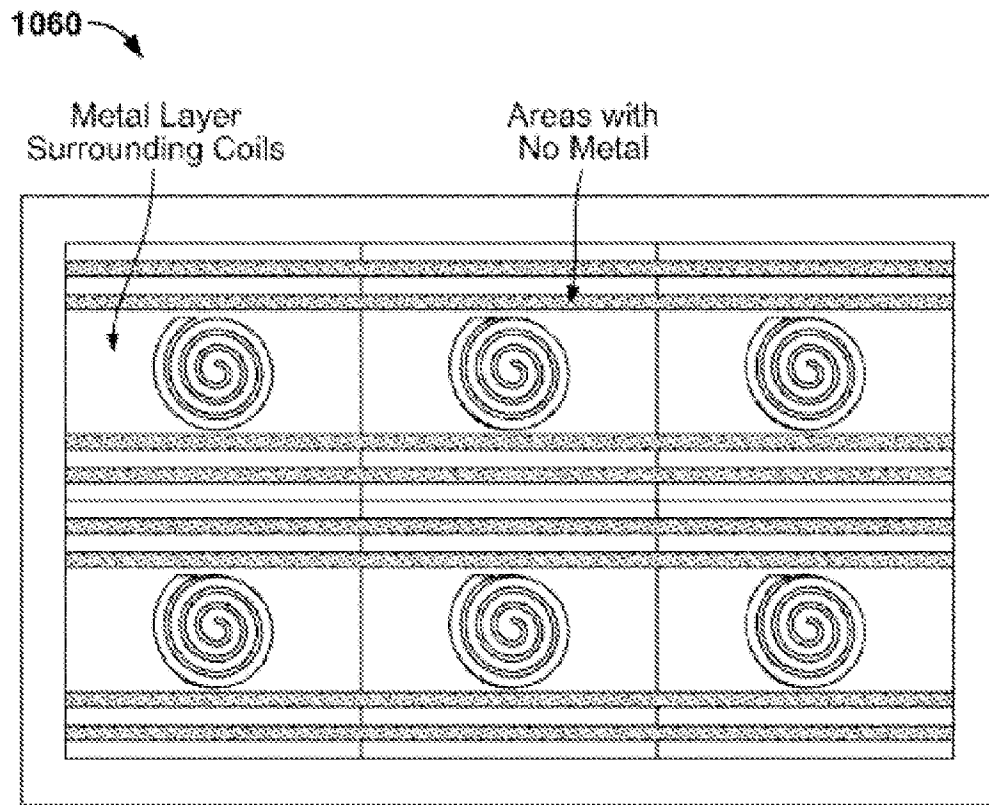


Fig. 69

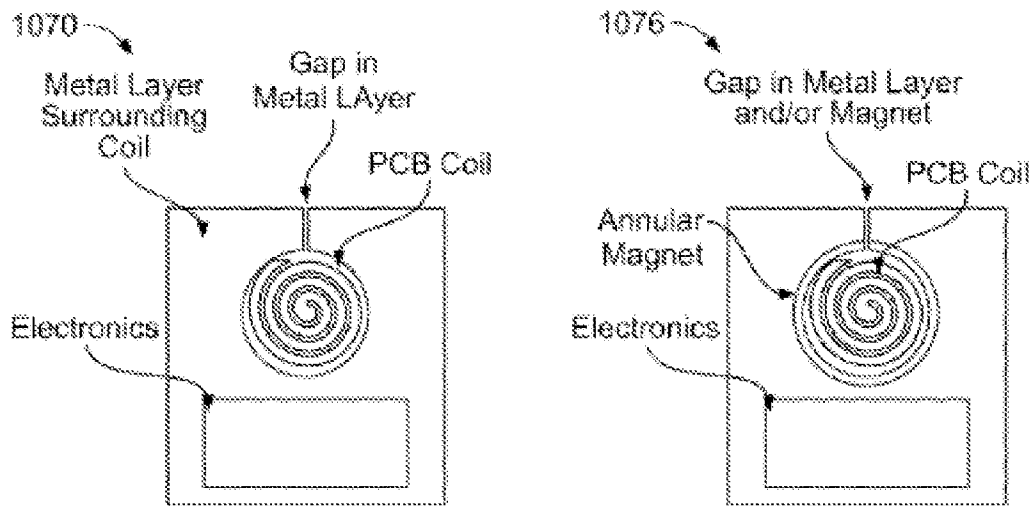


Fig. 70

REPLACEMENT SHEET

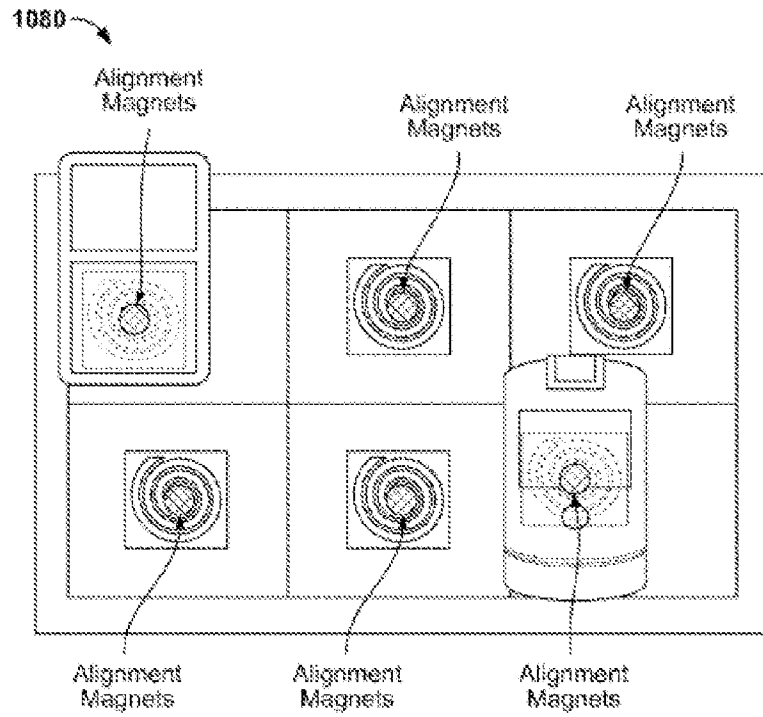


Fig. 71

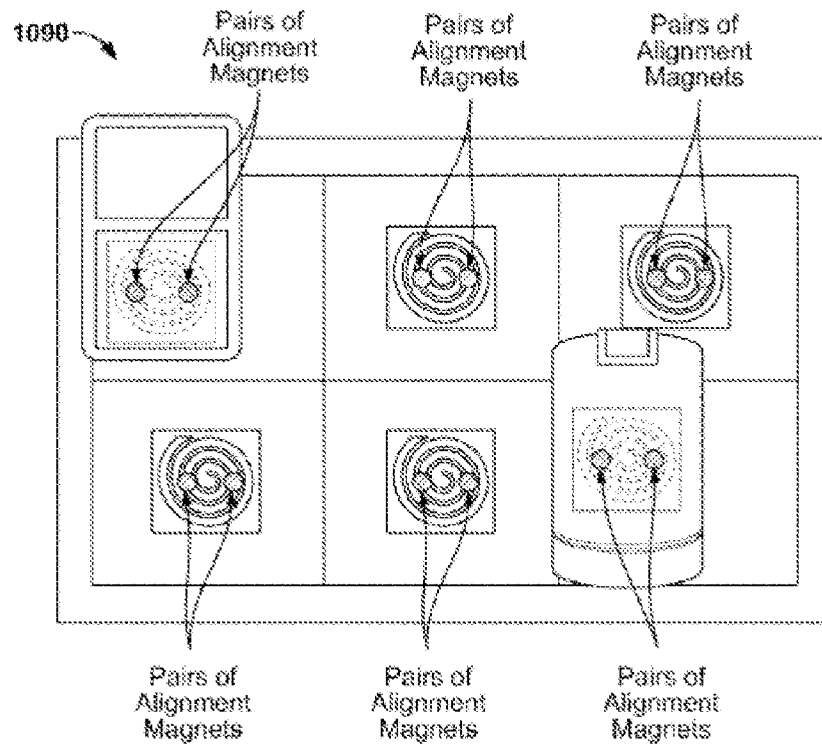


Fig. 72

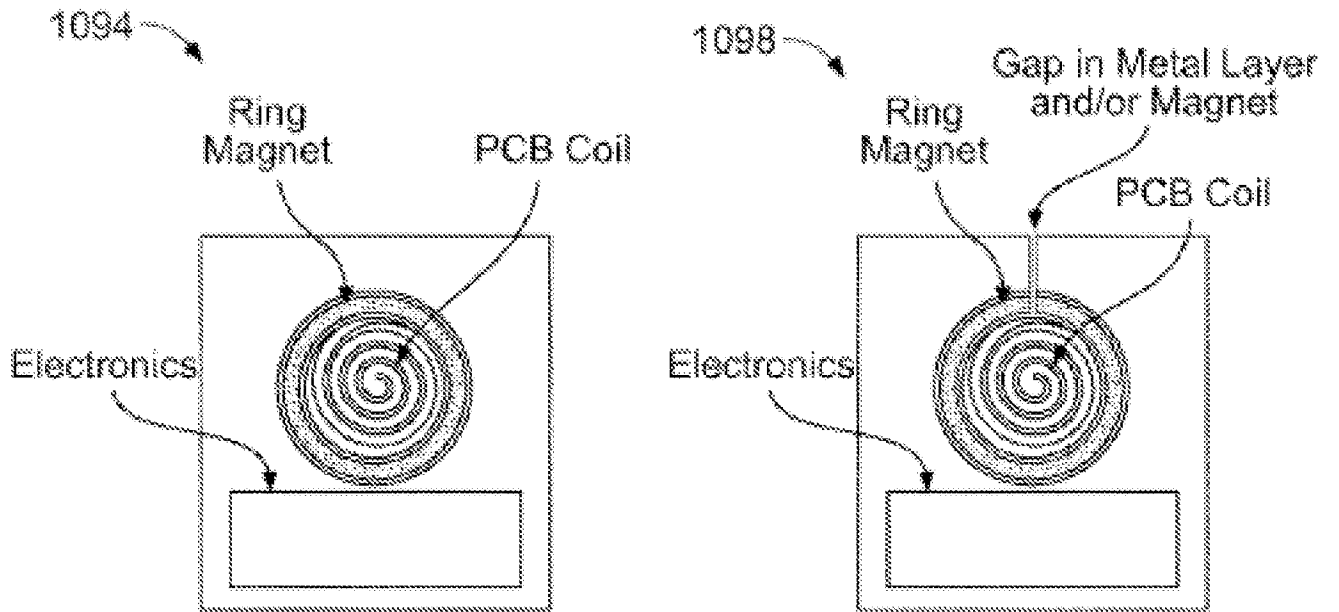


Fig. 73

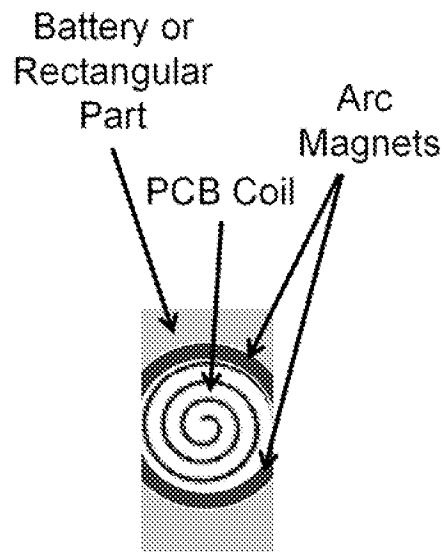


Fig. 74

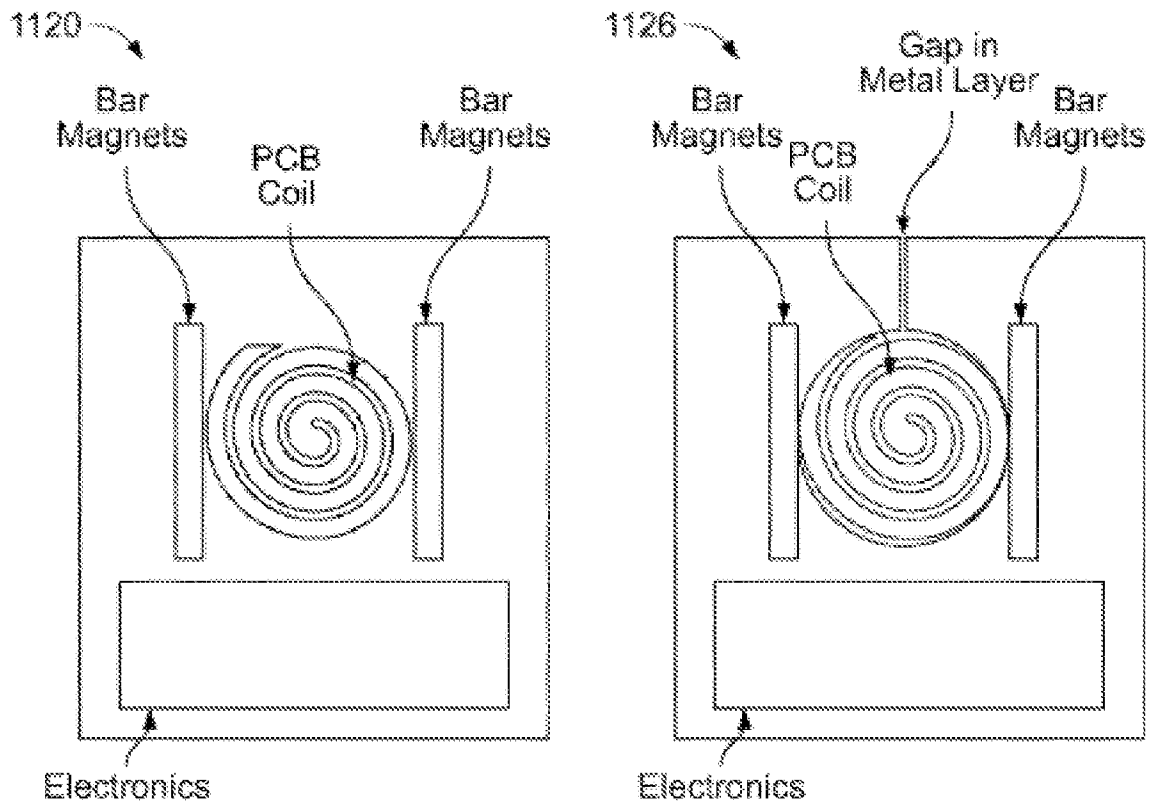


Fig. 75

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
October 5, 2021

AMENDMENT UNDER 37 C.F.R. §1.312

This paper is submitted under and in compliance with 37 C.F.R. §1.312. As explained in more detail below, Applicant respectfully submits that this amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Entry of the amendment is respectfully requested.

AMENDMENTS TO THE FIGURES

Please replace Figures 1-75 with the Replacement Sheets filed herewith.

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph 0012 as follows:

[0012] Systems and methods are provided for inductive powering and/or charging of electric or electronic devices or batteries. The system typically includes a base unit, such as a charger or power supply, which includes one or more primary coils generally having a planar or curved surface. Each of the one or more primary coils can be activated to generate a magnetic field in a direction substantially perpendicular to the planar or curved surface to provide power to one or more inductive power receiver coils of one or more receivers to power or charge one or more portable devices or batteries. The base unit is capable of detecting a wireless communication signal or a modulation communication signal in the one or more primary coils created by modulation of one or more receivers' impedance or impedances and is capable of using the wireless communication signal or the modulation communication signal to control output voltage, current or power from the one or more receivers.

Please amend paragraph 0260 as follows:

[0260] FIG. 26 shows a high level view of a flyback power supply geometry 580 in accordance with an embodiment. During the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary (receiver) coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred μ Henry are typical for 10's or 100's of Watts of power supply power.

Please amend paragraph 0264 as follows:

[0264] For example, for a coil of 10 turns, an outer radius of 15 mm, and inner radius of zero, then $L = 1 \mu\text{H}$. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor.

Please amend paragraph 0538 as follows:

[0538] FIG. 74 shows an embodiment 1100 in which magnetic arc shaped parts around a circular coil are used. This case may be combined with the matching magnet on the other coil having the same shape or a ring shape similar to FIG. 73. For example, in a mobile battery application where the battery with an integrated inductive receiver is charged by placement on an inductive charger pad, the size of the coil determines the received power and may require the width of the battery to be equal or similar to the receiver coil. To allow attachment of alignment magnets, two arcs as shown in FIG. 74 can be attached to the coil. In this case, the magnets can be placed in between the battery and the coil PCB to allow the coil to be on the top surface and therefore closest to the charger coil. The matching magnet in the charger can be a ring or a similar set of arcs or another shape or size to facilitate alignment. If a ring is used behind the charger coil, then central symmetry between the two parts is retained and the parts can be rotated with respect to each other while keeping alignment for optimum operation.

AMENDMENTS TO THE CLAIMS

1-18. (Canceled)

1 19. (Currently Amended) A system for inductive powering or charging of portable
2 devices, the system comprising:
3 one or more primary coils that are substantially planar and parallel to a surface of the
4 system for powering or charging compatible portable devices including batteries
5 and receiver units, each receiver unit including a receiver coil and a receiver
6 circuit including a receiver rectifier circuit;
7 one or more drive circuits including one or more FET drivers, FET switches, and
8 capacitors coupled to the one or more primary coils that when operated apply an
9 alternating electrical current to the one or more primary coils to generate a
10 magnetic field in a direction substantially perpendicular to the plane of the one or
11 more primary coils and the surface of the system to provide power to the one or
12 more portable devices capable of being powered or charged by the system when
13 present and near the one or more primary coils;
14 one or more sense circuits to monitor the current through the one or more primary coils to
15 sense communications from the one or more receiver coils; and
16 one or more communication and control circuits including one or more microcontrollers
17 coupled to the one or more drive circuits and the one or more sense circuits that
18 detect communications through the one or more sense circuits via the one or more
19 primary coils and control the one or more drive circuits to control the charging
20 process;
21 wherein the one or more communication and control circuits:
22 operate the one or more drive circuits near a first resonant frequency of a circuit
23 formed by a primary coil and a drive circuit and a receiver coil and a
24 receiver circuit of a compatible portable device when nearby;
25 sequentially switch the one or more primary coils at a frequency and power
26 level sufficient to transfer power to one or more of the receiver units
27 when near the one or more primary coils for a sufficiently long period of

time to activate the one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents; detect, through the one or more sense circuits, communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils[[,]] and information associated with the one or more portable devices and/or receiver units to enable the base unit to identify the one or more portable devices and/or receiver units and to determine any one or more appropriate charging or powering algorithm profiles therefor; for each portable device, determine the ~~one or more~~ primary [[coils]] coil electromagnetically most aligned with the ~~one or more~~ receiver [[coils]] coil of the portable device; drive the one or more FET switches associated with [[those]] the most aligned one or more primary coils; periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

20. (Previously Presented) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

1 21. (Previously Presented) The system of claim 19, wherein the one or more drive
2 circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage
3 Switching or Zero Current Switching mode during inductive power transfer to a portable device.

1 22. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits are designed to receive from a receiver unit of a portable
3 device identification information including one or more codes identifying the manufacturer of
4 the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a
5 charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

1 23. (Previously Presented) The system of claim 19, wherein the system comprises
2 more than one primary coil which are of different sizes and functions and provide different
3 power levels to portable devices with different power requirements.

1 24. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits, prior to activating the one or more receivers for
3 communication and further identification, ~~sequentially~~ drive each primary coil for a short period
4 of time near a nominal second resonant frequency of each primary coil and associated capacitor
5 without a receiver coil present, and the one or more sense circuits monitor the current through
6 the primary coil to detect a higher than a baseline current draw to indicate potential portable
7 devices or metallic objects near the primary coil for further investigation.

1 25. (Currently Amended) The system of claim 19, wherein the one or more primary
2 coils ~~[[are]]~~ include coils arrayed in multiple layers such that any location on the effective
3 charger area of the surface of the system is located at a distance equal to or less than half a radius
4 or half a side-to-center length of at least one coil.

1 26. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits use encryption for at least a portion of the communication
3 with a portable device for powering or charging for security.

1 27. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits can provide bi-directional digital communication between
3 the one or more primary coils and the receiver coils for a verification process to ensure that a
4 receiver unit that can be charged or powered by the system is present and to determine the
5 voltage or power requirements of the receiver unit.

1 28. (Currently Amended) The system of claim 19, further comprising a $1 \times N$ switch,
2 wherein N primary coils of the system share a common drive circuit and a common sense circuit
3 that are switched by the one or more communication and control circuits to connect the common
4 drive circuit and the common sense circuit to the N primary coils by ~~one or more~~ the $1 \times N$
5 ~~switches~~ switch where the number N is equal or greater than 2.

1 29. (Currently Amended) The system of claim 19, wherein the one or more primary
2 coils are constructed of a Printed Circuit Boards Board comprising multiple layers connected by
3 vias.

1 30. (Previously Presented) The system of claim 19, wherein the system is
2 incorporated into a portable device or battery pack comprising an internal rechargeable battery
3 that can be periodically recharged and can operate the system for inductive charging or powering
4 for a period of time.

1 31. (Currently Amended) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more of the one or more primary coils to enable the
3 system and its internal battery to be charged or powered inductively.

1 32. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more coils separate from the one or more primary coils to
3 charge or power the system and its internal battery inductively.

1 33. (Currently Amended) The system of claim 30, wherein the system is incorporated
2 into a battery pack that can be clipped or attached to a portable device to extend [[its]] battery
3 run time of the portable device.

1 34. (Currently Amended) The system of claim 30, wherein the system is incorporated
2 into a [[the]] battery pack that is incorporated into a case for a portable device.

1 35. (Previously Presented) The system of claim 19, wherein the system further
2 includes a common mode filter circuit at an input.

1 36. (Currently Amended) The system of claim 19, further wherein the one or more
2 communication and control circuits use a Proportional-Integral-Derivative control technique to
3 regulate one or more outputs of the one or more receiver ~~rectification~~ rectifier circuits.

1 37. (Currently Amended) The system of claim 19, further comprising an internal data
2 storage system and a data communication system ~~such as WiFi or Bluetooth~~ that can establish
3 wireless communication using WiFi or Bluetooth with one or more of the portable devices
4 during charging and upload or download user digital data between the one or more portable
5 devices and the internal data storage system.

1 38. (Currently Amended) A portable device including a battery capable of receiving
2 inductive power from an inductive charging system including a base unit with one or more
3 primary coils and associated circuits, the portable device comprising:

4 a receiver coil which has a substantially planar shape and located parallel to a surface of
5 the portable device so that a magnetic field received from a primary coil in a base
6 unit of an inductive charging system in a direction substantially perpendicular to
7 the plane of the receiver coil is used to inductively generate a current in the
8 receiver coil to power or charge the portable device;

9 a ferrite material layer placed behind the receiver coil and opposite to the surface of the
10 portable device to provide shielding in the portable device from electromagnetic
11 fields;

12 a receiver circuit designed to operate near a resonant frequency of a circuit formed by the
13 receiver coil, the receiver circuit, and a compatible base unit primary coil and
14 associated circuit when adjacent to the portable device for inductive powering or
15 charging;

16 wherein the receiver circuit is part of a receiver unit and comprises:

17 a receiver rectifier circuit including one or more rectifiers and one or more
18 capacitors; and

19 a receiver communication and control circuit including a microcontroller and a
20 communication FET to modulate the input impedance of the receiver
21 circuit to communicate with the base unit through the primary coil;

22 wherein when a current is generated in the receiver coil inductively by the
23 primary coil in the base unit, the current is rectified by the one or more
24 rectifiers and smoothed by the one or more capacitors in the receiver
25 rectifier circuit and is used to power and activate the receiver
26 communication and control circuit and to power or charge the portable
27 device; and

28 wherein upon powering and activation of the receiver circuit by a primary coil in
29 the base unit, the receiver circuit: [[;]]

30 communicates information corresponding to a voltage at an output of the
31 receiver rectifier circuit and information associated with the ~~one or~~
32 ~~more~~ portable device and/or receiver unit to enable the base unit to
33 identify the portable device and/or receiver unit, to determine any
34 appropriate charging or powering algorithm therefor, and to
35 identify one or more primary coils of the base unit most aligned
36 with the receiver coil for use in charging or powering the portable
37 device; and

38 subsequently, periodically communicates information corresponding to an
39 output voltage or current of the receiver rectifier circuit to the base
40 unit to enable the base unit to regulate in a closed loop manner the
41 output voltage or current of the receiver rectifier circuit during the
42 charging or powering of the portable device.

1 39. (Previously Presented) The portable device of claim 38, wherein the
2 communication and control circuit communicates information including one or more codes
3 identifying the manufacturer of the portable device, a unique portable device and/or receiver unit
4 ID, a charge algorithm profile, and a power requirement of the portable device and/or receiver
5 unit.

1 40. (Previously Presented) The portable device of claim 38, further wherein the
2 receiver circuit can additionally receive communication from the base unit via the receiver coil
3 inductively from the primary coil for bi-directional communication.

1 41. (Previously Presented) The portable device of claim 38, further including an
2 output disconnect switch under the control of the receiver communication and control circuit to
3 disconnect the battery from the receiver rectifier circuit output.

1 42. (Previously Presented) The portable device of claim 38, wherein the receiver coil
2 is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a
3 layer of ferrite material.

1 43. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit communicates an end of charge message to terminate power transfer from the base unit
3 upon the battery reaching a desired charged state.

1 44. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit further comprises a regulator or charge management circuit, coupled to the output of the
3 receiver rectifier circuit, that regulates or controls an output voltage or output current provided to
4 the battery, to ensure proper charging of the battery.

1 45. (Previously Presented) The portable device of claim 38, further comprising a
2 base unit circuit to enable the portable device to operate as an inductive charger or power supply
3 using the receiver coil of the portable device to inductively charge or power another portable
4 device including a battery which is capable of receiving power inductively.

1 46. (Previously Presented) The portable device of claim 38, whereby the receiver coil
2 and/or receiver circuit further comprises a near-field communication (NFC) antenna and/or
3 circuit.

1 47. (Currently Amended) The system of claim 19, further comprising a metallic layer
2 designed to remove heat from the ~~charger coil~~ one or more primary coils during power transfer.

1 48. (Previously Presented) The system of claim 19, further comprising a fan designed
2 to remove heat from the system during power transfer.

1 49. (Currently Amended) The system of claim 19, further comprising 2 or more arc
2 shaped permanent magnet components that are attached or placed surrounding at least one of the
3 ~~charger coil or the receiver coils~~ one or more primary coils in a circular pattern and concentric
4 with the ~~charger coils or the receiver coils~~ at least one of the one or more primary coils to assist
5 the user in alignment of the ~~charger coils~~ at least one of the one or more primary coils with the
6 receiver coils during inductive power transfer.

1 50. (Currently Amended) The portable device of claim 38, further comprising a fan
2 designed to remove heat from the ~~system~~ portable device during power transfer.

1 51. (Currently Amended) The portable device of claim 38, further comprising 2 or
2 more arc shaped permanent magnet components that are attached or placed surrounding the
3 ~~charger coil or the receiver~~ [[coils]] coil in a circular pattern and concentric with the ~~charger~~
4 ~~coils or the receiver~~ [[coils]] coil to assist the user in alignment of the ~~charger coils~~ one or more
5 primary coils with the receiver [[coils]] coil during inductive power transfer.

REMARKS

Claims 19-47 are allowed.

Claims 48-49 were objected to in the preceding *ex parte Quayle* action.

Claims 50 and 51 were added Applicant's response to the *ex parte Quayle* action.

Claims 19, 24, 25, 28, 29, 31, 33, 34, 36, 37, 38, 47, and 49-51 have been amended for clarity.

The issue fee has not been paid.

37 C.F.R. § 1.312 and MPEP §714.16 permit an applicant to amend an application after allowance and before payment of the issue fee (unless the amendment is required by the Office of Data Management). The MPEP §714.16 states that "where amendments of the type noted [below] are shown (A) to be needed for proper disclosure or protection of the invention, and (B) to require no substantial amount of additional work on the part of the Office, they may be considered and, if proper, entry may be recommended by the primary examiner." Types of amendments permitted under 37 C.F.R. § 1.312:

- (A) an amendment to the specification,
- (B) a change in the drawings,
- (C) an amendment to the claims,
- (D) a change in the inventorship,
- (E) the submission of prior art,
- (F) a petition to correct the spelling of an inventor's name,
- (G) a petition to change the order of the names of the inventors, etc.

The amendments requested herein are of the type noted above are shown (i) to be needed for proper disclosure or protection of the invention, and (ii) to require no substantial amount of additional work on the part of the Office.

AMENDMENTS TO THE FIGURES

Applicant has submitted replacement sheets for all the Figures to provide better clarity to the Figures. The Replacement Sheets are identical to the Figures as filed with the exception of correction of minor errors as described below:

- **Figure 25.** Figure 25 has been amended to show for clarity the alignment of the coils in the circuit diagram 560, which is consistent with standard transformer depictions and consistent with the other depicted transformer circuits in the *Present Application*.
- **Figures 30-32.** In original Figures 30-32, “Vbat” was truncated to produce “Vba” on one line and “t” directly below “Vba.” Amended Figures 30-32 correct the original figures by replacing “Vba” with “Vbat” and deleting the separated letter “t.”
- **Figure 74.** Figure 74 has been amended to conform with Figure 9 of US Provisional Patent Application No. 61/043, 027 (the ‘027 Provisional). The *Present Application* incorporates the ‘027 Provisional application by reference in as set forth in paragraph 0001 of the *Present Application*. (See the last 6 lines of the *Present Application*, ¶0001. The description of Figure 74 in the *Present Application*, ¶¶0086 and 0538 are identical to the description of Figure 9 of the ‘027 Provisional, ¶¶0015 and 0055. Paragraph 0538 of the originally filed *Present Application* actually retains a reference to “Figure 9” in the description of Figure 74. Thus, Figure 74 of the *Present Application* has been amended to reflect the actual priority Figure 9 of the ‘027 Provisional.

No new matter has been added.

AMENDMENTS TO THE SPECIFICATION

The Specification has amended as follows:

- In Paragraph 0012, the Summary has been amended to add a concluding period.
- Paragraph 0260 has been amended to replace “Henry” with “μH.” Support for the amendment is on page 4 of U.S. Provisional Patent Application No. 61/012/924 (the “’924 Provisional”), which is incorporated by reference by the *Present Application* as indicated on p. 2, first paragraph, last 9 sentences of the *Present Application*. Page 4 of the ’924 Provisional references Figure 1, and paragraph 0260 of the *Present Application* references Figure 25. Figure 1 of the ’924 Provisional is identical to Figure 25 of the *Present Application*. The description of the ’924 Provisional Figure 1, which corresponds to Figure 25 of the *Present Application*, states:

Figure 1 shows a high level view of a Flyback power supply geometry wherein, during the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred μHenry are typical for 10 's or 100 's of Watts of power supply power. ’924 Provisional, p. 4, ¶2 (emphasis added).

- Paragraph 0264 has been amended to correct an error in the unit of inductance from L=1 H to L=1 μH. Support for the amendment is on page 6 of the ’924 Provisional. Page 6 of the ’924 Provisional provides the exact same formula and sample problem as paragraphs 0263 and 0264 of the *Present Application*. The inductance for the example problem in the ’924 Provisional is L=1 μH. The relevant portion of page 6 of the ’924 Provisional is copied below for convenient reference:

For a spiral coil, the inductance of a coil is given by:

$$L = \frac{r^2 N^2}{(2r + 2.8d) \times 10^5}$$

Where

L = inductance (H)

r = mean radius of coil (m)

N = number of turns

d – depth of coil (outer radius minus inner radius) (m)

For example, for a coil of 10 turns, and outer radius of 15 mm and inner radius of zero, $L = 1 \mu H$. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor. '924 Provisional, p. 6, ¶5 (emphasis added).

- Paragraph 0538 has been amended to correct a Figure reference error from “Fig. 9” to “Fig. 74.”

No new matter has been added.

AMENDMENTS TO THE CLAIMS

Claims 19, 28, 37, 38, 47, and 49-51 have been amended for clarity. Also, the indentation of lines 22-40 of claim 19 has been revised for consistency.

- Claim 19:
 - line 7 has been amended to clarify that the one or more drive circuits include one or more FET drivers, FET switches, and capacitors coupled to the one or more primary coils as shown in, for example, in Fig. 25.
 - line 25 has been amended to clarify that ‘sequential’ switching is not required. See, for example, ¶0261, lines 8-10.
 - lines 32 and 36 have been amended for clarity.
 - line 39 has been amended for clarity.
 - lines 41-43 has been amended for clarity.
 - line 44 has been amended for consistency with amended line 7.
- Claim 24 has been amended for consistency with amended line 25 of claim 1.

- Claim 25 has been amended for clarity.
- Claim 28 has been amended to correct an antecedent basis issue.
- Claim 29 has been amended for clarity.
- Claim 31 has been amended to correct an antecedent basis issue.
- Claim 34 has been amended for clarity.
- Claim 36 has been amended to correct an antecedent basis issue.
- Claim 37 has been amended for grammar and for clarity to remove redundancy.
- Claim 38:
 - lines 23-24 have been amended to reference the antecedent in line 17;
 - line 29 has been amended for grammar to replace the semi-colon with a colon; and
 - lines 31-32 have been amended to correct a grammar and an antecedent basis issue.
- Claims 47 and 49-51 have been amended to correct antecedent basis issues and for internal consistency.

CONCLUSION

Applicant respectfully submits that this Supplemental Amendment complies with 37 C.F.R. §1.312 and MPEP §714.16. Accordingly, Applicant respectfully requests entry of the amendments herein. Nonetheless, should any issues remain that might be subject to resolution through a telephone interview, the Examiner is requested to telephone the undersigned at 512-338-9100.

CERTIFICATE OF TRANSMISSION

I hereby certify that on October 5, 2021 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

Kent B. Chambers
Attorney for Applicant(s)
Reg. No. 38,839

SCORE Placeholder Sheet for IFW Content

Application Number: 16055109

Document Date: 10/05/2021

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

133328 7590 10/01/2021
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

EXAMINER	
ZHOU, ZIXUAN	
ART UNIT	PAPER NUMBER

2859

DATE MAILED: 10/01/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571

TITLE OF INVENTION: EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	01/03/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

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Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
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Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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133328 7590 10/01/2021
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571

TITLE OF INVENTION: EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	01/03/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
ZHOU, ZIXUAN	2859	320-108000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	10/01/2021	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074			ART UNIT	
Oakland, CA 94610			PAPER NUMBER	
			2859	
DATE MAILED: 10/01/2021				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/055,109	Applicant(s) Partovi et al.	
	Examiner ZIXUAN ZHOU	Art Unit 2859	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 09/20/2021.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 19-51. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some* c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____. 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.

/ZIXUAN ZHOU/
Primary Examiner, Art Unit 2859

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Priority

This application discloses and claims only subject matter disclosed in prior application no 12/116,876 (US Patent 8,169,185), filed 05/07/2008, and names the inventor or at least one joint inventor named in the prior application. Accordingly, this application may constitute a continuation or division. Should applicant desire to claim the benefit of the filing date of the prior application, attention is directed to 35 U.S.C. 120, 37 CFR 1.78, and MPEP § 211 *et seq.*

Allowable Subject Matter

Claims 19-51 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 19, the prior art fails to teach or suggest further inclusion of the system comprising: wherein the one or more communication and control circuits is able to operate the one or more drive circuits near a first resonant frequency of a circuit formed by a primary coil and a drive circuit and a receiver coil and a receiver circuit of a compatible portable device when nearby; determine the one or more primary coils electromagnetically most aligned with the one or more receiver coils; drive FET switches associated with those most aligned one or more primary coils; periodically receive information corresponding to one or more output voltages or currents of the one

or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

The dependent claims are allowable for the reasons as the independent claims from which they depend.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ZIXUAN ZHOU whose telephone number is (571)272-6739. The examiner can normally be reached on 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew A Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ZIXUAN ZHOU/
Primary Examiner, Art Unit 2859
09/27/2021

Issue Classification 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CPC						
Symbol					Type	Version
H02J	/	50	/	10	F	2016-02-01
G06F	/	1	/	1683	I	2013-01-01
H02J	/	7	/	025	I	2020-01-01
H02J	/	50	/	05	I	2016-02-01
H02J	/	50	/	402	I	2020-01-01

CPC Combination Sets					
Symbol				Type	Version
	/		/		

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 33	
/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859 (Primary Examiner) _____ (Date) 27 September 2021		O.G. Print Claim(s) 1	O.G. Print Figure 1

<i>Issue Classification</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H02J	/	7	/ 00
NON-CLAIMED			
/	/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
320	108

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
307	104					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	33	
/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	27 September 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

☐ Claims renumbered in the same order as presented by applicant
 ☐ CPA
 ☐ T.D.
 ☐ R.1.47

CLAIMS															
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-	2	-	11	2	20	11	29	23	38	20	47				
-	3	-	12	3	21	12	30	24	39	21	48				
-	4	-	13	4	22	13	31	25	40	22	49				
-	5	-	14	5	23	14	32	26	41	32	50				
-	6	-	15	6	24	15	33	27	42	33	51				
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-	9	-	18	9	27	18	36	30	45						

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 33	
/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859 (Primary Examiner) _____ (Date) 27 September 2021		O.G. Print Claim(s) 1	O.G. Print Figure 1

<i>Index of Claims</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
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<i>Index of Claims</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CLAIM		DATE								
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21	48			O	=					
22	49			O	=					
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33	51				=					

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CPC - Searched*		
Symbol	Date	Examiner
H02J50/10, H02J50/05, G06F1/1683, H02J7/025	11/04/2019	ZZ
H02J50/10, H02J50/402, G06F1/1683, H02J7/025, H02J50/05, G06F1/26, G06F1/1635, H02J50/70, H02J50/80, H02J50/90	05/13/2021	ZZ

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	108	11/04/2019	ZZ
307	104	11/04/2019	ZZ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST text search was conducted - - see printout	11/04/2019	ZZ
Inventor and assignee search	11/04/2019	ZZ
CPC and USPC search with text base	11/04/2019	ZZ
Updated EAST text search was conducted - - see printout	12/15/2020	ZZ
Updated EAST text search was conducted - - see printout	05/13/2021	ZZ
Updated EAST text search was conducted - - see printout	09/27/2021	ZZ

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	US PG Pub interference search was conducted	09/27/2021	ZZ

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

PE2E SEARCH - Search History (Prior Art)

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L3	12	L1 and L2	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2019/11/01 02:43 PM
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L39	115648	(H02J50/10 or H02J50/402 or G06F1/1683 or H02J7/025 or H02J50/05 or G06F1/26 or G06F1/1635 or H02J50/70 or H02J50/80 or H02J50/90).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 02:59 PM
L40	5326	320/108.ccls.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/05/05 02:59 PM
L41	8239	307/104.ccls.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/05/05 02:59 PM
L42	119754	L39 or L40 or L41	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 02:59 PM
L43	782	(receiv\$3 secondary) with (ferrite) with (shield\$3)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 03:52 PM
L44	396	L42 and L43	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 03:55 PM
L45	9408	(ferrite) with (shield\$3)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 03:58 PM
L46	18941	(ferrite ferromagnet\$3) with (shield\$3)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 03:59 PM
L47	1704401	(resonant resonance resonator)	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	ON	2021/05/05 03:59 PM

L48	4334	L46 and L47	JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 03:59 PM
L49	14341	(rectif\$3 rectify\$3 rectification) and (modulat\$3 with (impedance resistance))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 04:01 PM
L50	133	L48 and L49	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 04:01 PM
L51	107	L42 and L50	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/05 04:01 PM
L56	209	("20020004167" "20020 067238" "20020089305 " "20020093309" "2003 0094921" "2003010303 9" "20030210106" "200 30214255" "200401135 89" "20040130915" "20 040130916" "20040145 342" "20040145343" "2 0040150934" "2004022 2751" "20040232845" " 20050007067" "200500 17677" "20050063488" " "20050075696" "20050 093475" "20050116650 " "20050116683" "2005 0122058" "2005012205 9" "20050127849" "200 50127850" "200501278 67" "20050127869" "20 050135122" "20050140 482" "20050162125" "2 0050189910" "2006002 1926" "20060038794" " 20060105718" "200601 06965" "20060108977" " "20060132045" "20060 146517" "20060202665 " "20060205381" "2006 0238930" "2006028459 3" "20070029965" "200 70069687" "200701097 08" "20070139000" "20 070178945" "20070182 367" "20070236174" "2 0070279002" "2007029 6393" "20080014897" " 20080067874" "200801	(US-PGPUB; USPAT)	OR	ON	ON	2021/05/18 09:34 AM

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L58	466	("2009/0284227").URP N.	(USPAT)	OR	ON	ON	2021/05/18 09:40 AM
L59	18981	(ferrite ferromagnet\$3) with (shield\$3)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:42 AM
L60	1707388	(resonant resonance resonator)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:42 AM
L61	4353	L59 and L60	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:42 AM
L62	14367	(rectif\$3 rectify\$3 rectification) and (modulat\$3 with (impedance resistance))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:42 AM
L63	135	L61 and L62	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:42 AM

L64	4353	L59 and L60	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:44 AM
L65	115934	(H02J50/10 or H02J50/402 or G06F1/1683 or H02J7/025 or H02J50/05 or G06F1/26 or G06F1/1635 or H02J50/70 or H02J50/80 or H02J50/90).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/05/18 09:45 AM
L66	5325	320/108.ccls.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/05/18 09:45 AM
L67	8238	307/104.ccls.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/05/18 09:45 AM
L68	1185	(L65 or L66 or L67) and L64	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 09:45 AM
L69	27967	((dut\$3 near3 cycle) OR (duty near3 ratio)) WITH (chang\$3 OR adjust\$3 OR alter\$3 OR alternat\$3) WITH (frequency) WITH (current OR voltage OR power OR energy) WITH (output\$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/27 03:45 PM
L70	461351	(modulat\$3 OR PWM) WITH (current OR voltage) WITH (sens\$3 OR detect\$3 OR measur\$3 OR monitor\$3)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/27 03:49 PM
L71	7233	L69 AND L70	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/27 03:51 PM

L72	266	(L65 OR L66 OR L67) AND L71	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/27 03:51 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N52	571	((rectif\$3 rectify\$3 rectification) and (modulat\$3 with (impedance resistance))).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2021/05/05 04:02 PM
N56	16855	((modulat\$3 OR PWM) WITH (current OR voltage) WITH (sens\$3 OR detect\$3 OR measur\$3 OR monitor\$3)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/27 03:52 PM
N57	521	((duty\$3 near3 cycle) OR (duty near3 ratio)) WITH (chang\$3 OR adjust\$3 OR alter\$3 OR alternat\$3) WITH (frequency) WITH (current OR voltage OR power OR energy) WITH (output\$4)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/27 03:52 PM



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :67620

Sale Accounting Date:09/22/2021

Sale Item Reference Number
16055109

Effective Date
09/20/2021

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20219LM29023144	2202	CLAIMS IN EXCESS OF 20	\$200.00	Deposit Account

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)		Docket Number (Optional) AFPA-01013US6
Application Number 16/055109	Filed 2018-08-05	
For Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Art Unit 2859	Examiner Zixuan Zhou	

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	<u>Fee</u>	<u>Small Entity Fee</u>	<u>Micro Entity Fee</u>	
☒ One month (37 CFR 1.17(a)(1))	\$220	\$110	\$55	\$ <u>220</u>
☐ Two months (37 CFR 1.17(a)(2))	\$640	\$320	\$160	\$ _____
☐ Three months (37 CFR 1.17(a)(3))	\$1,480	\$740	\$370	\$ _____
☐ Four months (37 CFR 1.17(a)(4))	\$2,320	\$1,160	\$580	\$ _____
☐ Five months (37 CFR 1.17(a)(5))	\$3,160	\$1,580	\$790	\$ _____

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to
Deposit Account Number 502264.

☒ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☒ attorney or agent of record. Registration number 38,839.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Kent B. Chambers/ September 20, 2021

Signature Date

Kent B. Chambers 512.338.9100

Typed or printed name Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☒ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		16055109		
Filing Date:		05-Aug-2018		
Title of Invention:		EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
First Named Inventor/Applicant Name:		Afshin Partovi		
Filer:		Kent Bryan Chambers/Celeste Scarborough		
Attorney Docket Number:		AFPA-01013US6		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	2202	2	50	100
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Extension - 1 month with \$0 paid	2251	1	110	110
Miscellaneous:				
Total in USD (\$)				210

Electronic Acknowledgement Receipt

EFS ID:	43814362
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Kent Bryan Chambers/Celeste Scarborough
Filer Authorized By:	Kent Bryan Chambers
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	20-SEP-2021
Filing Date:	05-AUG-2018
Time Stamp:	19:00:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$210
RAM confirmation Number	E20219JJ01251234
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response after Ex Parte Quayle Action	AFPA-01013US_Res_Ex-Parte-Quayle_2021-09-17.pdf	440170	no	19
			3b0790f16440ce1d01cdc1e2a2e62b8c942b87d3		
Warnings:					
Information:					
2	Extension of Time	AFPA-01013US_Extension.pdf	172946	no	2
			a08e5d7f1958439ffe3dc0ca2e784209b4418d9b		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	41111	no	2
			4937ad9c3de314e2e53135805a51cf6fc0dba7fa		
Warnings:					
Information:					
Total Files Size (in bytes):			654227		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

AMENDMENTS TO THE CLAIMS

1-18. (Canceled)

1 19. (Currently Amended) A system for inductive powering or charging of portable
2 devices, the system comprising:
3 one or more primary coils that are substantially planar and parallel to a surface of the
4 system for powering or charging compatible portable devices including batteries
5 and receiver units, each receiver unit including a receiver coil and a receiver
6 circuit including a receiver rectifier circuit;
7 one or more drive circuits including FET drivers, FET switches, and capacitors coupled
8 to the one or more primary coils that when operated apply an alternating electrical
9 current to the one or more primary coils to generate a magnetic field in a direction
10 substantially perpendicular to the plane of the one or more primary coils and the
11 surface of the system to provide power to the one or more portable devices
12 capable of being powered or charged by the system when present and near the one
13 or more primary coils;
14 one or more sense circuits to monitor the current through the one or more primary coils to
15 sense communications from the one or more receiver coils; and
16 one or more communication and control circuits including one or more microcontrollers
17 coupled to the one or more drive circuits and the one or more sense circuits that
18 detect ~~communications~~ communications through the one or more sense circuits via
19 the one or more primary coils and control the one or more drive circuits to control
20 the charging process;
21 wherein the one or more communication and control circuits:
22 operate the one or more drive circuits near a first resonant frequency of a circuit formed
23 by a primary coil and a drive circuit and a receiver coil and a receiver circuit of a
24 compatible portable ~~devices~~ device when nearby;
25 sequentially switch the one or more primary coils at a frequency and power
26 level sufficient to transfer power to one or more of the receiver units
27 when near the one or more primary coils for a sufficiently long period of

time to activate the one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents; detect through the one or more sense circuits communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils, and information associated with the one or more portable devices and/or receiver units to enable the base unit to identify the one or more portable devices and/or receiver units and to determine any appropriate charging or powering algorithm profiles therefor; determine the one or more primary coils electromagnetically most aligned with the one or more receiver coils; drive FET switches associated with those most aligned one or more primary coils; periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices.

20. (Previously Presented) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

21. (Previously Presented) The system of claim 19, wherein the one or more drive circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage Switching or Zero Current Switching mode during inductive power transfer to a portable device.

1 22. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits are designed to receive from a receiver unit of a portable
3 device identification information including one or more codes identifying the manufacturer of
4 the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a
5 charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

1 23. (Previously Presented) The system of claim 19, wherein the system comprises
2 more than one primary coil which are of different sizes and functions and provide different
3 power levels to portable devices with different power requirements.

1 24. (Previously Presented) The system of claim 19, further wherein the one or more
2 communication and control circuits, prior to activating the one or more receivers for
3 communication and further identification, sequentially drive each primary coil for a short period
4 of time near a nominal second resonant frequency of each primary coil and associated capacitor
5 without a receiver coil present, and the one or more sense circuits monitor the current through
6 the primary coil to detect a higher than a baseline current draw to indicate potential portable
7 devices or metallic objects near the primary coil for further investigation.

1 25. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils are arrayed in multiple layers such that any location on the effective charger area of the
3 surface of the system is located at a distance equal to or less than half a radius or half a side-to-
4 center length of at least one coil.

1 26. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits use encryption for at least a portion of the communication
3 with a portable device for powering or charging for security.

1 27. (Previously Presented) The system of claim 19, wherein the one or more
2 communication and control circuits can provide bi-directional digital communication between
3 the one or more primary coils and the receiver coils for a verification process to ensure that a
4 receiver unit that can be charged or powered by the system is present and to determine the
5 voltage or power requirements of the receiver unit.

1 28. (Previously Presented) The system of claim 19, further comprising a $1 \times N$ switch,
2 wherein N primary coils of the system share a common drive circuit and a common sense circuit
3 that are switched by the one or more communication and control circuits to connect the common
4 drive circuit and the common sense circuit to the N primary coils by one or more $1 \times N$ switches
5 where the number N is equal or greater than 2.

1 29. (Previously Presented) The system of claim 19, wherein the one or more primary
2 coils are constructed of Printed Circuit Boards comprising multiple layers connected by vias.

1 30. (Previously Presented) The system of claim 19, wherein the system is
2 incorporated into a portable device or battery pack comprising an internal rechargeable battery
3 that can be periodically recharged and can operate the system for inductive charging or powering
4 for a period of time.

1 31. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more of the primary coils to enable the system and its
3 internal battery to be charged or powered inductively.

1 32. (Previously Presented) The system of claim 30, further comprising one or more
2 receiver unit circuits coupled to one or more coils separate from the one or more primary coils to
3 charge or power the system and its internal battery inductively.

1 33. (Previously Presented) The system of claim 30, wherein the system is
2 incorporated into a battery pack that can be clipped or attached to a portable device to extend its
3 battery run time.

1 34. (Previously Presented) The system of claim 30, wherein the battery pack is
2 incorporated into a case for a portable device.

1 35. (Previously Presented) The system of claim 19, wherein the system further
2 includes a common mode filter circuit at an input.

1 36. (Previously Presented) The system of claim 19, further wherein the one or more
2 communication and control circuits use a Proportional-Integral-Derivative control technique to
3 regulate one or more outputs of the one or more receiver rectification circuits.

1 37. (Previously Presented) The system of claim 19, further comprising an internal
2 data storage system and data communication system such as WiFi or Bluetooth that can establish
3 wireless communication using WiFi or Bluetooth with one or more of the portable devices
4 during charging and upload or download user digital data between the one or more portable
5 devices and the internal data storage system.

1 38. (Previously Presented) A portable device including a battery capable of receiving
2 inductive power from an inductive charging system including a base unit with one or more
3 primary coils and associated circuits, the portable device comprising:

4 a receiver coil which has a substantially planar shape and located parallel to a
5 surface of the portable device so that a magnetic field received from a
6 primary coil in a base unit of an inductive charging system in a direction
7 substantially perpendicular to the plane of the receiver coil is used to
8 inductively generate a current in the receiver coil to power or charge the
9 portable device;

10 a ferrite material layer placed behind the receiver coil and opposite to the surface
11 of the portable device to provide shielding in the portable device from
12 electromagnetic fields;

13 a receiver circuit designed to operate near a resonant frequency of a circuit
14 formed by the receiver coil, the receiver circuit, and a compatible base unit

primary coil and associated circuit when adjacent to the portable device
for inductive powering or charging;
wherein the receiver circuit is part of a receiver unit and comprises:
a receiver rectifier circuit including one or more rectifiers and one or more
capacitors; and
a receiver communication and control circuit including a microcontroller
and a communication FET to modulate the input impedance of the
receiver circuit to communicate with the base unit through the
primary coil;
wherein when a current is generated in the receiver coil inductively by the
primary coil in the base unit, the current is rectified and smoothed
by the one or more capacitors in the receiver rectifier circuit and is
used to power and activate the receiver communication and control
circuit and to power or charge the portable device; and
wherein upon powering and activation of the receiver circuit by a primary
coil in the base unit, the receiver circuit;
communicates information corresponding to a voltage at an output
of the receiver rectifier circuit and information associated
with the one or more portable device and/or receiver unit to
enable the base unit to identify the portable device and/or
receiver unit, to determine any appropriate charging or
powering algorithm therefor, and to identify one or more
primary coils of the base unit most aligned with the
receiver coil for use in charging or powering the portable
device; and
subsequently, periodically communicates information
corresponding to an output voltage or current of the
receiver rectifier circuit to the base unit to enable the base
unit to regulate in a closed loop manner the output voltage
or current of the receiver rectifier circuit during the
charging or powering of the portable device.

1 39. (Previously Presented) The portable device of claim 38, wherein the
2 communication and control circuit communicates information including one or more codes
3 identifying the manufacturer of the portable device, a unique portable device and/or receiver unit
4 ID, a charge algorithm profile, and a power requirement of the portable device and/or receiver
5 unit.

1 40. (Previously Presented) The portable device of claim 38, further wherein the
2 receiver circuit can additionally receive communication from the base unit via the receiver coil
3 inductively from the primary coil for bi-directional communication.

1 41. (Previously Presented) The portable device of claim 38, further including an
2 output disconnect switch under the control of the receiver communication and control circuit to
3 disconnect the battery from the receiver rectifier circuit output.

1 42. (Previously Presented) The portable device of claim 38, wherein the receiver coil
2 is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a
3 layer of ferrite material.

1 43. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit communicates an end of charge message to terminate power transfer from the base unit
3 upon the battery reaching a desired charged state.

1 44. (Previously Presented) The portable device of claim 38, wherein the receiver
2 circuit further comprises a regulator or charge management circuit, coupled to the output of the
3 receiver rectifier circuit, that regulates or controls an output voltage or output current provided to
4 the battery, to ensure proper charging of the battery.

1 45. (Previously Presented) The portable device of claim 38, further comprising a
2 base unit circuit to enable the portable device to operate as an inductive charger or power supply
3 using the receiver coil of the portable device to inductively charge or power another portable
4 device including a battery which is capable of receiving power inductively.

1 46. (Currently Amended) The portable device of claim 38, whereby the receiver coil
2 and/or receiver circuit further comprises a near-field communication (NFC) antenna and/or
3 circuit.

1 47. (Previously Presented) The system of claim 19, further comprising a metallic
2 layer designed to remove heat from the charger coil during power transfer.

1 48. (Currently Amended) The system of claim 19, ~~or 46~~, further comprising a fan
2 designed to remove heat from the system during power transfer.

1 49. (Currently Amended) The ~~charger~~ system of claim 19, ~~or the portable device of~~
2 ~~claim 38~~, further comprising 2 or more arc shaped permanent magnet components that are
3 attached or placed surrounding the charger coils or the receiver coils in a circular pattern and
4 concentric with the charger coils or the receiver coils to assist the user in alignment of the
5 charger coils with the receiver coils during inductive power transfer.

1 50. (New) The portable device of claim 38, further comprising a fan designed to
2 remove heat from the system during power transfer.

1 51. (New) The portable device of claim 38, further comprising 2 or more arc shaped
2 permanent magnet components that are attached or placed surrounding the charger coils or the
3 receiver coils in a circular pattern and concentric with the charger coils or the receiver coils to
4 assist the user in alignment of the charger coils with the receiver coils during inductive power
5 transfer.

REMARKS

Claims 19-47 are allowed.

Claims 48-49 are objected to.

Claims 19-49 are pending.

Claims 19, 46, 48, and 49 have been amended.

- Claim 19 has been amended for clarity to correct minor grammatical errors.
- Claim 46 has been amended for clarity to include the name “near-field communication” for which the initials “NFC” stand. See, the *Present Application*, ¶320.
- Claims 48 and 49 have been amended to eliminate multiple claim dependencies and depend only from claim 19.

Claims 50 and 51 have been added to recite the limitations of claims 48 and 49 and depend only from claim 38.

Priority

The Examiner states:

This application discloses and claims only subject matter disclosed in prior application no 12/116,876, filed 05/07/2008, and names the inventor or at least one joint inventor named in the prior application. Accordingly, this application may constitute a continuation or division. Should applicant desire to claim the benefit of the filing date of the prior application, attention is directed to 35 U.S.C. 120, 37 CFR 1.78, and MPEP §211 *et seq.* *Office Action*, pp. 2-3.

Applicant has included with this response an October 30, 2020 decision by the USPTO's Office of Petitions (Exhibit 1) and the associated revised October 30, 2020 USPTO Filing Receipt (Exhibit 2). In accordance Exhibits 1 and 2, Applicant respectfully submits that the *Present Application* already properly claims priority under 35 USC § 120, 37 C.F.R. § 1.78, and MPEP §211 to U.S. Patent Application No. 12/116,876 as well as to intervening and preceding regular and provisional U.S. Patent Applications as identified in Exhibit 2.

Formal Claim Matters

Per the Examiner's suggestion, claims 48 and 49 have been amended to eliminate multiple dependencies and depend only from claim 19.

New claims 50 and 51 have been added to claim the limitations in respective claims 48 and 49 and depend only from claim 38.

CONCLUSION

Applicant respectfully submits that this Response complies with the requirements set forth in the *ex parte Quayle* action and all pending claims are in condition for allowance. Accordingly, Applicant requests that a Notice of Allowance be issued. Nonetheless, should any issues remain that might be subject to resolution through a telephone interview, the Examiner is requested to telephone the undersigned at 512-338-9100.

CERTIFICATE OF TRANSMISSION

I hereby certify that on September 20, 2021 this correspondence is being transmitted via the U.S. Patent & Trademark Office's electronic filing system.

/Kent B. Chambers/

Respectfully submitted,

/Kent B. Chambers/

Kent B. Chambers
Attorney for Applicant(s)
Reg. No. 38,839



EX PARTE QUAYLE RESPONSE-EXHIBIT 1
UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571

133328 7590 10/30/2020 Mojo Mobility (c/o Louis Wu) PO Box 10074 Oakland, CA 94610	<table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="text-align: center; padding: 5px;">EXAMINER</td></tr><tr><td style="text-align: center; padding: 5px;">ZHOU, ZIXUAN</td></tr></table> <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; text-align: center; padding: 5px;">ART UNIT</td><td style="width: 50%; text-align: center; padding: 5px;">PAPER NUMBER</td></tr><tr><td style="text-align: center; padding: 5px;">2859</td><td></td></tr></table> <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; text-align: center; padding: 5px;">MAIL DATE</td><td style="width: 50%; text-align: center; padding: 5px;">DELIVERY MODE</td></tr><tr><td style="text-align: center; padding: 5px;">10/30/2020</td><td style="text-align: center; padding: 5px;">PAPER</td></tr></table>	EXAMINER	ZHOU, ZIXUAN	ART UNIT	PAPER NUMBER	2859		MAIL DATE	DELIVERY MODE	10/30/2020	PAPER
EXAMINER											
ZHOU, ZIXUAN											
ART UNIT	PAPER NUMBER										
2859											
MAIL DATE	DELIVERY MODE										
10/30/2020	PAPER										

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
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In re Application of :
Partovi et al. :
Application No. 16/055,109 :
Filed: 5 Aug 2018 : **DECISION ON PETITION**
For: EFFICIENCIES AND :
FLEXIBILITIES IN INDUCTIVE :
(WIRELESS) CHARGING :

This is a decision on the constructive petition under 37 CFR 1.78(c) and (e), filed June 2, 2020, to accept an unintentionally delayed claim under 35 U.S.C. 119(e) and 120 for the benefit of priority to the prior-filed applications listed in the concurrently application data sheet (“ADS”).

The petition under 37 CFR 1.78(c) and (e) is **GRANTED**.

A petition for acceptance of a claim for late priority under 37 CFR 1.78(c) and 1.78(e) is only applicable to those applications in which a proper benefit claim is filed after the expiration of the period specified in 37 CFR 1.78(a)(4) and 1.78(d)(3).

The petition under 37 CFR 1.78(c) and 1.78(e) must be accompanied by:

- (1) the reference required by 35 U.S.C. 120 and 119(e) and 37 CFR 1.78(d)(2) and 1.78(a)(3) of the prior-filed application, which must be filed in an Application Data Sheet;
- (2) the petition fee set forth in § 1.17(m); and
- (3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(d)(3) and 1.78(a)(4) and the date the claim was filed was unintentional. The Director may require additional where there is a question whether the delay was unintentional.

A nonprovisional application in the priority chain claiming the benefit of each prior-filed provisional application must have been filed within twelve months of the filing dates of the prior-filed provisional applications.

The statement of unintentional delay presented in the petition is being construed as the required statement: The entire delay between the date the claim was due under 37 CFR 1.78(d)(3) and 1.78(a)(4) and the date the claim was filed was unintentional.

All the above requirements having been satisfied, the late claim for benefit of priority under 35 U.S.C. 120 and 119(e) is accepted as being unintentionally delayed.

Petitioner is advised that this decision grants the petition to accept the unintentionally delayed domestic benefit claim to the prior filed applications because the petition requirements of 37 CFR 1.78(c) and (e) and the formal requirements for claiming domestic benefit (see MPEP 211.01 et. seq.) have been met. This acceptance should not be construed as meaning that this application is entitled to the benefit of the prior-filed applications. Whether a claimed invention in a nonprovisional application is entitled to the benefit of the filing date of a prior-filed application on the basis of the disclosure thereof is determined during examination if it becomes necessary to do so (e.g., intervening reference and interference proceeding). See MPEP 211.05.

A corrected Filing Receipt, which includes the priority claim to the prior-filed applications, accompanies this decision on petition.

Any questions concerning this decision may be directed to the undersigned at (571) 272-3230.

This application is being referred to Technology Center G.A.U. 2859 for the examiner of record's consideration of the claim under 35 U.S.C. 120 and 119(e) of the prior-filed nonprovisional and provisional applications.

/SHIRENE W BRANTLEY/
Attorney Advisor, OPET

Enclosure: Corrected Filing Receipt

EX PARTE QUAYLE RESPONSE-EXHIBIT 2



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/055,109	08/05/2018	2859	985	AFPA-01013US6	18	2

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

CONFIRMATION NO. 7571
CORRECTED FILING RECEIPT



Date Mailed: 10/30/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Afshin Partovi, Palo Alto, CA;
Michael Sears, Ben Lomond, CA;

Applicant(s)

Mojo Mobility, Inc., Santa Clara, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/463,252 03/20/2017 PAT 10044229
which is a CON of 15/056,689 02/29/2016 PAT 9601943
which is a CON of 14/608,052 01/28/2015 PAT 9276437
which is a CON of 13/708,548 12/07/2012 PAT 8947047
which is a CON of 13/442,698 04/09/2012 PAT 8629654
which is a CON of 12/116,876 05/07/2008 PAT 8169185
which is a CIP of 11/669,113 01/30/2007 PAT 7952322
which claims benefit of 60/763,816 01/31/2006
and claims benefit of 60/810,262 06/01/2006
and claims benefit of 60/810,298 06/01/2006
and claims benefit of 60/868,674 12/05/2006
and said 12/116,876 05/07/2008
claims benefit of 60/916,748 05/08/2007
and claims benefit of 60/952,835 07/30/2007
and claims benefit of 61/012,922 12/12/2007

and claims benefit of 61/012,924 12/12/2007
and claims benefit of 61/015,606 12/20/2007
and claims benefit of 61/043,027 04/07/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/22/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/055,109**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application

page 2 of 4

serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Afshin Partovi, Michael Sears		
Applicant:	Mojo Mobility, Inc.		
Title:	Efficiencies and Flexibilities in Inductive (Wireless) Charging		
Application No.:	16/055,109	Filed:	August 5, 2018
Confirmation No.	7571		
Examiner:	Zixuan Zhou	Group Art Unit:	2859
Docket No.:	AFPA-01013US6	Customer No.:	33438

ELECTRONICALLY FILED

Austin, Texas
September 20, 2021

RESPONSE TO EX PARTE QUAYLE ACTION

This paper is responsive to the *ex parte Quayle* Office Action dated May 19, 2021. Page 1 of the Office Action sets a shortened statutory period for reply is set to expire three (3) months from May 19, 2021, which is August 19, 2021. Accordingly, accompanying this Response is a petition under 37 C.F.R. § 1.136 for extension of time by 1 month, setting a new time for response of September 20, 2021 (September 19, 2021 being a Sunday). Further examination and reconsideration are respectfully requested.

CONTINGENT PETITION FOR EXTENSION OF TIME

Note, the body of the *Office Action* on page 4 states that the shortened statutory period expires two (2) months from May 19, 2021, which is inconsistent with the time period set forth in the official Office Action Summary. In the event that the USPTO resolves the inconsistency in favor of a 2 month shortened statutory period, Applicant hereby petitions for a 2 month extension of time and also authorizes the USPTO to charge any underpayment of fees to Deposit Account No. 502264.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/055,109		Filing Date 08/05/2018		☐ To be Mailed			
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO											
APPLICATION AS FILED - PART I											
		(Column 1)		(Column 2)							
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *				x \$50 =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$230 =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))											
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL					
APPLICATION AS AMENDED - PART II											
		(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	09/20/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 33	Minus	** 27	= 6			x \$50 =		300	
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0			x \$240 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE		300	
		(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=			x \$0 =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=			x \$0 =			
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/DORIAN EVANS/			
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".											
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.											

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	05/19/2021	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074				
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			05/19/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary**Application No.**

16/055,109

Applicant(s)

Partovi et al.

Examiner

ZIXUAN ZHOU

Art Unit

2859

AIA (FITF) Status

No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 04/29/2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**.

2b) ☐ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 19-49 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☒ Claim(s) 19-47 is/are allowed.

7) ☐ Claim(s) ____ is/are rejected.

8) ☒ Claim(s) 48-49 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date 04/29/2021, 04/29/2021, 04/29/2021.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/22/2021 has been entered.

Response to Amendment

The supplemental amendment filed on 04/26/2021 has been entered. Claims 1-18 have been cancelled. Claims 19-49 have been newly added. Therefore, claims 19-49 remain pending in this application.

Priority

This application discloses and claims only subject matter disclosed in prior application no 12/116,876, filed 05/07/2008, and names the inventor or at least one joint inventor named in the prior application. Accordingly, this application may constitute a continuation or division. Should applicant desire to claim the benefit of the filing date of

the prior application, attention is directed to 35 U.S.C. 120, 37 CFR 1.78, and MPEP § 211 *et seq.*

Information Disclosure Statement

The information disclosure statement (IDS) submitted on are 04/29/2021, 04/29/2021 and 04/29/2021 in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

Claims 19-47 are allowed.

Conclusion

This application is in condition for allowance except for the following formal matters:

In claim 48, line 1, the Office suggests Applicant to delete the phrase "**or 46**," and further incorporate claim 50 as shown below:

50. The portable device of claim 46, further comprising a fan designed to remove heat from the system during power transfer.

In claim 49, line 1, the Office suggest Applicant to delete the phrase "The charger system" and replace with "The system".

Further, the Office suggest Applicant to delete the phrase "**or the portable device of claims 38**," and further incorporate claim 51 as shown below:

51. The portable device of claim 38, further comprising 2 or more arc shaped permanent magnet components that are attached or placed surrounding the charger coils or the receiver coils in a circular pattern and concentric with the charger coils or the receiver coils to assist the user in alignment of the charger coils with the receiver coils during inductive power transfer.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hsu (US Pub 2006/0202665)

Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 25 USPQ 74, 453 O.G. 213, (Comm'r Pat. 1935).

A shortened statutory period for reply to this action is set to expire **TWO (2) MONTHS** from the mailing date of this letter. Extensions of time may be granted under 37 CFR 1.136 but in no case can any extension carry the date for reply to this Office action beyond the maximum period of SIX MONTHS set by statute (35 U.S.C. 133).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ZIXUAN ZHOU whose telephone number is (571)272-6739. The examiner can normally be reached on 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew A Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ZIXUAN ZHOU/
Primary Examiner, Art Unit 2859
05/13/2021

<i>Notice of References Cited</i>	Application/Control No. 16/055,109		Applicant(s)/Patent Under Reexamination Partovi et al.	
	Examiner ZIXUAN ZHOU		Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20060202665-A1	09-2006	Hsu; Feng-Hsiung	H02J50/40	320/139
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Index of Claims</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	11/04/2019	12/15/2020	05/13/2021						
	1	✓	✓	-						
	2	✓	✓	-						
	3	✓	✓	-						
	4	✓	✓	-						
	5	✓	✓	-						
	6	✓	✓	-						
	7	✓	✓	-						
	8	✓	✓	-						
	9	✓	✓	-						
	10	✓	✓	-						
	11	✓	✓	-						
	12	✓	✓	-						
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	14	✓	✓	-						
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	42			=						

<i>Index of Claims</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CLAIM		DATE								
Final	Original	11/04/2019	12/15/2020	05/13/2021						
	43			=						
	44			=						
	45			=						
	46			=						
	47			=						
	48			O						
	49			O						

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CPC - Searched*		
Symbol	Date	Examiner
H02J50/10, H02J50/05, G06F1/1683, H02J7/025	11/04/2019	ZZ
H02J50/10, H02J50/402, G06F1/1683, H02J7/025, H02J50/05, G06F1/26, G06F1/1635, H02J50/70, H02J50/80, H02J50/90	05/13/2021	ZZ

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	108	11/04/2019	ZZ
307	104	11/04/2019	ZZ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST text search was conducted - - see printout	11/04/2019	ZZ
Inventor and assignee search	11/04/2019	ZZ
CPC and USPC search with text base	11/04/2019	ZZ
Updated EAST text search was conducted - - see printout	12/15/2020	ZZ
Updated EAST text search was conducted - - see printout	05/13/2021	ZZ

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number	16055109
Filing Date	2019-08-05
First Named Inventor	Afshin PARTOVI
Art Unit	2859
Examiner Name	ZHOU, ZIHUAN
Attorney Docket Number	AFPA-01013US6

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7554316		2009-06-30	Stevens	
	2	7151357		2006-12-19	Xian	
	3	6803774		2004-10-12	Park	
	4	8169185		2012-05-01	Partovi	
	5	5925814		1999-07-20	Tsuzuki	
	6	5744933		1998-04-28	Inoue	
	7	4800328		1989-01-24	Bolger	
	8	7151357		2006-12-19	Xian	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16055109
Filing Date		2019-08-05
First Named Inventor	Afshin PARTOVI	
Art Unit		2859
Examiner Name	ZHOU, ZIHUAN	
Attorney Docket Number		AFPA-01013US6

9	5434493		1995-07-18	Woody	
10	7336054		2005-03-09	Crisp	
11	7211986		2007-05-01	Flowerdew	
12	6803744		2004-10-12	Sabo	
13	6844702		2005-01-28	Giannopoulos	
14	4311953		1982-01-19	Fukuda	
15	4800328		1989-01-24	Bolger	
16	7952322		2011-05-31	Partovi	
17	7948208		2011-05-24	Partovi	
18	7443135		2008-10-28	Cho	
19	7915858		2011-03-29	Liu	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
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STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16055109
Filing Date	2019-08-05
First Named Inventor	Afshin Partovi
Art Unit	2859
Examiner Name	ZHOU, ZIHUAN
Attorney Docket Number	AFPA-01013US6

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Art Unit	2859
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Attorney Docket Number	AFPA-01013US6

50	PCT International Preliminary Report on Patentability dated 10 November 2011 in re International Application No. PCT/US2010/032845, 7 pages.

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EXAMINER SIGNATURE

Examiner Signature	/ZIXUAN ZHOU/	Date Considered	05/05/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

EAST Search History

EAST Search History (Prior Art)

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S46	18,941	(ferrite ferromagnet\$3) with (shield\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 15:59
S47	1,704,401	(resonant resonance resonator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 15:59
S48	4,334	S46 and S47	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 15:59
S49	14,341	(rectif\$3 rectify\$3 rectification) and (modulat\$3 with (impedance resistance))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 16:01
S50	133	S48 and S49	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 16:01
S51	107	S42 and S50	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/05 16:01

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Art Unit	2859
Examiner Name	ZHOU, ZIHUAN
Attorney Docket Number	AFPA-01013US6

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Louis Wu/	Date (YYYY-MM-DD)	2021-04-29
Name/Print	Louis Wu	Registration Number	44413

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16055109
	Filing Date	2019-08-05
	First Named Inventor	Afshin Partovi
	Art Unit	2859
	Examiner Name	ZHOU, ZIHUAN
	Attorney Docket Number	AFPA-01013US6

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Application Number	16055109
Filing Date	2019-08-05
First Named Inventor	Afshin Partovi
Art Unit	2859
Examiner Name	ZHOU, ZIHUAN
Attorney Docket Number	AFPA-01013US6

1	Office Action in connection with Application No. 13/115,811 dated March 28, 2013, 13 pages.
2	Office Action in connection with Application No. 13/708,520 dated May 24, 2013, 7 pages.
3	Office Action in connection with Application No. 13/158, 134 dated June 12, 2013, 15 pages.
4	Office Action in connection with Application No. 13/709,983 dated June 7, 2013, 7 pages.
5	Office Action in connection with Application No. 13/710,017 dated June 11, 2013, 7 pages.
6	Office Action in connection with Application No. 13/710,062 dated June 7, 2013, 7 pages.
7	Office Action in connection with Japanese Application JP/2010-507666 (Japanese National Stage application of PCT/US2008/063084) dated December 3, 2012, 4 pages.
8	Office Action in connection with Application No. 12/769,586 dated December 13, 2012, 19 pages.
9	International Search Report and Written Opinion of the International Searching Authority, Korean Intellectual Property Office, in re International Application No. PCT/US2010/032845 dated December 13, 2010, 10 pages.
10	WildCharge Life unplugged!. http://www.wildcharg.com/4/17/2009 , 2 pages
11	Powermat "the Future of Wireless Power has Arrived", http://www.pwrml.com,4/15/2009 , 2 pages

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12	ecoupled Wireless Power Technology Fulton Innovation, http://www.ecoupled.com , 4/15/2009, 5 pages
13	Qualcomm Products and Services -Wirelss Airlink Technologies, http://www.qualcomm.com/products_services/airlinks , 4/15/2009, 4 pages
14	Office Action in connection with Application No. 11/757,067 dated January 26, 2009, 14 pages.
15	Office Action in connection with Application No. 11/757,067 dated October 19, 2009, 14 pages.
16	Office Action in connection with Application No. 11/757,067 dated May 10, 2010, 15 pages.
17	Office Action in connection with Application No. 13/113,977 dated November 9, 2012, 9 pages.
18	Office Action in connection with Application No. 11/669, 113 dated October 29, 2008, 11 pages.
19	Office Action in connection with Application No. 11/669, 113 dated August 25, 2009, 17 pages.
20	Office Action in connection with Application No. 11/669, 113 dated May 13, 2010, 20 pages.
21	Office Action in connection with Application No. 12/116,876 dated May 2, 2011, 5 pages.
22	Office Action in connection with Application No. 13/442,698 dated September 13, 2012, 6 pages.

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23	PCT International Search Report in connection with PCT application No. PCT/US2008/63084, 8 pages, dated August 8, 2008.
24	PCT International Search Report in connection with PCT application No. PCT/US2007/61406, 8 pages, dated February 14, 2008.
25	United States Patent and Trademark Office, Office Action for U.S. Patent Application No. 13/115, 811, September 23, 2013, 17 pages.
26	United States Patent and Trademark Office, Office Action for U.S. Patent Application No. 13/708,584, September 13, 2013, 16 pages.

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Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Louis Wu/	Date (YYYY-MM-DD)	2021-04-29
Name/Print	Louis Wu	Registration Number	44413

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	42590004
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	29-APR-2021
Filing Date:	05-AUG-2018
Time Stamp:	13:00:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	2021-04-29IDSCommunication.pdf	73765 b3ec77b65fdb15c6b105f9af5c60aecd10cd448e	no	1

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	MasterIDS.pdf	1044662 04fcd92a19a2522c3d5bdf6bab1df40322cb fac7	no	38
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	MasterIDS2.pdf	1038926 6de9335b7cc82fa00c5a3d6e25badcbecfab 8445	no	15
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4	Information Disclosure Statement (IDS) Form (SB08)	MasterIDS3.pdf	1035516 6e279fcb66e652e2910d9c9ce4ca28adeb2 8fda4	no	6
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Total Files Size (in bytes):			3192869		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

COMMUNICATION REGARDING INFORMATION DISCLOSURE STATEMENTS

Submitted via EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant hereby submits a number of information disclosure statements (IDS) for the Examiner's review. The references contained in the IDS correspond to a number of IDS found in a co-owned case of the subject application, U.S. Patent Application Serial No. 14/252,627, issued December 5, 2017 as U.S. Patent No. 9,837,846 to Partovi (hereinafter the '846 Partovi Patent). All foreign and nonpatent literature associated with the IDS submitted hereby are contained in the file history of the '846 Partovi Patent.

Should the Examiner have any questions concerning this communication and the accompanying IDS, he is welcome to telephone the undersigned.

No fee is believed due. Should additional fees be required, e.g., the fee set forth in 37 CFR 1.17 (p), the USPTO is authorized to debit the additional fees from Deposit Account 506896. Before such a debit is made, however, Applicant's representative requests a courtesy phone call as to the USPTO's intent to make such a debit so that Applicant's representative may ensure that sufficient funds are present in the Deposit Account.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328
(510) 652-2397

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16055109
	Filing Date		2019-08-05
	First Named Inventor	Afshin Partovi	
	Art Unit	2859	
	Examiner Name	ZHOU, ZIHUAN	
	Attorney Docket Number	AFPA-01013US6	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8234189	B2	2012-01-31	Taylor et al.	
	2	8069100	B2	2011-11-29	Taylor et al.	
	3	7733215		2010-06-08	Kozuma	
	4	5311973		1994-05-17	Tseng	
	5	7804054		2010-09-28	Shalom	
	6	4873677		1989-10-10	Sakamoto	
	7	6301128		2001-10-09	Jang	
	8	5600225		1997-02-04	Goto	

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9	5963012		1999-10-05	Garcia	
10	6870089		2005-03-02	Gray	
11	3938018		1976-02-10	Dahl	
12	5991170		1999-11-23	Nagai	
13	5550452		1996-08-27	Shirai	
14	6310465		2001-10-30	Najima	
15	7026789		2006-04-11	Bozzone	
16	7399202		2008-07-15	Dayan	
17	6184654		2001-02-06	Bachner	
18	7355150		2008-04-08	Baarman	
19	7855529		2010-12-21	Xun Liu	

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20	7872445		2011-01-18	Shu-Yuen Ron Hui	
21	6888438		2005-05-03	Shu-Yuen Ron Hui	
22	6501364		2002-12-31	Shu-Yuen Ron Hui	
23	6913477		2005-07-05	Dayan	
24	4415959		1983-11-15	Vinciarelli	
25	7311526		2007-12-25	Rohrbach	
26	7645143		2010-01-12	Rohrbach	
27	7554316		2009-06-30	Stevens	
28	7605496		2009-10-20	Stevens	
29	7164245		2007-01-16	Chen	
30	8035255		2011-10-11	Kurs	

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31	7825543		2010-11-02	Karalis	
32	7741734		2010-06-22	Joannopoulos	
33	8049370		2011-11-01	Azancot	
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35	8040103		2011-10-18	Hui	
36	7495414		2009-02-24	Hui	
37	5642087		1997-06-24	Crow	
38	4731585		1988-03-15	Fox	
39	7781916		2010-08-24	Boys	
40	8050068		2011-11-01	Hussmann	
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42	D625721		2010-10-19	Ferber	
43	D624316		2010-09-28	Ferber	
44	D611408		2010-03-09	Ferber	
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46	D607879		2010-01-12	Ferber	
47	D603603		2009-11-10	Laine	
48	D636333		2011-04-19	Kulikowski	
49	6906495		2005-06-14	Cheng	
50	5959433		1999-09-28	Rohde	
51	6208115		2001-03-27	Binder	
52	5952814		1999-09-14	Van Lerbergne	

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53	6489745		2002-12-03	Koreis	
54	6331744		2001-12-18	Chen	
55	6040680		2000-03-21	Toya	
56	5734254		1998-03-31	Stephens	
57	6636017		2003-10-21	Zink	
58	6586909		2003-07-01	Trepka	
59	6462509		2002-10-08	Abe	
60	7042196		2006-05-09	Cheng	
61	6184651		2001-02-06	Fernandez	
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64	6756765		2004-06-29	Bruning	
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66	6741064		2004-05-25	Liu	
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STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16055109
Filing Date		2019-08-05
First Named Inventor	Afshin Partovi	
Art Unit	2859	
Examiner Name	ZHOU, ZIHUAN	
Attorney Docket Number	AFPA-01013US6	

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	Examiner Name	ZHOU, ZIHUAN	
	Attorney Docket Number	AFPA-01013US6	

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If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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Art Unit	2859
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Attorney Docket Number	AFPA-01013US6

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Louis Wu/	Date (YYYY-MM-DD)	2021-04-29
Name/Print	Louis Wu	Registration Number	44413

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

SUPPLEMENTAL AMENDMENT PURSUANT TO 37 CFR 1.116

Submitted via EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the final Office Action dated December 21, 2020 and as a follow up to the papers submitted March 22, 2021, Applicant requests entry of the following amendment.

Amendments to the Claims are reflected in the listing of the claims, which begins on page 2 of this document.

Remarks begin on page 9 of this document.

Electronic Acknowledgement Receipt

EFS ID:	42554600
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	26-APR-2021
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Time Stamp:	16:13:36
Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021-04-26SupplementalResponseToFinalOA.pdf	121040 aaffe16cc9847fd4f1f70bf49aff45c8eca0abe6	yes	11

Multipart Description/PDF files in .zip description			
Document Description	Start	End	
Applicant Arguments/Remarks Made in an Amendment	10	11	
Claims	2	9	
Supplemental Response or Supplemental Amendment	1	1	

Warnings:

Information:

Total Files Size (in bytes):	121040

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, the claims 1-18 were examined. Claims 1-18 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Hui (US Pub 2005/0189910) or under pre-AIA 35 USC 103(a) as being unpatentable over Hui.

AMENDMENTS TO THE CLAIMS:

Upon entry of the above amendments, claims 1 to 18 have been cancelled. New claims 19 to 43 has been added/amended in a manner that does not introduce any new matter. Accordingly, entry of the above amendments is proper and requested.

New claims 19 to 43 are now presented/amended to clarify the scope of the invention and to distinguish the inventive subject matter relative to Hui. Support for the various elements in the invention are in FIGS. 3, 10, 11, 20, 28, 34 and 40 and the following sections of the published application:

- General operation and control (see paragraphs [0013], [0117] to [0119], [0188] to [0196] and [0318]);
- Resonance (see paragraphs [0114] and [0132]);
- Rectification circuit and smoothing capacitor (see paragraphs [0091] and [0102]);
- Wake up of receiver circuit and communication through receiver and primary coil (see paragraphs [0279] and [0318]);
- Information transferred between the receiver and base unit (see paragraphs [0106] and [0132]);
- Closed loop regulation (see paragraphs [0279] and [0013]);
- Potential receiver or metallic object detection (see paragraphs [0313] and [0333]);
- PID control (see paragraph [0282]);
- Encryption (see paragraph [0318]);
- Ferrite layer (see paragraph [0143]);
- Multi-layer PCB Coil (see paragraph [0232] and FIG. 18);
- Bi-directional communication (see paragraph [0286, 0319]);

- ZVS or ZCS (see paragraphs [0259] to [0273]);
- 1xN switching multiplex (see paragraph [0341]);
- Common Mode Filter (see FIGS. 10, 26-32, 34, 65);
- Portable device receiving wireless power as well as charging other devices through the same coil (see paragraph [0053]);
- Battery Pack or Wireless charging Case with battery (see FIGS. 62, 63, and 65; see also paragraphs [0494], [0499], [0500], [0502], and [0511]); and
- Charger with Storage, WiFi or Bluetooth (see paragraphs [0494], [0504] to [0506]).

CONCLUSION:

All claims are believed allowable, and a prompt indication to that effect would be much appreciated.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328

LISTING OF THE CLAIMS

This listing of the claims will replace all prior versions and listings of claims in the application:

1-18. (Cancelled)

19. (Currently Amended) A system for inductive powering or charging of portable devices, the system comprising:

one or more primary coils that are substantially planar and parallel to a surface of the system for powering or charging compatible portable devices including batteries and receiver units, each receiver unit including a receiver coil and a receiver circuit including a receiver rectifier circuit;

one or more drive circuits including FET drivers, FET switches, and capacitors coupled to the one or more primary coils that when operated apply an alternating electrical current to the one or more primary coils to generate a magnetic field in a direction substantially perpendicular to the plane of the one or more primary coils and the surface of the system to provide power to the one or more of the portable devices capable of being powered or charged by the system when present and near the one or more primary coils;

one or more sense circuits to monitor the current through the one or more primary coils to sense communications from the one or more receiver coils; and

one or more communication and control circuits including one or more microcontrollers coupled to the one or more drive circuits and the one or more sense circuits that detect ~~communication~~ communications through the one or more sense circuits via the one or more primary coils and control the one or more drive circuits to control the charging process;

wherein the one or more communication and control circuits:

operate the one or more drive circuits near a first resonant frequency of a circuit formed by a primary coil and a drive circuit and a receiver coil and a receiver circuit of ~~one of the~~ a compatible portable devices when nearby;

sequentially switch the one or more primary coils at a frequency and power level sufficient to transfer power to one or more of the receiver units when near the one or more primary coils for a sufficiently long period of time to activate the one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents;

detect through the one or more sense circuits communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils, and information associated with the one or more portable devices and/or receiver units to enable the base unit to identify the one or more portable devices and/or receiver units and to determine any appropriate charging or powering algorithm profiles therefor;

determine the one or more primary coils electromagnetically most aligned with the one or more receiver coils;

drive FET switches associated with those most aligned one or more primary coils;

periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and

regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices-.

20. (New) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

21. (New) The system of claim 19, wherein the one or more drive circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage Switching or Zero Current Switching mode during inductive power transfer to a portable device.

22. (Currently Amended) The system of claim 19, wherein the one or more communication and control circuits are designed to receive from a receiver unit of a portable device identification information including one or more codes identifying the manufacturer of the portable device and/or receiver unit, a unique portable device and/or receiver ID code, a charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

23. (New) The system of claim 19, wherein the system comprises more than one primary coil which are of different sizes and functions and provide different power levels to portable devices with different power requirements.

24. (New) The system of claim 19, further wherein the one or more communication and control circuits, prior to activating the one or more receivers for communication and further identification, sequentially drive each primary coil for a short period of time near a nominal second resonant frequency of each primary coil and associated capacitor without a receiver coil present, and the one or more sense circuits monitor the current through the primary coil to detect a higher than a baseline current draw to indicate potential portable devices or metallic objects near the primary coil for further investigation.

25. (New) The system of claim 19, wherein the one or more primary coils are arrayed in multiple layers such that any location on the effective charger area of the surface of the system is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

26. (Currently Amended) The system of claim 19, wherein the one or more communication and control circuits use encryption for at least a portion of the communication ~~between the system and~~ with a portable device for powering or charging ~~is encrypted for security~~.

27. (Currently Amended) The system of claim 19, wherein the one or more communication and control circuits can provide bi-directional digital communication between the one or more primary coils and the receiver coils for a verification process to ensure that a receiver unit that can be charged or powered by the system is present and to ~~inform the system about~~ determine the voltage or power requirements of the receiver unit.

28. (New) The system of claim 19, further comprising a 1xN switch, wherein N primary coils of the system share a common drive circuit and a common sense circuit that are switched by the one or more communication and control circuits to connect the common drive circuit and the common sense circuit to the N primary coils by one or more 1xN switches where the number N is equal or greater than 2.

29. (New) The system of claim 19, wherein the one or more primary coils are constructed of Printed Circuit Boards comprising multiple layers connected by vias.

30. (New) The system of claim 19, wherein the system is incorporated into a portable device or battery pack comprising an internal rechargeable battery that can be periodically recharged and can operate the system for inductive charging or powering for a period of time.

31. (New) The system of claim 30, further comprising one or more receiver unit circuits coupled to one or more of the primary coils to enable the system and its internal battery to be charged or powered inductively.

32. (New) The system of claim 30, further comprising one or more receiver unit circuits coupled to one or more coils separate from the one or more primary coils to charge or power the system and its internal battery inductively.

33. (New) The system of claim 30, wherein the system is incorporated into a battery pack that can be clipped or attached to a portable device to extend its battery run time.

34. (New) The system of claim 30, wherein the battery pack is incorporated into a case for a portable device.

35. (New) The system of claim 19, wherein the system further includes a common mode filter circuit at an input.

36. (New) The system of claim 19, further wherein the one or more communication and control circuits use a Proportional-Integral-Derivative control technique to regulate one or more outputs of the one or more receiver rectification circuits.

37. (New) The system of claim 19, further comprising an internal data storage system and data communication system such as WiFi or Bluetooth that can establish wireless communication using WiFi or Bluetooth with one or more of the portable devices during charging and upload or download user digital data between the one or more portable devices and the internal data storage system.

38. (Currently Amended) A portable device including a battery capable of receiving inductive power from an inductive charging system including a base unit with one or more primary coils and associated circuits, the portable device comprising:

a receiver coil which has a substantially planar shape and located parallel to a surface of the portable device so that a magnetic field received from a primary coil in a base unit of an inductive charging system in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil to power or charge the portable device;

a ferrite material layer placed behind the receiver coil and opposite to the surface of the portable device to provide shielding in the portable device from electromagnetic fields;

a receiver circuit designed to operate near a resonant frequency of a circuit formed by the receiver coil, the receiver circuit, and a compatible base unit primary coil and associated circuit when adjacent to the portable device for inductive powering or charging;

wherein the receiver circuit is part of a receiver unit and comprises:

a receiver rectifier circuit including one or more rectifiers and one or more capacitors; and

a receiver communication and control circuit including a microcontroller and a communication FET to modulate the input impedance of the receiver circuit to communicate with the base unit through the primary coil;

wherein when a current is generated in the receiver coil inductively by the primary coil in the base unit, the current is rectified and smoothed by the one or more capacitors in the receiver rectifier circuit and is used to power and activate the receiver communication and control circuit and to power or charge the portable device; and

wherein upon powering and activation of the receiver circuit by a primary coil in the base unit, the receiver circuit:

communicates information corresponding to a voltage at an output of the receiver rectifier circuit and information associated with ~~identifying~~ the one or more portable devices and/or receiver units to enable the base unit to identify the portable device and/or receiver unit, to determine any appropriate charging or powering algorithm therefor, and to identify one or more primary coils of the base unit most aligned with the receiver coil for use in charging or powering the portable device; and

subsequently, periodically communicates information corresponding to an output voltage or current of the receiver rectifier circuit to the base unit to enable the base unit to regulate in a closed loop manner the output voltage or current of the receiver rectifier circuit during the charging or powering of the portable device.

39. (Currently Amended) The portable device of claim 38, wherein the communication and control circuit communicates information including one or more codes identifying the manufacturer of the portable device, a unique portable device and/or receiver unit ID ~~code~~, a charge algorithm profile, and a power requirement of the portable device and/or receiver unit.

40. (New) The portable device of claim 38, further wherein the receiver circuit can additionally receive communication from the base unit via the receiver coil inductively from the primary coil for bi-directional communication.

41. (New) The portable device of claim 38, further including an output disconnect switch under the control of the receiver communication and control circuit to disconnect the battery from the receiver rectifier circuit output.

42. (Currently Amended) The portable device of claim 38, wherein the receiver coil is constructed of a Printed Circuit Board comprising multiple layers connected by vias and a layer of ferrite material.

43. (Currently Amended) The portable device of claim 38, wherein the receiver circuit communicates an end of charge ~~message~~code to terminate power transfer from the base unit upon the battery reaching a desired charged state.

44. (New) The portable device of claim 38, wherein the receiver circuit further comprises a regulator or charge management circuit, coupled to the output of the receiver rectifier circuit, that regulates or controls an output voltage or output current provided to the battery, to ensure proper charging of the battery.

45. (New) The portable device of claim 38, further comprising a base unit circuit to enable the portable device to operate as an inductive charger or power supply using the receiver coil of the portable device to inductively charge or power another portable device including a battery which is capable of receiving power inductively.

46. (New) The portable device of claim 38, whereby the receiver coil and/or receiver circuit further comprises NFC antenna and/or circuit.

47. (New) The system of claim 19, further comprising a metallic layer designed to remove heat from the charger coil during power transfer.

48. (New) The system of claim 19, or 46, further comprising a fan designed to remove heat from the system during power transfer.

49. (New) The charger system of claim 19, or the portable device of claim 38, further comprising 2 or more arc shaped permanent magnet components that are attached or placed surrounding the charger coils or the receiver coils in a circular pattern and concentric with the charger coils or the receiver coils to assist the user in alignment of the charger coils with the receiver coils during inductive power transfer.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/055,109		Filing Date 08/05/2018		☐ To be Mailed					
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO													
APPLICATION AS FILED - PART I													
		(Column 1)	(Column 2)										
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)						
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A								
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A		N/A								
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A								
TOTAL CLAIMS (37 CFR 1.16(i))		18 minus 20 =	* 0		x \$50 =		0						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		2 minus 3 =	* 0		x \$230 =		0						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).											
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))													
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL		0					
APPLICATION AS AMENDED - PART II													
		(Column 1)	(Column 2)		(Column 3)								
AMENDMENT	04/26/2021	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)				
	Total (37 CFR 1.16(i))	* 27	Minus	** 27		= 0		x \$50 =		0			
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3		= 0		x \$240 =		0			
	☐ Application Size Fee (37 CFR 1.16(s))												
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
								TOTAL ADD'L FEE		0			
AMENDMENT			(Column 1)	(Column 2)		(Column 3)							
			CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))		*	Minus	**		=		x \$0 =				
	Independent (37 CFR 1.16(h))		*	Minus	***		=		x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))												
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))													
								TOTAL ADD'L FEE		LIE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.													
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/GERALDINE L STANLEY/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".													
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.													

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/055,109		Filing Date 08/05/2018		☐ To be Mailed			
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO											
APPLICATION AS FILED - PART I											
		(Column 1)	(Column 2)								
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)					
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A							
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A	N/A							
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A							
TOTAL CLAIMS (37 CFR 1.16(i))		18 minus 20 =	* 0	x \$50 =		0					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		2 minus 3 =	* 0	x \$230 =		0					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))											
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		0					
APPLICATION AS AMENDED - PART II											
		(Column 1)	(Column 2)	(Column 3)							
AMENDMENT	03/22/2021	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)				
	Total (37 CFR 1.16(i))	* 27 Minus	** 20	= 7	x \$50 =		350				
	Independent (37 CFR 1.16(h))	* 2 Minus	*** 3	= 0	x \$240 =		0				
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
						TOTAL ADD'L FEE		350			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)				
	Total (37 CFR 1.16(i))	* Minus	**	=	x \$0 =						
	Independent (37 CFR 1.16(h))	* Minus	***	=	x \$0 =						
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
						TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/GERALDINE L STANLEY/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".											
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.											

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

AMENDMENT PURSUANT TO 37 CFR 1.116
REQUEST FOR CONTINUED EXAMINATION (RCE)

Submitted via EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the final Office Action dated December 21, 2020, Applicant requests entry of the following amendment.

Amendments to the Claims are reflected in the listing of the claims, which begins on page 2 of this document.

Remarks begin on page 9 of this document.

Appropriate fees for claims in excess of twenty and fees for a Request for Continued Examination (RCE) accompany these papers.

LISTING OF THE CLAIMS

This listing of the claims will replace all prior versions and listings of claims in the application:

1-18. (Cancelled)

19. (New) A system for inductive powering or charging of portable devices, the system comprising:

one or more primary coils that are substantially planar and parallel to a surface of the system for powering or charging portable devices including batteries and receiver units each including a receiver coil and a receiver circuit including a receiver rectifier circuit;

one or more drive circuits including FET drivers, FET switches, and capacitors coupled to the one or more primary coils that when operated apply an alternating electrical current to the one or more primary coils to generate a magnetic field in a direction substantially perpendicular to the plane of the one or more primary coils and the surface of the system to provide power to one or more of the portable devices capable of being powered or charged by the system when present and near the one or more primary coils;

one or more sense circuits to monitor the current through the one or more primary coils to sense communications from the one or more receiver coils; and

one or more communication and control circuits including one or more microcontrollers coupled to the one or more drive circuits and the one or more sense circuits that detect communication through the one or more sense circuits via the one or more primary coils and control the one or more drive circuits to control the charging process;

wherein the one or more communication and control circuits:

operate the one or more drive circuits near a first resonant frequency of a circuit formed by a primary coil and a drive circuit and a receiver coil and a receiver circuit of one of the portable devices when nearby;

sequentially switch the one or more primary coils at a frequency and power level sufficient to transfer power to one or more of the receiver units when near the one or

more primary coils for a sufficiently long period of time to activate the one or more receiver circuits and to receive a response from the one or more receiver circuits via the one or more receiver coils which the one or more primary coils sense via the one or more sense circuits as a modulation of one or more primary coil currents;

detect through the one or more sense circuits communications from the one or more receiver units through the one or more receiver coils including information corresponding to one or more voltages at one or more outputs of the one or more receiver rectifier circuits induced by the one or more primary coils and the one or more receiver coils, and information identifying the one or more portable devices and receiver units;

determine the one or more primary coils electromagnetically most aligned with the one or more receiver coils;

drive FET switches associated with those most aligned one or more primary coils; periodically receive information corresponding to one or more output voltages or currents of the one or more receiver rectifier circuits via the one or more primary coils and the one or more sense circuits; and

regulate in a closed loop feedback manner the one or more output voltages or currents of the one or more receiver rectifier circuits by adjusting the frequency or duty cycle of the one or more drive circuits during the charging or powering of the one or more portable devices .

20. (New) The system of claim 19, further comprising one or more voltage regulator circuits that can change input voltages to the one or more drive circuits between two or more levels to accommodate different powers required by the portable devices.

21. (New) The system of claim 19, wherein the one or more drive circuits, primary coils and associated capacitors are designed to be driven in a Zero Voltage Switching or Zero Current Switching mode during inductive power transfer to a portable device.

22. (New) The system of claim 19, wherein the one or more communication and control circuits are designed to receive from a receiver unit of a portable device identification

information including one or more codes identifying the manufacturer of the portable device, a unique portable device or receiver ID code, a charge algorithm profile, and a power requirement of the portable device.

23. (New) The system of claim 19, wherein the one or more primary coils are of different size and functions and provide different power levels to portable devices with different power requirements.

24. (New) The system of claim 19, further wherein the one or more communication and control circuits, prior to activating the one or more receivers for communication and further identification, sequentially drive each primary coil for a short period of time and at a low power near a nominal second resonant frequency of each primary coil and associated capacitor without a receiver coil present, and the one or more sense circuits monitor the current through the primary coil to detect a higher than a baseline current draw to indicate potential portable devices or metallic objects near the primary coil for further investigation.

25. (New) The system of claim 19, wherein the one or more primary coils are arrayed in multiple layers such that any location on the effective charger area of the surface of the system is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

26. (New) The system of claim 19, wherein at least a portion of the communication between the system and portable device for powering or charging is encrypted for security.

27. (New) The system of claim 19, wherein the one or more communication and control circuits can provide bi-directional digital communication between the one or more primary coils and the receiver coils for a verification process to ensure that a receiver unit that can be charged or powered by the system is present and to inform the system about the voltage or power requirements of the receiver unit.

28. (New) The system of claim 19, further comprising a 1xN switch, wherein N primary coils of the system share a common drive circuit and a common sense circuit that are switched by the one or more communication and control circuits to connect the common drive circuit and the common sense circuit to the N primary coils by one or more 1xN switches where the number N is equal or greater than 2.

29. (New) The system of claim 19, wherein the one or more primary coils are constructed of Printed Circuit Boards comprising multiple layers connected by vias.

30. (New) The system of claim 19, wherein the system is incorporated into a portable device or battery pack comprising an internal rechargeable battery that can be periodically recharged and can operate the system for inductive charging or powering for a period of time.

31. (New) The system of claim 30, further comprising one or more receiver unit circuits coupled to one or more of the primary coils to enable the system and its internal battery to be charged or powered inductively.

32. (New) The system of claim 30, further comprising one or more receiver unit circuits coupled to one or more coils separate from the one or more primary coils to charge or power the system and its internal battery inductively.

33. (New) The system of claim 30, wherein the system is incorporated into a battery pack that can be clipped or attached to a portable device to extend its battery run time.

34. (New) The system of claim 30, wherein the battery pack is incorporated into a case for a portable device.

35. (New) The system of claim 19, wherein the system further includes a common mode filter circuit at an input.

36. (New) The system of claim 19, further wherein the one or more communication and control circuits use a Proportional-Integral-Derivative control technique to regulate one or more outputs of the one or more receiver rectification circuits.

37. (New) The system of claim 19, further comprising an internal data storage system and data communication system such as WiFi or Bluetooth that can establish wireless communication using WiFi or Bluetooth with one or more of the portable devices during charging and upload or download user digital data between the one or more portable devices and the internal data storage system.

38. (New) A portable device including a battery capable of receiving inductive power from an inductive charging system including a base unit with one or more primary coils, the portable device comprising:

- a receiver coil which has a substantially planar shape and located parallel to a surface of the portable device so that a magnetic field received from a primary coil in a base unit of an inductive charging system in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil to power or charge the portable device;

- a ferrite material layer placed behind the receiver coil and opposite to the surface of the portable device to provide shielding in the portable device from electromagnetic fields;

- a receiver circuit designed to operate near a resonant frequency of a circuit formed by the receiver coil, the receiver circuit, and a base unit primary coil when adjacent the portable device for inductive powering or charging;

- wherein the receiver circuit comprises:

- a receiver rectifier circuit including one or more rectifiers and one or more capacitors; and

- a receiver communication and control circuit including a microcontroller and a communication FET to modulate the receiver coil to communicate with the base unit through the primary coil;

wherein when a current is generated in the receiver coil inductively by the primary coil in the base unit, the current is rectified and smoothed by the one or more capacitors in the receiver rectifier circuit and is used to power and activate the receiver communication and control circuit and to power or charge the portable device; and

wherein upon powering and activation of the receiver circuit by a primary coil in the base unit, the receiver circuit

communicates information corresponding to a voltage at an output of the receiver rectifier circuit and information identifying the one or more portable devices and receiver units to enable the base unit to identify the portable device, to determine any appropriate charging or powering algorithm therefor, and to identify one or more primary coils of the base unit most aligned with the receiver coil for use in charging or powering the portable device; and

subsequently, periodically communicates information corresponding to an output voltage or current of the receiver rectifier circuit to the base unit to enable the base unit to regulate in a closed loop manner the output voltage or current of the receiver rectifier circuit during the charging or powering of the portable device.

39. (New) The portable device of claim 38, wherein the communication and control circuit communicates portable device identification information including one or more codes identifying the manufacturer of the portable device, a unique portable device or receiver ID code, a charge algorithm profile, and a power requirement of the portable device.

40. (New) The portable device of claim 38, further wherein the receiver circuit can additionally receive communication from the base unit via the receiver coil inductively from the primary coil for bi-directional communication.

41. (New) The portable device of claim 38, further including an output disconnect switch under the control of the receiver communication and control circuit to disconnect the battery from the receiver rectifier circuit output.

42. (New) The portable device of claim 38, wherein the receiver coil is constructed of a Printed Circuit Board comprising multiple layers connected by vias.

43. (New) The portable device of claim 38, wherein the receiver circuit communicates an end of charge code to terminate power transfer from the base unit upon the battery reaching a desired charged state.

44. (New) The portable device of claim 38, wherein the receiver circuit further comprises a regulator or charge management circuit, coupled to the output of the receiver rectifier circuit, that regulates or controls an output voltage or output current provided to the battery, to ensure proper charging of the battery.

45. (New) The portable device of claim 38, further comprising a base unit circuit to enable the portable device to operate as an inductive charger or power supply using the receiver coil of the portable device to inductively charge or power another portable device including a battery which is capable of receiving power inductively.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, the claims 1-18 were examined. Claims 1-18 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Hui (US Pub 2005/0189910) or under pre-AIA 35 USC 103(a) as being unpatentable over Hui.

AMENDMENTS TO THE CLAIMS:

Upon entry of the above amendments, claims 1 to 18 have been cancelled. New claims 19 to 43 has been added in a manner that does not introduce any new matter. Accordingly, entry of the above amendments is proper and requested.

THE ART BASED REJECTIONS:

Claims 1-6, 8-10, 12-18 stand rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Hui (US Pub 2005/0189910). Similarly claims 7 and 11 stand rejected under pre-AIA 35 USC 103(a) as being unpatentable over Hui. In essence, the Examiner states that all elements of these claims are disclosed in or suggested by Hui.

In response, Applicant has cancelled all previous claims and introduced a new set of claims to describe the inventive elements of the current invention in more detail and such defines an invention that is neither anticipated by nor rendered obvious in view of by Hui.

In particular, it should be noted that the Hui wireless charger includes an array of coils (Fig. 8) connected to an AC voltage source (Figure 10c) in parallel providing power to multiple receivers consisting of a coil and rectifier circuit connected to a load. Hui takes great pains to design the charger to have a uniform magnetic field on its surface with all the coils activated during charging and providing uniform charging to multiple devices placed on the surface of the charger. As discussed in our invention, this architecture suffers from low charging efficiency, high electromagnetic emission, safety and heating issues.

In contrast, the currently pending claims are directed to a position free wireless charging system with multiple coils that overcomes these issues by a more sophisticated system including communication and control in a structured manner between the charger and receiver to allow

detection of the charger and receiver coils most aligned to provide best power transfer and efficient safe power transfer.

New claims 19 to 43 are now presented to clarify the scope of the invention and to distinguish the inventive subject matter relative to Hui. Support for the various elements in the invention are in FIGS. 3, 10, 11, 20, 28, 34 and 40 and the following sections of the published application:

- General operation and control (see paragraphs [0013], [0117] to [0119], [0188] to [0196] and [0318]);
- Resonance (see paragraphs [0114] and [0132]);
- Rectification circuit and smoothing capacitor (see paragraphs [0091] and [0102]);
- Wake up of receiver circuit and communication through receiver and primary coil (see paragraphs [0279] and [0318]);
- Information transferred between the receiver and base unit (see paragraphs [0106] and [0132]);
- Closed loop regulation (see paragraphs [0279] and [0013]);
- Potential receiver or metallic object detection (see paragraphs [0313] and [0333]);
- PID control (see paragraph [0282]);
- Encryption (see paragraph [0318]);
- Ferrite layer (see paragraph [0143]);
- Multi-layer PCB Coil (see paragraph [0232] and FIG. 18);
- Bi-directional communication (see paragraphs [0286] and [0319]);
- ZVS or ZCS (see paragraphs [0259] to [0273]);
- 1xN switching multiplex (see paragraph [0341]);
- Common Mode Filter (see FIGS. 10, 26-32, 34, 65);
- Portable device receiving wireless power as well as charging other devices through the same coil (see paragraph [0053]);
- Battery Pack or Wireless charging Case with battery (see FIGS. 62, 63, and 65; see also paragraphs [0494], [0499], [0500], [0502], and [0511]); and
- Charger with Storage, WiFi or Bluetooth (see paragraphs [0494], [0504] to [0506]).

CONCLUSION:

All claims are believed allowable, and a prompt indication to that effect would be much appreciated.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328

Electronic Patent Application Fee Transmittal

Application Number:	16055109			
Filing Date:	05-Aug-2018			
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			
First Named Inventor/Applicant Name:	Afshin Partovi			
Filer:	Louis L. Wu			
Attorney Docket Number:	AFPA-01013US6			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	2202	7	50	350
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
RCE- 1ST REQUEST	2801	1	680	680
Total in USD (\$)				1030

Electronic Acknowledgement Receipt

EFS ID:	42243776
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	22-MAR-2021
Filing Date:	05-AUG-2018
Time Stamp:	14:46:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1030
RAM confirmation Number	E20213LE49431446
Deposit Account	506896
Authorized User	Louis Wu

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2020-12-21ResponseToFinalOA.pdf	122068	yes	11
			29a7b9c6ec2b130520a546d5f701cc9cc972e0bc		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	8	
	Applicant Arguments/Remarks Made in an Amendment		9	11	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32330	no	2
			d96d482e5e2bd1aa239760c9c02748bf42efb65b		
Warnings:					
Information:					
Total Files Size (in bytes):			154398		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

AMENDMENT PURSUANT TO 37 CFR 1.116
REQUEST FOR CONTINUED EXAMINATION (RCE)

Submitted via EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the final Office Action dated December 21, 2020, Applicant requests entry of the following amendment.

Amendments to the Claims are reflected in the listing of the claims, which begins on page 2 of this document.

Remarks begin on page 9 of this document.

Appropriate fees for claims in excess of twenty and fees for a Request for Continued Examination (RCE) accompany these papers.



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6

CONFIRMATION NO. 7571

PUBLICATION NOTICE



OC000000123342308

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Title:EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Publication No.US-2021-0044147-A9

Publication Date:02/11/2021

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	12/21/2020	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074				
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			12/21/2020	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Response to Amendment

The amendment filed 05/08/2020 has been entered. No claims have been added or cancelled. Claims 1-18 remain pending in this application.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim(s) 1-6, 8-10, 12-18 is/are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Hui (US Pub 2005/0189910).

Regarding claim 1, Hui teaches a charger or power supply for providing substantially continuous charging or for supplying wireless power (¶ 0079; a movable device is able to be continually charged as it moves over the charging surface) to one, a plurality, or a combination of electrical, electronic or mobile devices and/or batteries (inductive charging; see abstract), on a surface of the charger or power supply (see fig. 4(c)), comprising:

a plurality of coils (fig. 15-17) arrayed in two or more layers (see fig. 17 and ¶ 0087; two layers of arrays) to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply (¶ 0079),

wherein the effective charging area is larger than a single coil surface area (see fig. 15-17; formed by multiple coils), and the coils in multiple layers are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil in one of the layers (see fig. 15-17 and ¶ 0087); and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within (¶ 0071, 0084; a bottom EMI shield formed of ferrite and a conductive sheet such as copper) the charger or power supply or to shield nearby environment (fig. 4(c), fig. 14).

Regarding claims 2 and 16, Hui teaches wherein the plurality of coils is arranged in an overlapping arrangement (¶ 0087).

Regarding claim 3, Hui teaches wherein the coils are made of circles, hexagons or other shapes to fill the effective charging area (¶ 0077, 0089 and fig. 17-19).

Regarding claims 4 and 17, Hui teaches the charger or power supply of claim 1, further comprising means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface (§ 0074).

Regarding claims 5 and 18, Hui teaches wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil (fig. 15-17).

Regarding claim 6, Hui teaches wherein the coils have substantially (almost) similar diameters, sizes, and/or characteristics (§ 0105 and fig. 15-17).

Regarding claim 8, Hui teaches wherein the coils are located in different layers and have different diameters, sizes, and/or characteristics (fig. 15 and 16; the number of turns are different).

Regarding claim 9, Hui teaches wherein coils in each layer are arranged in a similar arrangement pattern and the pattern is shifted between the layers relative to one another other along the surface (see fig. 17).

Regarding claim 10, Hui teaches wherein no two coils in the charger or power supply share a center (see fig. 17).

Regarding claim 12, Hui teaches wherein the coils are made of wires, Printed Circuit Boards, or a combination thereof (§ 0006 and fig. 15-17).

Regarding claim 13, Hui teaches wherein each coil layer is constructed of a Printed Circuit Board patterned with multiple coils (§ 0006, 0071, 0086, 0103, claim 2).

Regarding claim 14, Hui discloses wherein multiple coil layers are constructed on a single multi-layer Printed Circuit Board (¶ 0071; can be stacked on top of each other as one single PCB).

Regarding claim 15, Hui discloses a wireless charging or power system, comprising:

one or more of electrical or electronic or mobile devices, or batteries, each comprising a receiver coil to generate power (¶ 0072; the secondary winding is also planar and is located in the portable electronic equipment and couples this energy) when placed near a time varying magnetic field (¶ 0072, 0085, 0087; the primary transformer circuit module transmits electrical energy at high frequency [time varying parameter] through a flat charging surface that contains the primary transformer windings); and

a wireless charger or power supply (fig. 10a, 10b) to generate a time varying magnetic field for supplying wireless (¶ 0072, 0085, 0087),

the charger or power supply including a plurality of coils arrayed in two or more layers (see fig. 17 and ¶ 0087; two layers of arrays) to provide substantially continuous charging or to supply wireless power (¶ 0079; a movable device is able to be continually charged as it moves over the charging surface) over an effective charging area of the surface of the charger or power supply to the one or more of electrical or electronic or mobile devices, or batteries (see fig. 4a to 4c),

each comprising a receiver coil (¶ 0072), wherein the effective charging area is larger than a single coil surface area (fig. 15-17), and

the coils in multiple layers are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil in one of the layers (fig. 15-17), to provide substantially continuous charging or power to one or more device, product or battery over an effective charging area of the surface of the charger greater than the area of a single coil (¶ 0079 and fig. 15-17; a movable device is able to be continually charged as it moves over the charging surface),

the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is equal or less than the radius or side of the center of at least one charger or power supply coil (see fig. 15-17), and ferromagnetic and/or electrically conductive layers or structures are positioned within the charger or power supply to shield components within (¶ 0071, 0084; a bottom EMI shield formed of ferrite and a conductive sheet such as copper) the charger or power supply or to shield nearby environment (fig. 4(c), fig. 14).

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 11 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hui (US Pub 2005/0189910).

Regarding claims 7 and 11, though Hui does not expressly disclose wherein the coils within each layer have different diameters, sizes, and/or characteristics, the shapes/sizes of the coils, does not show any criticality, on considered to be obvious modifications of the shape of windings disclosed by Hui as the courts have held that a change in shape or configuration, without any criticality, is within the level of skill in the art as the particular shape claimed by Applicant is nothing more than one of numerous shapes that a person having ordinary skill in the art will find obvious to provide using routine experimentation based on its suitability for the intended use of the invention. See *In re Dailey*, 149 USPQ 47 (CCPA 1976) and MPEP 2144.04.

Response to Arguments

Applicant's arguments with respect to claim(s) 1-18 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ZIXUAN ZHOU whose telephone number is (571)272-6739. The examiner can normally be reached on 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew A Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ZIXUAN ZHOU/
Primary Examiner, Art Unit 2859
12/15/2020

Notice of References Cited	Application/Control No. 16/055,109		Applicant(s)/Patent Under Reexamination Partovi et al.	
	Examiner ZIXUAN ZHOU		Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20050189910-A1	09-2005	Hui, Shu-yuen Ron	H01F17/0006	320/108
	B					
	C					
	D					
	E					
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	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CPC - Searched*		
Symbol	Date	Examiner
H02J50/10, H02J50/05, G06F1/1683, H02J7/025	11/04/2019	ZZ

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	108	11/04/2019	ZZ
307	104	11/04/2019	ZZ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST text search was conducted - - see printout	11/04/2019	ZZ
Inventor and assignee search	11/04/2019	ZZ
CPC and USPC search with text base	11/04/2019	ZZ
Updated EAST text search was conducted - - see printout	12/15/2020	ZZ

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	79	((("Sears") near3 ("Michael"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/01 14:41
S2	242,638	(effective near3 area)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:43
S3	12	S1 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:43
S4	73	((("Partovi") near3 ("Afshin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/01 14:44
S5	12	S4 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:45
S6	12	S5 and (ferromagnetic)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:45
S7	5,408	320/108.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:20
S8	8,399	307/104.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:20
S9	56,697	(H02J50/10 H02J50/05 G06F1/1683 H02J7/025).cpc.	US-PGPUB; USPAT;	OR	ON	2019/11/04 15:22

			USOCR; FPRS; EPO; JPO; DERWENT			
S10	4,893	(S7 S8 S9) and (plurality near3 (coil receiver))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:23
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S14	111,099	(H02J50/10 or H02J50/402 or G06F1/1683 or H02J7/025 or H02J50/05 or G06F1/26 or G06F1/1635 or H02J50/70 or H02J50/80 or H02J50/90).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 10:48
S15	1	"16055109"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 10:50
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S19	8,255	307/104.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 11:37
S20	115,233	S14 or S18 or S19	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2020/12/14 11:37

			EPO; JPO; DERWENT; IBM_TDB			
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S22	75	S21 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	ADJ	ON	2020/12/14 16:13
S23	191	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) with (locat\$3) with (coil\$3) with (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 16:23
S24	70	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) with ((location place) near7 (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3)) with (coil\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 16:44
S25	454	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) same ((location place) near7 (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3)) same(coil\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 16:47
S26	8,823	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) same ((location place) near7 (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/14 17:07
S27	2,678	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) with ((location place) near7 (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/15 00:06
S28	111,099	(H02J50/10 or H02J50/402 or G06F1/1683 or H02J7/025 or H02J50/05 or G06F1/26 or G06F1/1635 or H02J50/70 or H02J50/80 or H02J50/90).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/15 00:24
S29	5,330	320/108.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/15 00:24
S30	8,255	307/104.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/15 00:24
S31	115,233	S28 or S29 or S30	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/12/15 00:24

			DERWENT; IBM_TDB			
S32	19	S31 and S27	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/15 00:24
S33	8,823	((switch\$3 chang\$3 modificat\$3 modif\$4) near7 (frequency)) same ((location place) near7 (detect\$3 sens\$3 measur\$3 monitor\$3 measur\$3 calculat\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2020/12/15 00:25
S34	66	S31 and S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/15 00:26
S35	47	S34 not S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/15 00:26
S36	6	"20150054462"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/15 09:29

12/15/2020 1:10:55 PM

C:\Users\zzhou1\Documents\EAST\Workspaces\Application_16055109.wsp



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

CONFIRMATION NO. 7571
PUB REQUEST ACCEPTANCE
LETTER



OC000000121141243

Date Mailed: 11/04/2020

NOTICE OF ACCEPTANCE OF PUBLICATION REQUEST

The request for voluntary publication, amended publication, early publication, redacted publication, republication, corrected publication or revised publication has been received for this application. The request, including payment of any necessary fee(s), is in compliance with 37 CFR 1.215, 1.217, 1.219 or 1.221.

The projected publication date is 02/11/2021.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/npfarmer/



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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/055,109	08/05/2018	2859	985	AFPA-01013US6	18	2

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

CONFIRMATION NO. 7571
CORRECTED FILING RECEIPT



Date Mailed: 10/30/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Afshin Partovi, Palo Alto, CA;
Michael Sears, Ben Lomond, CA;

Applicant(s)

Mojo Mobility, Inc., Santa Clara, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/463,252 03/20/2017 PAT 10044229
which is a CON of 15/056,689 02/29/2016 PAT 9601943
which is a CON of 14/608,052 01/28/2015 PAT 9276437
which is a CON of 13/708,548 12/07/2012 PAT 8947047
which is a CON of 13/442,698 04/09/2012 PAT 8629654
which is a CON of 12/116,876 05/07/2008 PAT 8169185
which is a CIP of 11/669,113 01/30/2007 PAT 7952322
which claims benefit of 60/763,816 01/31/2006
and claims benefit of 60/810,262 06/01/2006
and claims benefit of 60/810,298 06/01/2006
and claims benefit of 60/868,674 12/05/2006
and said 12/116,876 05/07/2008
claims benefit of 60/916,748 05/08/2007
and claims benefit of 60/952,835 07/30/2007
and claims benefit of 61/012,922 12/12/2007

and claims benefit of 61/012,924 12/12/2007
and claims benefit of 61/015,606 12/20/2007
and claims benefit of 61/043,027 04/07/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/22/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/055,109**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application

page 2 of 4

serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	10/30/2020	EXAMINER	
Mojo Mobility (c/o Louis Wu)			ZHOU, ZIXUAN	
PO Box 10074				
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			10/30/2020	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
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In re Application of :
Partovi et al. :
Application No. 16/055,109 :
Filed: 5 Aug 2018 : **DECISION ON PETITION**
For: EFFICIENCIES AND :
FLEXIBILITIES IN INDUCTIVE :
(WIRELESS) CHARGING :

This is a decision on the constructive petition under 37 CFR 1.78(c) and (e), filed June 2, 2020, to accept an unintentionally delayed claim under 35 U.S.C. 119(e) and 120 for the benefit of priority to the prior-filed applications listed in the concurrently application data sheet (“ADS”).

The petition under 37 CFR 1.78(c) and (e) is **GRANTED**.

A petition for acceptance of a claim for late priority under 37 CFR 1.78(c) and 1.78(e) is only applicable to those applications in which a proper benefit claim is filed after the expiration of the period specified in 37 CFR 1.78(a)(4) and 1.78(d)(3).

The petition under 37 CFR 1.78(c) and 1.78(e) must be accompanied by:

- (1) the reference required by 35 U.S.C. 120 and 119(e) and 37 CFR 1.78(d)(2) and 1.78(a)(3) of the prior-filed application, which must be filed in an Application Data Sheet;
- (2) the petition fee set forth in § 1.17(m); and
- (3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(d)(3) and 1.78(a)(4) and the date the claim was filed was unintentional. The Director may require additional where there is a question whether the delay was unintentional.

A nonprovisional application in the priority chain claiming the benefit of each prior-filed provisional application must have been filed within twelve months of the filing dates of the prior-filed provisional applications.

The statement of unintentional delay presented in the petition is being construed as the required statement: The entire delay between the date the claim was due under 37 CFR 1.78(d)(3) and 1.78(a)(4) and the date the claim was filed was unintentional.

All the above requirements having been satisfied, the late claim for benefit of priority under 35 U.S.C. 120 and 119(e) is accepted as being unintentionally delayed.

Petitioner is advised that this decision grants the petition to accept the unintentionally delayed domestic benefit claim to the prior filed applications because the petition requirements of 37 CFR 1.78(c) and (e) and the formal requirements for claiming domestic benefit (see MPEP 211.01 et. seq.) have been met. This acceptance should not be construed as meaning that this application is entitled to the benefit of the prior-filed applications. Whether a claimed invention in a nonprovisional application is entitled to the benefit of the filing date of a prior-filed application on the basis of the disclosure thereof is determined during examination if it becomes necessary to do so (e.g., intervening reference and interference proceeding). See MPEP 211.05.

A corrected Filing Receipt, which includes the priority claim to the prior-filed applications, accompanies this decision on petition.

Any questions concerning this decision may be directed to the undersigned at (571) 272-3230.

This application is being referred to Technology Center G.A.U. 2859 for the examiner of record's consideration of the claim under 35 U.S.C. 120 and 119(e) of the prior-filed nonprovisional and provisional applications.

/SHIRENE W BRANTLEY/
Attorney Advisor, OPET

Enclosure: Corrected Filing Receipt



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
16/055,109	08/05/2018	2859	985	AFPA-01013US6	18	2

133328

Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

CONFIRMATION NO. 7571
CORRECTED FILING RECEIPT



Date Mailed: 10/30/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Afshin Partovi, Palo Alto, CA;
Michael Sears, Ben Lomond, CA;

Applicant(s)

Mojo Mobility, Inc., Santa Clara, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/463,252 03/20/2017 PAT 10044229
which is a CON of 15/056,689 02/29/2016 PAT 9601943
which is a CON of 14/608,052 01/28/2015 PAT 9276437
which is a CON of 13/708,548 12/07/2012 PAT 8947047
which is a CON of 13/442,698 04/09/2012 PAT 8629654
which is a CON of 12/116,876 05/07/2008 PAT 8169185
which is a CIP of 11/669,113 01/30/2007 PAT 7952322
which claims benefit of 60/763,816 01/31/2006
and claims benefit of 60/810,262 06/01/2006
and claims benefit of 60/810,298 06/01/2006
and claims benefit of 60/868,674 12/05/2006
and said 12/116,876 05/07/2008
claims benefit of 60/916,748 05/08/2007
and claims benefit of 60/952,835 07/30/2007
and claims benefit of 61/012,922 12/12/2007

and claims benefit of 61/012,924 12/12/2007
and claims benefit of 61/015,606 12/20/2007
and claims benefit of 61/043,027 04/07/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/22/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/055,109**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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page 2 of 4

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: **IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING**

PETITION TO THE COMMISSIONER UNDER ONE OF 37 CFR 1.78(e)

Submitted via EFS

Mail Stop: Office of Petitions
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

STATEMENT OF FACTS

Applicant recently noticed that the Application Data Sheet (“ADS”) mailed on October 19, 2018 contained a number of errors. The application was filed on August 5, 2019. The error relates to the priority data claimed by the Applicant. As a result, the ADS does not correctly reflect the correct priority for the instant application. Similarly, the Filing Receipt mailed from the USPTO does not indicate the correct priority for the instant application. In fact, the Filing Receipt does not indicate any priority for the instant application. Accordingly, 37 CFR 1.78(e) appears to apply here.

REQUEST FOR RELIEF

Applicant requests that the USPTO correct its records by correcting the priority claim and issuing a corrected filing receipt showing the correction.

MATERIALS REQUIRED

Applicant submits herewith a corrected ADS at **EXHIBIT A**.

Applicant submits herewith at **EXHIBIT B** a true and correct copy of the first page of the instant patent application showing the correct reference to the prior applications.

Appropriate payment under Section 1.17m accompany these papers.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 506896 for any matter in connection with this response, including any fee for extension of time, which may be required.

CERTIFICATION OF APPLICANT

Applicant hereby certifies as follows: The entire delay between the date that the benefit claim was due under 37 CFR 1.78(d)(3) and the date of benefit was claimed (today) was unintentional.

Should there be any questions regarding this matter, the USPTO is invited to contact the undersigned representative via telephone at 510-652-2397.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328

EXHIBIT A

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1						Remove	
Legal Name							
Prefix	Given Name	Middle Name		Family Name		Suffix	
	Afshin			Partovi			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service							
City	Palo Alto	State/Province	CA	Country of Residence	US		
Mailing Address of Inventor:							
Address 1		3350 Scott Blvd					
Address 2		Bldg. 37A					
City	Santa Clara			State/Province	CA		
Postal Code	95054		Country	US			
Inventor 2						Remove	
Legal Name							
Prefix	Given Name	Middle Name		Family Name		Suffix	
	Michael			Sears			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service							
City	Ben Lomond	State/Province	CA	Country of Residence	US		
Mailing Address of Inventor:							
Address 1		140 Middle Road					
Address 2							
City	Ben Lomond			State/Province	CA		
Postal Code	95005		Country	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						Add	

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	16/055,109
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	133328		
Email Address	info@wuiplaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
Attorney Docket Number	AFPA-01013US6	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	50	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

Request Not to Publish. I hereby request that the attached application not be published under

☐ 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	133328		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		~~Pending~~		Remove	
Application Number		Continuity Type		Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~15463252~~		~~Continuation of~~		~~15056689~~	~~2017-03-20~~
Prior Application Status		~~Patented~~		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
~~15056689~~	~~Continuation of~~	~~14608052~~	~~2015-01-28~~	~~9601943~~	~~2017-03-21~~
Prior Application Status		~~Patented~~		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
~~14608052~~	~~Continuation of~~	~~13708548~~	~~2012-12-07~~	~~8947047~~	~~2015-02-03~~
Prior Application Status		~~Patented~~		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
~~13708548~~	~~Continuation of~~	~~13442698~~	~~2012-04-09~~	~~8629654~~	~~2014-01-14~~
Prior Application Status		~~Patented~~		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
~~13442698~~	~~Continuation of~~	~~12116876~~	~~2008-06-07~~	~~8169185~~	~~2012-05-01~~
Prior Application Status		~~Patented~~		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
~~12116876~~	~~Continuation in part of~~	~~11669113~~	~~2007-01-30~~	~~7952322~~	~~2011-05-31~~
Prior Application Status		Expired		Remove	
Application Number		Continuity Type		Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~14669113~~		~~Claims benefit of provisional~~		~~60763816~~	~~2006-01-31~~
Prior Application Status		~~Expired~~		Remove	
Application Number		Continuity Type		Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~11669113~~		~~Claims benefit of provisional~~		~~60810202~~	~~2006-06-01~~

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Prior Application Status	~~Pending~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~15056689~~	~~Continuation in part of~~	~~15056689~~	~~2017-03-20~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~11669113~~	~~Claims benefit of provisional~~	~~60810298~~	~~2006-06-01~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~11669113~~	~~Claims benefit of provisional~~	~~60868674~~	~~2006-12-05~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~42116876~~	~~Claims benefit of provisional~~	~~60916748~~	~~2007-05-08~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~42116876~~	~~Claims benefit of provisional~~	~~60952835~~	~~2007-07-30~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~42116876~~	~~Claims benefit of provisional~~	~~61012922~~	~~2007-12-12~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~12116876~~	~~Claims benefit of provisional~~	~~61012924~~	~~2007-12-12~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~12116876~~	~~Claims benefit of provisional~~	~~61016606~~	~~2007-12-20~~
Prior Application Status	~~Expired~~	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
~~42116876~~	~~Claims benefit of provisional~~	~~61043027~~	~~2008-04-07~~

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	<u>Continuation of</u>	<u>15463252</u>	<u>2017-03-20</u>	<u>10044229</u>	<u>2018-08-07</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>15463252</u>	<u>Continuation of</u>	<u>15056689</u>	<u>2016-02-29</u>	<u>9601943</u>	<u>2017-03-21</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>15056689</u>	<u>Continuation of</u>	<u>14608052</u>	<u>2015-01-28</u>	<u>9276437</u>	<u>2016-03-01</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>14608052</u>	<u>Continuation of</u>	<u>13708548</u>	<u>2012-12-07</u>	<u>8947047</u>	<u>2015-02-03</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>13708548</u>	<u>Continuation of</u>	<u>13442698</u>	<u>2012-04-09</u>	<u>8629654</u>	<u>2014-01-14</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>13442698</u>	<u>Continuation of</u>	<u>12116876</u>	<u>2008-05-07</u>	<u>8169185</u>	<u>2012-05-01</u>
Prior Application Status		<u>Patented</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
<u>12116876</u>	<u>Continuation in part of</u>	<u>11669113</u>	<u>2007-01-30</u>	<u>7952322</u>	<u>2011-05-31</u>
Prior Application Status		<u>Expired</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
<u>11669113</u>	<u>Claims benefit of provisional</u>	<u>60763816</u>	<u>2006-01-31</u>		
Prior Application Status		<u>Expired</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
<u>11669113</u>	<u>Claims benefit of provisional</u>	<u>60810262</u>	<u>2006-06-01</u>		
Prior Application Status		<u>Expired</u>		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
<u>11669113</u>	<u>Claims benefit of provisional</u>	<u>60810298</u>	<u>2006-06-01</u>		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>11669113</u>	<u>Claims benefit of provisional</u>	<u>60868674</u>	<u>2006-12-05</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>60916748</u>	<u>2007-05-08</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>60952835</u>	<u>2007-07-30</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>61012922</u>	<u>2007-12-12</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>61012924</u>	<u>2007-12-12</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>61015606</u>	<u>2007-12-20</u>
Prior Application Status	<u>Expired</u>	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<u>12116876</u>	<u>Claims benefit of provisional</u>	<u>61043027</u>	<u>2008-04-07</u>

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
			Remove
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	AFPA-01013US6		
	Application Number	<u>16/055,109</u>		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; vertical-align: top;">Title of Invention</td> <td style="vertical-align: top;">IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING</td> </tr> </table>			Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

☒ Assignee
 ☐ Legal Representative under 35 U.S.C. 117
 ☐ Joint Inventor

☐ Person to whom the inventor is obligated to assign.
 ☐ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name

Mailing Address Information For Applicant:

Address 1	3350 Scott Blvd.		
Address 2	Bldg. 37A		
City	Santa Clara	State/Province	CA
Country	US	Postal Code	95054
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	<u>16/055,109</u>
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country ⁱ		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Louis Wu/		Date (YYYY-MM-DD)	~~2017-03-20~~ <u>2020-06-02</u>
First Name	Louis	Last Name	Wu	Registration Number 44413

Additional Signature may be generated within this form by selecting the Add button.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
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EXHIBIT B

**IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE
(WIRELESS) CHARGING**

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 15/463,252, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING, filed on March 20, 2017, which is a continuation of U.S. Patent Application No. 15/056,689, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed February 29, 2016, which is now US Patent No. 9,601,943; which is a continuation of U.S. Patent Application No. 14/608,052, titled "SYSTEM AND METHOD THAT PROVIDES EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed January 28, 2015, which is now U.S. Patent No. 9,276,437; which is a continuation of U.S. Patent Application No. 13/708,548, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed December 7, 2012, which is now U.S. Patent No. 8,947,047, issued on February 3, 2015; which application is a continuation of U.S. Patent Application No. 13/442,698, titled "SYSTEM AND METHOD FOR INDUCTIVE CHARGING OF PORTABLE DEVICES," filed April 9, 2012, which is now U.S. Patent No. 8,629,654, issued January 14, 2014; which is a continuation of U.S. patent application Ser. No. 12/116,876, titled "SYSTEM AND METHOD FOR INDUCTIVE CHARGING OF PORTABLE DEVICES," filed May 7, 2008, which is now U.S. Patent No. 8,169,185, issued May 1, 2012; which is a continuation-in-part of U.S. patent application Ser. No. 11/669,113, titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM," filed Jan. 30, 2007, which is now U.S. Patent No. 7,952,322, issued May 31, 2011, which claims the benefit of priority to U.S. Provisional Patent Application No. 60/763,816, titled "PORTABLE INDUCTIVE POWER SOURCE," filed Jan. 31, 2006; U.S. Provisional Patent Application No. 60/810,262, titled "MOBILE DEVICE, CHARGER, AND POWER SUPPLY", filed Jun. 1, 2006; U.S. Provisional Patent Application No. 60/810,298, titled "MOBILE DEVICE, BATTERY, CHARGING

SYSTEM, AND POWER SUPPLY," filed Jun. 1, 2006; and U.S. Provisional Patent Application No. 60/868,674, titled "SYSTEM FOR PROVIDING A PORTABLE INDUCTIVE POWER SOURCE," filed Dec. 5, 2006; which application also claims the benefit of priority to U.S. Provisional Patent Application No. 60/916,748, titled "CHARGING AND POWERING MOBILE DEVICES, BATTERIES," filed May 8, 2007; U.S. Provisional Patent Application No. 60/952,835, titled "INDUCTIVE CHARGING OF PORTABLE DEVICES," filed Jul. 30, 2007; U.S. Provisional Patent Application No. 61/012,922, titled "WIRELESS CHARGER WITH POSITION INSENSITIVITY," filed Dec. 12, 2007; U.S. Provisional Patent Application No. 61/012,924, titled "CONTROL, REGULATION, AND COMMUNICATION IN CHARGERS", filed Dec. 12, 2007; U.S. Provisional Patent Application No. 61/015,606, titled "PORTABLE INDUCTIVE POWER SOURCE," filed Dec. 20, 2007; and U.S. Provisional Patent Application No. 61/043,027, titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM," filed Apr. 7, 2008; which application is also related to U.S. patent application Ser. No. 11/757,067, titled "POWER SOURCE, CHARGING SYSTEM, AND INDUCTIVE RECEIVER FOR MOBILE DEVICES," filed Jun. 1, 2007; each of which above applications are herein incorporated by reference.

BACKGROUND

[0002] The invention is related generally to power supplies, power sources, and particularly to a system and method for inductive charging of portable devices.

[0003] There is currently a need for powering portable or mobile devices for use in commercial, business, personal, consumer, and other applications. Examples of such devices include cellular telephones, personal digital assistants (PDAs), notebook computers, mobile email devices, Blackberry devices, Bluetooth headsets, hearing aids, music players (for example, MP3 players), radios, compact disk players, video game consoles, digital cameras, walkie-talkie or other communication devices, GPS devices, laptop computers, electric shavers, and electric toothbrushes. Most of these devices include a rechargeable internal battery that must be first charged by an external power supply or charger, before the device itself can be used. The power supply typically provides direct current (DC) voltage through a special connector to the device. The power supply can then be disconnected, and the device will continue to run for a short period of time until the battery is depleted. The voltage and power requirements of the different

Electronic Patent Application Fee Transmittal				
Application Number:		16055109		
Filing Date:		05-Aug-2018		
Title of Invention:		EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
First Named Inventor/Applicant Name:		Afshin Partovi		
Filer:		Louis L. Wu		
Attorney Docket Number:		AFPA-01013US6		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
PET. DELAY SUB OR RESTORE PRIORITY-CLAIM	2454	1	1000	1000
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt

EFS ID:	39598235
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	02-JUN-2020
Filing Date:	05-AUG-2018
Time Stamp:	12:12:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	E202062C14166658
Deposit Account	506896
Authorized User	Louis Wu

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions	2020-06-02PetitionToCorrectPriority.pdf	271630	no	18
			eb2227e4e8ba42350f73c098c2f382ade8747371		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30743	no	2
			379f04ba124c0fb8908cc2e83ec3892ae443db03		
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Total Files Size (in bytes):			302373		
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Electronic Patent Application Fee Transmittal

Application Number:	16055109			
Filing Date:	05-Aug-2018			
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			
First Named Inventor/Applicant Name:	Afshin Partovi			
Filer:	Louis L. Wu			
Attorney Docket Number:	AFPA-01013US6			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 3 months with \$0 paid	2253	1	700	700
Miscellaneous:				
Total in USD (\$)				700

Electronic Acknowledgement Receipt

EFS ID:	39396574
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	08-MAY-2020
Filing Date:	05-AUG-2018
Time Stamp:	20:31:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 700
RAM confirmation Number	E202058K33325663
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	30958	no	2
			dcc93eeb2f8fb874d47db96a48901714d5d6d579		
Warnings:					
Information:					
Total Files Size (in bytes):			30958		
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/055,109		Filing Date 08/05/2018		☐ To be Mailed		
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☒	BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		150				
☒	SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A		330				
☒	EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		380				
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *		x \$50 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *		x \$230 =						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		860				
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	05/08/2020	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	x \$50 =		0		
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0	x \$230 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE		0		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE				
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE				
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/KATINA R TOBIN/				
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI

Examiner: ZHOU, ZIHUAN

Serial No.: 16/055,109

Group Art Unit: 2859

Filing Date: August 5, 2019

Confirmation No: 7571

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

AMENDMENT PURSUANT TO 37 CFR 1.111

Submitted via EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the nonfinal Office Action dated November 14, 2019, Applicant requests entry of the following amendment.

Amendments to the Claims are reflected in the listing of the claims, which begins on page 2 of this document.

Remarks begin on page 6 of this document.

Appropriate fees for a three-month extension of time accompany these papers.

LISTING OF THE CLAIMS

This listing of the claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A charger or power supply for providing substantially continuous charging or for supplying wireless power to one, a plurality, or a combination of electrical, electronic or mobile devices and/or batteries, on a surface of the charger or power supply, comprising:

a plurality of coils arrayed in two or more layers ~~in one or multiple layers~~ to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply, wherein the effective charging area is larger than a single coil surface area, and the coils in multiple layers are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil in one of the layers; and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within the charger or power supply or to shield nearby environment.

2. (Original) The charger or power supply of claim 1, wherein the plurality of coils is arranged in an overlapping arrangement.

3. (Original) The charger or power supply of claim 1, wherein the coils are made of circles, hexagons or other shapes to fill the effective charging area.

4. (Original) The charger or power supply of claim 1, further comprising means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface.

5. (Original) The charger or power supply of claim 1, wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

6. (Original) The charger or power supply of claim 1, wherein the coils have substantially similar diameters, sizes, and/or characteristics.

7. (Original) The charger or power supply of claim 1, wherein the coils within each layer have different diameters, sizes, and/or characteristics.

8. (Original) The charger or power supply of claim 1, wherein the coils are located in different layers and have different diameters, sizes, and/or characteristics.

9. (Original) The charger or power supply of claim 1, wherein coils in each layer are arranged in a similar arrangement pattern and the pattern is shifted between the layers relative to one another other along the surface.

10. (Original) The charger or power supply of claim 1, wherein no two coils in the charger or power supply share a center.

11. (Original) The charger or power supply of claim 1, wherein coils sharing a center have different diameters, sizes, and/or characteristics.

12. (Original) The charger or power supply of claim 1, wherein the coils are made of wires, Printed Circuit Boards, or a combination thereof.

13. (Original) The charger or power supply of claim 1, wherein each coil layer is constructed of a Printed Circuit Board patterned with multiple coils.

14. (Original) The charger or power supply of claim 1, wherein multiple coil layers are constructed on a single multi-layer Printed Circuit Board.

15. (Currently Amended) A wireless charging or power system, comprising:
one or more of electrical or electronic or mobile devices, or batteries, each comprising a receiver coil to generate power when placed near a time varying magnetic field; and
a wireless charger or power supply to generate a time varying magnetic field for supplying wireless, the charger or power supply including

a plurality of coils arrayed in two or more layers ~~one or multiple layers~~ to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply to the one or more of electrical or electronic or mobile devices, or batteries, each comprising a receiver coil,
wherein

the effective charging area is larger than a single coil surface area, and
the coils in multiple layers are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil in one of the layers, ~~and a plurality of coils~~ to provide substantially continuous charging or power to one or more device, product or battery over an effective charging area of the surface of the charger greater than the area of a single coil; ~~and,~~

the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is equal or less than the radius or side of the center of at least one charger or power supply coil; and

ferromagnetic and/or electrically conductive layers or structures are positioned within the charger or power supply to shield components within the charger or power supply or to shield nearby environment.

16. (Original) The wireless charging or power system of claim 15, wherein the plurality of coils is arranged in an overlapping arrangement.

17. (Original) The wireless charging or power system of claim 15, wherein the charger or power supply further includes means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface.

18. (Original) The wireless charging or power system of claim 15, wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, the claims 1-18 were examined. Claims 1-18 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by U.S. Patent Application Publication No. 2009/0096413 Partovi et al. (hereinafter “the Partovi Publication”), which is associated with U.S. Patent Application Serial No. 12/116,876, and which has issued as U.S. Patent No. 8,169,185 to Partovi et al. As set forth in paragraph [0001] of the subject application as filed, this case effectively claims priority to the Partovi Publication. That is, **the pending claims enjoy a priority date earlier than the publication date of the Partovi Publication.**

AMENDMENTS TO THE CLAIMS:

Upon entry of the above amendments, claims 1 and 15 have been amended. No new matter has been added. Accordingly, entry of the above amendments is proper and requested.

THE ART BASED (35 USC 102) REJECTION:

All pending claims are rejected under 35 U.S.C. 102(a)(1) as being anticipated by the Partovi Publication. The Examiner states that all elements of these claims are disclosed in the Partovi Publication.

In response, Applicant points out that the Partovi Publication is merely a published version of a patent application that is now an issued patent from which the current application claims priority. Thus, the Partovi Publication cannot qualify as proper prior art for the present case, as a timely claim of priority was expressly made when the subject application was originally filed. In other words, Applicant believes that the Examiner has erred as a legal matter in issuing the pending rejection under 35 U.S.C. 102(a)(1), because it is improper for the Examiner to rely on a patent application from which the subject application claims priority to support a section 102 rejection.

In addition, Applicant does not believe that an obviousness type double patenting rejection would be warranted here because the pending claims are sufficiently different from the claims that ultimately issued in U.S. Patent No. 8,169,185 to Partovi et al. to support such a rejection. Thus, all possible art-based rejections have been addressed based on the Partovi

Publication or the '185 patent.

CONCLUSION:

All claims are believed allowable, and a prompt indication to that effect would be much appreciated.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 506896 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328

Electronic Patent Application Fee Transmittal

Application Number:	16055109			
Filing Date:	05-Aug-2018			
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			
First Named Inventor/Applicant Name:	Afshin Partovi			
Filer:	Louis L. Wu			
Attorney Docket Number:	AFPA-01013US6			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 3 months with \$0 paid	2253	1	700	700
Miscellaneous:				
Total in USD (\$)				700

Electronic Acknowledgement Receipt

EFS ID:	39388759
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	08-MAY-2020
Filing Date:	05-AUG-2018
Time Stamp:	12:29:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2020-05-14ResponseToNonfinal IOA.pdf	97912	yes	7
			8e2d4a4ae7a31f22c73a655a3aa2e98a28d2 2b21		

Multipart Description/PDF files in .zip description					
Document Description			Start	End	
Amendment/Req. Reconsideration-After Non-Final Reject			1	1	
Claims			2	5	
Applicant Arguments/Remarks Made in an Amendment			6	7	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30956	no	2
			20068476b9266487f54edc96cdad20e6ba90d890		
Warnings:					
Information:					
Total Files Size (in bytes):			128868		
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6

CONFIRMATION NO. 7571

PUBLICATION NOTICE



OC000000114530051

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Title:EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Publication No.US-2020-0044482-A1

Publication Date:02/06/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6	7571
133328	7590	11/14/2019		
Mojo Mobility (c/o Louis Wu)			EXAMINER	
PO Box 10074			ZHOU, ZIXUAN	
Oakland, CA 94610				
			ART UNIT	PAPER NUMBER
			2859	
			MAIL DATE	DELIVERY MODE
			11/14/2019	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Interpretation

The following is a quotation of 35 U.S.C. 112(f):

(f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The claims in this application are given their broadest reasonable interpretation using the plain meaning of the claim language in light of the specification as it would be understood by one of ordinary skill in the art. The broadest reasonable interpretation of a claim element (also commonly referred to as a claim limitation) is limited by the description in the specification when 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is invoked.

As explained in MPEP § 2181, subsection I, claim limitations that meet the following three-prong test will be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph:

- (A) the claim limitation uses the term “means” or “step” or a term used as a substitute for “means” that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function;
- (B) the term “means” or “step” or the generic placeholder is modified by functional language, typically, but not always linked by the transition word “for” (e.g., “means for”) or another linking word or phrase, such as “configured to” or “so that”; and
- (C) the term “means” or “step” or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Use of the word “means” (or “step”) in a claim with functional language creates a rebuttable presumption that the claim limitation is to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites sufficient structure, material, or acts to entirely perform the recited function.

Absence of the word “means” (or “step”) in a claim creates a rebuttable presumption that the claim limitation is not to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is not interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites function without reciting sufficient structure, material or acts to entirely perform the recited function.

Claim limitations in this application that use the word “means” (or “step”) are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action. Conversely, claim limitations in this application that do not use the word “means” (or “step”) are not being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

Claim(s) 1-18 is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Partovi et al. US Pub 2009/0096413 (hereinafter Partovi).

Regarding claim 1, Partovi teaches a charger or power supply for providing substantially continuous charging or for supplying wireless power (Abstract; a receiver comprises a means for receiving the energy from the alternating magnetic field from the pad and transferring it to a mobile device, battery or other device) to one, a plurality, or a combination of electrical, electronic or mobile devices and/or batteries, on a surface of the charger or power supply (Abstract and fig. 16), comprising:

a plurality of coils (§ 0122 and fig. 4; a first set of coils 152...) arrayed in one or multiple layers to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply (§ 0124),

wherein the effective charging area is larger than a single coil surface area (fig. 3-5; because the charging pad includes a plurality of coils), and the coils are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil (§ 0122; such that the centers of this coil array fill the voids in the primary set); and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within the charger or power supply or to shield nearby environment (§ 0400; ferromagnetic layers in the system can shield the outside environment from any potential radiative fields).

Regarding claim 2, Partovi teaches wherein the plurality of coils is arranged in an overlapping arrangement (fig. 4 and § 0019).

Regarding claim 3, Partovi teaches wherein the coils are made of circles, hexagons or other shapes to fill the effective charging area (§ 0197 and fig. 1).

Regarding claim 4, Partovi teaches the charger or power supply, further comprising means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface (§§ 0114, 0117, 0119).

Regarding claim 5, Partovi teaches wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a

distance equal to or less than half a radius or half a side-to-center length of at least one coil (fig. 4 and ¶ 0112).

Regarding claim 6, Partovi teaches wherein the coils have substantially similar diameters, sizes, and/or characteristics (¶ 0104).

Regarding claim 7, Partovi teaches wherein the coils within each layer have different diameters, sizes, and/or characteristics (¶ 0125).

Regarding claim 8, Partovi teaches wherein the coils are located in different layers and have different diameters, sizes, and/or characteristics (fig. 5 and ¶ 0127).

Regarding claim 9, Partovi teaches wherein coils in each layer are arranged in a similar arrangement pattern and the pattern is shifted between the layers relative to one another other along the surface (fig. 3-5).

Regarding claim 10, Partovi teaches wherein no two coils in the charger or power supply share a center (fig. 3-5).

Regarding claim 11, Partovi teaches wherein coils sharing a center have different diameters, sizes, and/or characteristics (fig. 5).

Regarding claim 12, Partovi teaches wherein the coils are made of wires, Printed Circuit Boards, or a combination thereof (¶ 0105).

Regarding claim 13, Partovi teaches wherein each coil layer is constructed of a Printed Circuit Board patterned with multiple coils (¶ 0105).

Regarding claim 14, Partovi teaches wherein multiple coil layers are constructed on a single multi-layer Printed Circuit Board (¶ 0126).

Regarding claim 15, Partovi teaches a wireless charging or power system, comprising:

one or more of electrical or electronic or mobile devices, or batteries, each comprising a receiver coil to generate power (§ 0200 and fig. 16) when placed near a time varying magnetic field (§ 0474; for an inductive charger and/or power supply that creates a time varying magnetic field to transfer energy to a receiver); and

a wireless charger or power supply to generate a time varying magnetic field for supplying wireless (§ 0474), the charger or power supply including

a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply (fig. 3-5 and § 0122),

wherein the effective charging area is larger than a single coil surface area (see fig. 4-5), and the coils are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil (§ 0122; such that the centers of this coil array fill the voids in the primary set), and

a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or power to one or more device, product or battery over an effective charging area of the surface of the charger greater than the area of a single coil (see fig. 4 and § 0122); and

the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is equal or less than the radius or side of the center of at least one charger or power supply coil (see fig. 4-5 and § 0122); and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within the charger or power supply or

to shield nearby environment (¶ 0400; ferromagnetic layers in the system can shield the outside environment from any potential radiative fields).

Regarding claim 16, Partovi teaches wherein the plurality of coils is arranged in an overlapping arrangement (fig. 4 and ¶ 0019).

Regarding claim 17, Partovi teaches wherein the charger or power supply further includes means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface (¶ 0114, 0117, and 0119).

Regarding claim 18, Partovi teaches wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil (fig. 4 and ¶ 0122).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ZIXUAN ZHOU whose telephone number is (571)272-6739. The examiner can normally be reached on 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew A Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ZIXUAN ZHOU/
Primary Examiner, Art Unit 2859
11/04/2019

<i>Notice of References Cited</i>	Application/Control No. 16/055,109		Applicant(s)/Patent Under Reexamination Partovi et al.	
	Examiner ZIXUAN ZHOU		Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20090096413-A1	04-2009	Partovi; Afshin	H01F5/003	320/108
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/055,109	Applicant(s)/Patent Under Reexamination Partovi et al.
	Examiner ZIXUAN ZHOU	Art Unit 2859

CPC - Searched*		
Symbol	Date	Examiner
H02J50/10, H02J50/05, G06F1/1683, H02J7/025	11/04/2019	ZZ

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	108	11/04/2019	ZZ
307	104	11/04/2019	ZZ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST text search was conducted - - see printout	11/04/2019	ZZ
Inventor and assignee search	11/04/2019	ZZ
CPC and USPC search with text base	11/04/2019	ZZ

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/ZIXUAN ZHOU/ Primary Examiner, Art Unit 2859	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5408	320/108.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:20
L2	8399	307/104.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:20
L3	56697	(H02J50/10 H02J50/05 G06F1/1683 H02J7/025).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:22
L4	4893	(1 2 3) and (plurality near3 (coil receiver))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2019/11/04 15:23
L5	360	4 and (ferromagnetic)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/04 15:24
L6	87	4 and ((ferromagnetic) with shield\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/04 15:24
S1	79	((("Sears") near3 ("Michael"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/01 14:41
S2	242638	(effective near3 area)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:43
S3	12	S1 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:43
S4	73	((("Partovi") near3 ("Afshin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/01 14:44
S5	12	S4 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:45
S6	12	S5 and (ferromagnetic)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/01 14:45

11/ 4/ 2019 3:30:22 PM
C:\Users\zzhou1\Documents\EAST\Workspaces\Application_16055109.wsp

Bibliographic Data

Application No: 16/055,109

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /ZIXUAN ZHOU/

Examiner's Signature

Initials

Title:

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE
(WIRELESS) CHARGING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/05/2018	320	2859	AFPA-01013US6
RULE			

APPLICANTS

Mojo Mobility, Inc., Santa Clara, CA,

INVENTORS

Afshin Partovi Palo Alto, CA, UNITED STATES

Michael Sears Ben Lomond, CA, UNITED STATES

CONTINUING DATA

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

08/22/2018

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

Mojo Mobility (c/o Louis Wu)

PO Box 10074

Oakland, CA 94610

UNITED STATES

FILING FEE RECEIVED

\$785

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/055,109	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	18	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			200			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
			TOTAL	985		TOTAL	
* If the difference in column 1 is less than zero, enter "0" in column 2.							
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/055,109	08/05/2018	2859	985	AFPA-01013US6	18	2

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

CONFIRMATION NO. 7571
UPDATED FILING RECEIPT



Date Mailed: 10/23/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Afshin Partovi, Palo Alto, CA;
Michael Sears, Ben Lomond, CA;

Applicant(s)

Mojo Mobility, Inc., Santa Clara, CA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/22/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/055,109**

Projected Publication Date: 02/06/2020

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOV

Examiner: TBD

Serial No.: 16,055,109

Group Art Unit: 2859

Filing Date: August 5, 2018

Confirmation No: 7521

Title: IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING

**RESPONSE TO NOTICE TO FILE MISSING PARTS AND
CONTINUED REQUEST FOR CORRECTED FILING RECEIPT**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the papers sent from the USPTO on August 22, 2018, accompanying these papers is a payment for \$200 for underpayment of page number fees, along with a substitute Application Data Sheet that should address the issues set forth in the “RESPONSE TO REQUEST FOR CORRECTED FILING RECIEPT.” Should the USPTO has any questions regarding this matter, please consult telephone conference reference number 1-618233921 in which Applicant’s representative discussed the matter with USPTO personnel. Alternatively, Applicant’s representative’s contact information is provided below.

Respectfully submitted,

By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 52128
Law Office of Louis L. Wu
P.O. Box 10074
Oakland, California 94610
(510) 652-2397

Electronic Patent Application Fee Transmittal

Application Number:	16055109			
Filing Date:	05-Aug-2018			
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			
First Named Inventor/Applicant Name:	Afshin Partovi			
Filer:	Louis L. Wu			
Attorney Docket Number:	AFPA-01013US6			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
UTILITY APPL SIZE FEE PER 50 SHEETS >100	2081	1	200	200
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt

EFS ID:	34063428
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	19-OCT-2018
Filing Date:	05-AUG-2018
Time Stamp:	15:30:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$200
RAM confirmation Number	102218INTEFSW15320600
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	ADS-substituteAsFiled.pdf	131949	no	10
			0eb5e77b05ee5b1b52117b7bccfae37eb6ff4ba		
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Miscellaneous Incoming Letter	20180822ResponseMissingPart sandRequestForCorrectedFiling Receipt.pdf	76994	no	1
			391ff5414b6db80cadbdc72b5c1bcd3f29009ad4		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30641	no	2
			52195e55d35c8d09b256e91b9e828079b4ff68f3f		
Warnings:					
Information:					
Total Files Size (in bytes):			239584		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1						
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Afshin		Partovi			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Palo Alto	State/Province	CA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1		3350 Scott Blvd				
Address 2		Bldg. 37A				
City	Santa Clara		State/Province	CA		
Postal Code	95054		Country	US		
Inventor 2						
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Michael		Sears			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Ben Lomond	State/Province	CA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1		140 Middle Road				
Address 2						
City	Ben Lomond		State/Province	CA		
Postal Code	95005		Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	133328		
Email Address	info@wuiplaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
Attorney Docket Number	AFPA-01013US6	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	50	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	133328		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
15463252	Continuation of	15056689	2017-03-20		
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15056689	Continuation of	14608052	2015-01-28	9601943	2017-03-21
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14608052	Continuation of	13708548	2012-12-07	8947047	2015-02-03
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13708548	Continuation of	13442698	2012-04-09	8629654	2014-01-14
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13442698	Continuation of	12116876	2008-05-07	8169185	2012-05-01
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12116876	Continuation in part of	11669113	2007-01-30	7952322	2011-05-31
Prior Application Status	<u>Expired</u>		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11669113	Claims benefit of provisional	60763816	2006-01-31		
Prior Application Status	Expired		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11669113	Claims benefit of provisional	60810262	2006-06-01		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15056689	Continuation in part of	15056689	2017-03-20
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
11669113	Claims benefit of provisional	60810298	2006-06-01
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
11669113	Claims benefit of provisional	60868674	2006-12-05
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	60916748	2007-05-08
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	60952835	2007-07-30
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61012922	2007-12-12
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61012924	2007-12-12
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61015606	2007-12-20
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61043027	2008-04-07

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	 Access Code ⁱ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
- NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	AFPA-01013US6
	Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant 1			
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
Clear			
☒ Assignee		☐ Legal Representative under 35 U.S.C. 117	
☐ Person to whom the inventor is obligated to assign.		☐ Joint Inventor	
☐ Person who shows sufficient proprietary interest			
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Mojo Mobility, Inc.		
Mailing Address Information For Applicant:			
Address 1	3350 Scott Blvd.		
Address 2	Bldg. 37A		
City	Santa Clara	State/Province	CA
Country	US	Postal Code	95054
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country ⁱ		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Louis Wu/		Date (YYYY-MM-DD)	2017-03-20
First Name	Louis	Last Name	Wu	Registration Number
44413				

Additional Signature may be generated within this form by selecting the Add button.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6

CONFIRMATION NO. 7571

IMPROPER CFR REQUEST



OC000000101769191

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Date Mailed: 08/22/2018

RESPONSE TO REQUEST FOR CORRECTED FILING RECEIPT

Continuity, Priority Claims, Petitions, and Non-Publication Requests

In response to your request for a corrected Filing Receipt, the Office is unable to comply with your request because:

- One or more of the benefit claims under 35 U.S.C. § 120 cannot be included on the Filing Receipt since applicant did not specify whether the application is a continuation, divisional or continuation-in-part of the prior application. Applicant must submit a new application data sheet (ADS) that sets forth the relationship, and the ADS must be accompanied by a petition under 37 CFR 1.78 if filed after the time period set forth in 37 CFR 1.78.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/slee/



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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/055,109	08/05/2018	Afshin Partovi	AFPA-01013US6

CONFIRMATION NO. 7571

FORMALITIES LETTER



OC000000101769060

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

Date Mailed: 08/22/2018

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **200** for **13** electronically equivalent pages in excess of **100** application size fee.
- \$(**0**) previous unapplied payment amount.
- \$ **200** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/055,109	08/05/2018	2859	785	AFPA-01013US6	18	2

CONFIRMATION NO. 7571

FILING RECEIPT

133328
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610



Date Mailed: 08/22/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Afshin Partovi, Palo Alto, CA;
Michael Sears, Ben Lomond, CA;

Applicant(s)

Mojo Mobility, Inc., Santa Clara, CA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/22/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/055,109**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/055,109	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	18	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			200			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
			TOTAL	985		TOTAL	
* If the difference in column 1 is less than zero, enter "0" in column 2.							
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							

**IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE
(WIRELESS) CHARGING**

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 15/463,252, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING, filed on March 20, 2017, which is a continuation of U.S. Patent Application No. 15/056,689, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed February 29, 2016, which is now US Patent No. 9,601,943; which is a continuation of U.S. Patent Application No. 14/608,052, titled "SYSTEM AND METHOD THAT PROVIDES EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed January 28, 2015, which is now U.S. Patent No. 9,276,437; which is a continuation of U.S. Patent Application No. 13/708,548, titled "EFFICIENCY AND FLEXIBILITY IN INDUCTIVE CHARGING," filed December 7, 2012, which is now U.S. Patent No. 8,947,047, issued on February 3, 2015; which application is a continuation of U.S. Patent Application No. 13/442,698, titled "SYSTEM AND METHOD FOR INDUCTIVE CHARGING OF PORTABLE DEVICES," filed April 9, 2012, which is now U.S. Patent No. 8,629,654, issued January 14, 2014; which is a continuation of U.S. patent application Ser. No. 12/116,876, titled "SYSTEM AND METHOD FOR INDUCTIVE CHARGING OF PORTABLE DEVICES," filed May 7, 2008, which is now U.S. Patent No. 8,169,185, issued May 1, 2012; which is a continuation-in-part of U.S. patent application Ser. No. 11/669,113, titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM," filed Jan. 30, 2007, which is now U.S. Patent No. 7,952,322, issued May 31, 2011, which claims the benefit of priority to U.S. Provisional Patent Application No. 60/763,816, titled "PORTABLE INDUCTIVE POWER SOURCE," filed Jan. 31, 2006; U.S. Provisional Patent Application No. 60/810,262, titled "MOBILE DEVICE, CHARGER, AND POWER SUPPLY", filed Jun. 1, 2006; U.S. Provisional Patent Application No. 60/810,298, titled "MOBILE DEVICE, BATTERY, CHARGING

SYSTEM, AND POWER SUPPLY," filed Jun. 1, 2006; and U.S. Provisional Patent Application No. 60/868,674, titled "SYSTEM FOR PROVIDING A PORTABLE INDUCTIVE POWER SOURCE," filed Dec. 5, 2006; which application also claims the benefit of priority to U.S. Provisional Patent Application No. 60/916,748, titled "CHARGING AND POWERING MOBILE DEVICES, BATTERIES," filed May 8, 2007; U.S. Provisional Patent Application No. 60/952,835, titled "INDUCTIVE CHARGING OF PORTABLE DEVICES," filed Jul. 30, 2007; U.S. Provisional Patent Application No. 61/012,922, titled "WIRELESS CHARGER WITH POSITION INSENSITIVITY," filed Dec. 12, 2007; U.S. Provisional Patent Application No. 61/012,924, titled "CONTROL, REGULATION, AND COMMUNICATION IN CHARGERS", filed Dec. 12, 2007; U.S. Provisional Patent Application No. 61/015,606, titled "PORTABLE INDUCTIVE POWER SOURCE," filed Dec. 20, 2007; and U.S. Provisional Patent Application No. 61/043,027, titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM," filed Apr. 7, 2008; which application is also related to U.S. patent application Ser. No. 11/757,067, titled "POWER SOURCE, CHARGING SYSTEM, AND INDUCTIVE RECEIVER FOR MOBILE DEVICES," filed Jun. 1, 2007; each of which above applications are herein incorporated by reference.

BACKGROUND

[0002] The invention is related generally to power supplies, power sources, and particularly to a system and method for inductive charging of portable devices.

[0003] There is currently a need for powering portable or mobile devices for use in commercial, business, personal, consumer, and other applications. Examples of such devices include cellular telephones, personal digital assistants (PDAs), notebook computers, mobile email devices, Blackberry devices, Bluetooth headsets, hearing aids, music players (for example, MP3 players), radios, compact disk players, video game consoles, digital cameras, walkie-talkie or other communication devices, GPS devices, laptop computers, electric shavers, and electric toothbrushes. Most of these devices include a rechargeable internal battery that must be first charged by an external power supply or charger, before the device itself can be used. The power supply typically provides direct current (DC) voltage through a special connector to the device. The power supply can then be disconnected, and the device will continue to run for a short period of time until the battery is depleted. The voltage and power requirements of the different

devices vary, and to date there is currently no standardized connector for the devices. As a result of this, each mobile device is invariably sold or distributed bundled with its own charger. The costs associated with these multiple different types and numbers of charger are paid by the consumer indirectly by being incorporated into the prices being charged for the mobile device.

[0004] The rapid increase in the total number and variety of mobile products has meant that most people have several of the above-mentioned devices. In a typical day, that user would have to separately connect their multiple devices to each of their appropriate chargers for charging of each device. In addition, many people find it necessary to charge their devices in different locations such as their offices and cars. Thus, many users have purchased additional chargers for their offices and cars, for use in charging their mobile phones, notebook computers, and music players in those locations.

[0005] It will be evident that the above situation has caused typical users to have a multitude of incompatible devices (i.e. power supplies and chargers) that essentially provide the same function of charging a mobile device, but because of the number and variety that must be kept by the user are inconvenient to use. In many situations, users simply forget to charge their devices, or else find they need to recharge their device in situations where no appropriate charger is available. This leads to loss of ability to use the device when desired or needed.

[0006] In addition, when traveling way from home, mobile users have a particular problem in that they need to pack and carry the multiple chargers for their devices. In many situations, these chargers are bulkier and heavier than the devices themselves, and use of these devices in foreign countries requires clumsy adaptors, and sometimes voltage converters. This leads to a high degree of inconvenience for the ever-more-mobile consumer.

[0007] In addition, the power connector for the mobile devices is often cheaply manufactured, and a source of mechanical and electrical failure. In many applications, such as toothbrushes or applications where the device is exposed to water and needs to be hermetically sealed, such a physical connection may not be used. Thus an alternative means of powering those types of devices must be used.

[0008] Several products have tried to address this situation. Some companies propose the use of a universal charger that consists of a power supply base unit, and interchangeable tips that both fit into the base unit and in turn fit different devices. The tip includes a customized regulator that sets the voltage required by the particular device. However, a user must carry the multiple tips he

or she needs for each of the various devices they have, and then charge each device serially by connecting the device to the power supply. While this product reduces the overall weight of the charging tools the user must carry, the user still needs to carry and exchange the tips to connect to different devices. In addition, the charging of multiple devices simultaneously is often not possible.

[0009] Realizing that a power supply typically contains a transformer for voltage conversion, another approach is to split the transformer into two parts: a first part can contain the first winding and the electronics to drive this winding at the appropriate operating frequency, while the second part consists of a winding where power is received and then rectified to obtain DC voltage. If the two parts are brought into physical proximity to each other, power is transformed from the first part to the second inductively, i.e. by induction, without any physical electrical connection. This is the approach that is used in many electrical toothbrushes, shavers, and other products that are expected to be used in wet environments. However, a common problem with such inductive units is that the windings are bulky, which restricts their use in lightweight portable devices. Furthermore, to achieve adequate power transfer, the parts must be designed to fit together suitably so that their windings are closely aligned. This is typically done by molding the device casing (for example, an electric toothbrush) and its charger/holder so that they fit together in only one suitable way. However, the molded base and shape of the portable device means they cannot be used in a universal fashion to power other devices.

[0010] Some companies have proposed pad-like charging devices based on inductive concepts, but that also ostensibly allow for different types of devices to be charged. These pads typically include grids of wires in an x and y direction, that carry an electrical current, and that generate a uniform magnetic field parallel to the surface of the pad. A receiver coil wound around a magnetic core lies on the surface of the pad and picks up the magnetic field parallel to the surface, and in this manner energy can be transferred. However, each of these methods suffer from poor power transfer, in that most of the power in the primary is not picked up in the receiver, and thus the overall power efficiency of the charger is very low. In addition, the magnetic cores used for the primary and receiver are often bulky and add to the total cost and size of the system, and limit incorporation into many devices.

[0011] Another point to note is that, while all of the above devices allow a user to charge a device, they also require the charging device or base unit to be electrically connected to a power

source, such as a power outlet or a DC source. In many cases, the user may not have access to such a power source such as when traveling, camping, or working in an area without access to power. However, to date, no device has been provided that is portable, and that allows for inductive charging of multiple devices with differing power requirements, and which itself can be intermittently or occasionally charged either by an external power source, or by other means, or that is self-powered or includes its own power source.

SUMMARY

[0012] Systems and methods are provided for inductive powering and/or charging of electric or electronic devices or batteries. The system typically includes a base unit, such as a charger or power supply, which includes one or more primary coils generally having a planar or curved surface. Each of the one or more primary coils can be activated to generate a magnetic field in a direction substantially perpendicular to the planar or curved surface to provide power to one or more inductive power receiver coils of one or more receivers to power or charge one or more portable devices or batteries. The base unit is capable of detecting a wireless communication signal or a modulation communication signal in the one or more primary coils created by modulation of one or more receivers' impedance or impedances and is capable of using the wireless communication signal or the modulation communication signal to control output voltage, current or power from the one or more receivers

BRIEF DESCRIPTION OF THE FIGURES

[0013] FIG. 1 shows a pad using multiple transmitter or charger coils in accordance with an embodiment.

[0014] FIG. 2 shows a figure of a circuit diagram in accordance with an embodiment.

[0015] FIG. 3 shows a charging pad using multiple coils in accordance with an embodiment.

[0016] FIG. 4 shows a charging pad using multiple overlapping coil layers in accordance with an embodiment.

[0017] FIG. 5 shows the use of multiple coil types and sizes in overlapping pad layers in accordance with an embodiment.

[0018] FIG. 6 shows a receiver with an integrated battery in accordance with an embodiment.

- [0019] FIG. 7 shows a coupling of receiver with a device to be charged or powered in accordance with an embodiment.
- [0020] FIG. 8 shows a pad allowing modular or multiple connectivity in accordance with an embodiment.
- [0021] FIG. 9 shows a figure of a circuit diagram in accordance with an embodiment.
- [0022] FIG. 10 shows a figure of a circuit diagram in accordance with an embodiment.
- [0023] FIG. 11 shows a figure of a circuit diagram in accordance with an embodiment.
- [0024] FIG. 12 shows a figure of power transfer chart in accordance with an embodiment.
- [0025] FIG. 13 shows a figure of a coil layout in accordance with an embodiment.
- [0026] FIG. 14 shows a figure of a coil layout in accordance with an embodiment.
- [0027] FIG. 15 shows a figure of a charging pad with multiple coils in accordance with an embodiment.
- [0028] FIG. 16 shows a figure of a charging pad with movable coils and two devices receiving power or charge in accordance with an embodiment.
- [0029] FIG. 17 shows a figure of a circuit diagram in accordance with an embodiment.
- [0030] FIG. 18 shows an illustration of a means of stacking coils, in accordance with an embodiment.
- [0031] FIG. 19 shows a figure of a circuit diagram for identification verification in accordance with an embodiment.
- [0032] FIG. 20 shows a figure of a circuit diagram for bidirectional communication in accordance with an embodiment.
- [0033] FIG. 21 shows a figure of a circuit diagram for output controller in accordance with an embodiment.
- [0034] FIG. 22 shows a figure of a circuit diagram for the receiver with regulator in accordance with an embodiment.
- [0035] FIG. 23 shows a figure of a circuit diagram for MCU regulation in accordance with an embodiment.
- [0036] FIG. 24 shows a figure of a circuit diagram for unidirectional communication in accordance with an embodiment.
- [0037] FIG. 25 shows a figure of a circuit diagram for time-based regulation in accordance with an embodiment.

[0038] FIG. 26 shows a high level view of a flyback power supply geometry in accordance with an embodiment.

[0039] FIG. 27 shows an embodiment in which the output voltage to a load is monitored and with changes in the load condition, a chip or a Micro Controller Unit (MCU) varies the frequency or the duty cycle of the FET driver to achieve optimum operation.

[0040] FIG. 28 shows an implementation of a charger in accordance with an embodiment, wherein the primary stage and the receiver stage communicate wirelessly.

[0041] FIG. 29 shows an embodiment that includes Zero Voltage Switching (ZVS).

[0042] FIG. 30 shows an embodiment in which, instead of a digital feedback circuit, an analog circuit based on coupling between a light emitting diode (LED) and a light detector can be used.

[0043] FIG. 31 shows an embodiment in which the opto-coupler is replaced by a Voltage Controlled Oscillator (VCO) and FET and in the primary, the signal is sent to adjust a frequency controller to provide optimum output voltage.

[0044] FIG. 32 shows an embodiment in which the wireless link can be analog or digital or can be integrated into the device to take advantage of existing wireless links in the device.

[0045] FIG. 33 shows a basic schematic for an inductive single coil charging system in accordance with an embodiment.

[0046] FIG. 34 shows the main components of a wireless power/charging system in accordance with an embodiment.

[0047] FIG. 35 shows a typical experimental curve for power transferred and Power Transfer in accordance with an embodiment.

[0048] FIG. 36 shows an embodiment in which a coil mosaic is used to cover the surface area of a pad.

[0049] FIG. 37 shows an embodiment in which the number of drive (and sensing) circuits may be reduced by using electrical or electronic switches.

[0050] FIG. 38 shows an embodiment in which three coil layer printed circuit board (PCB) is arranged to provide a cluster for uniform power in an area using only one coil powered at any given time.

[0051] FIG. 39 shows an embodiment in which the coils are arranged such that by powering only one of the coils in the cluster, any receiver coil placed with a center within any location in the effective area can receive the specified power if the appropriate charger coil is activated.

[0052] FIG. 40 shows an embodiment in which the number of switches required is reduced.

[0053] FIG. 41 shows an embodiment of a multi-charger pad that incorporates a plurality of charging clusters.

[0054] FIG. 42 shows an embodiment that uses a cluster of two layers of three coils and a central coil to create an effective area.

[0055] FIG. 43 shows a mosaic of hexagonal coils with the central port to each coil shown as circles.

[0056] FIG. 44 shows an embodiment of a MEMS pad including the top view.

[0057] FIG. 45 shows an embodiment of a MEMS pad including a segmented MEMS charger pad.

[0058] FIG. 46 shows an embodiment in which one or more regulated power supplies are connected to the charger pad.

[0059] FIG. 47 shows an array of contacts on the surface of a pad in accordance with an embodiment.

[0060] FIG. 48 shows the side view of a MEMS conductive charger pad in accordance with an embodiment.

[0061] FIG. 49 shows an embodiment wherein several regulated power supplies provide power to the pad, to allow charging of several devices simultaneously.

[0062] FIG. 50 shows an alternative embodiment of a pad using a segmented surface.

[0063] FIG. 51 shows an industry standard means that is used for measuring emissions from a product.

[0064] FIG. 52 shows an embodiment which illustrates absorption through a copper layer.

[0065] FIG. 53 shows attenuation values for Copper and Aluminum layers for several thicknesses.

[0066] FIG. 54 shows transmitted power through Copper and Aluminum layers of varying thickness for an incident field at 1 MHz.

[0067] FIG. 55 shows an embodiment which allows for obtaining local alignment independence between coils in the charger and the receiver.

[0068] FIG. 56 show an embodiment in which coil magnets can be divided into sections.

[0069] FIG. 57 shows an embodiment in which one or more alignment magnets can be used behind each coil.

[0070] FIG. 58 shows an illustration of a device for inductive power charging that includes an internal battery for self-powered operation, in accordance with an embodiment.

[0071] FIG. 59 shows an illustration of an inductive charger unit with a solar cell power source for self-powered operation, in accordance with an embodiment.

[0072] FIG. 60 shows an illustration of an inductive charger unit with an incorporated communications and/or storage unit, in accordance with an embodiment.

[0073] FIG. 61 shows an illustration of a kiosk that incorporates an inductive charger unit in accordance with an embodiment.

[0074] FIG. 62 illustrates some common regular (non-charger) mobile phone holders types, in accordance with an embodiment.

[0075] FIG. 63 illustrates various products for a music player that includes an external rechargeable battery pack, in accordance with an embodiment.

[0076] FIG. 64 illustrates a multi-function device that includes a hard drive, rechargeable battery, and wireless connectivity, in accordance with an embodiment.

[0077] FIG. 65 illustrates a system for use with a charger case to inductively power or charge a mobile device, in accordance with an embodiment.

[0078] FIG. 66 shows a pad using multiple receiver/energizer coils in accordance with an embodiment.

[0079] FIG. 67 shows, in a multi-charger or power supply where multiple coils are used, such a high heat conductivity layer may be repeated around each coil or cover all areas between the multiple coils, in accordance with an embodiment.

[0080] FIG. 68 shows a similar method that may be used for heat removal from wound coils of other shape and type.

[0081] FIG. 69 shows an embodiment in which the layer can be patterned to provide heat conductivity channels rather than a continuous layer.

[0082] FIG. 70 shows an illustration of the electronics for the PCB coil inductive charger and/or power supply or the inductive receiver as fabricated on the same PCB as the coil, in accordance with an embodiment.

[0083] FIG. 71 shows an embodiment in which magnets placed at the center of a stationary coil or a moving, floating charger and/or power supply coil and the receiver coil can provide a method for alignment of the coils and to achieve this result.

[0084] FIG. 72 shows an embodiment in which two or more magnets that do not cross the center of the coil are used.

[0085] FIG. 73 is an illustration that shows how the magnets may be placed outside the PCB coil area, in accordance with an embodiment.

[0086] FIG. 74 shows an embodiment in which magnetic arc-shaped parts around a circular coil are used.

[0087] FIG. 75 illustrates the use of bar magnets on or around the coil, in accordance with an embodiment.

DETAILED DESCRIPTION

[0088] A portable inductive power source, power device, or unit, for use in powering or charging electrical, electronic, battery-operated, mobile, rechargeable batteries, and other devices is disclosed herein. In accordance with an embodiment the system comprises two parts: The first part is a pad or similar base unit that contains a primary, which creates an alternating magnetic field by means of applying an alternating current to a winding, coil, or any type of current carrying wire. In some embodiments the pad can also contain various signaling, and switching or communication circuitry, or means of identifying the presence of devices or batteries to be charged or powered. In some embodiments the pad can also contain multiple coils or sections to charge or power various devices or to allow charging or powering of devices or batteries placed anywhere on the pad. The second part of the system is a receiver that comprises a means for receiving the energy from the alternating magnetic field from the pad and transferring it to a mobile battery, or other device. The receiver can comprise coils, windings, or any wire that can sense a changing magnetic field, and rectify it to produce a direct current (DC) voltage, which is then used to charge or power the device or battery.

[0089] In some embodiments the receiver can also comprise electronic components or logic to set the voltage and current to the appropriate levels required by the mobile device or battery. In some embodiments, the receiver can also contain circuitry to sense and determine the status of the electronic device or battery to be charged, the battery inside a device, or a variety of other parameters and to communicate this information to the pad. In additional embodiments, the system can provide for additional functionality such as communication of data stored in the

electronic device (for example, digital images stored in cameras, telephone numbers in cell phones, songs in MP3 players) or data into the device.

[0090] Embodiments can also incorporate efficiency measures that improve the efficiency of power transfer between the charger or power supply and the receiver, and ultimately to the mobile device or battery. In accordance with an embodiment, the charger or power supply comprises a switch, (for example, a MOSFET device or another switching mechanism), that is switched at an appropriate frequency to generate an alternative current (AC) voltage across a primary coil, and generates an AC magnetic field. This field in turn generates a voltage in the coil in the receiver that is rectified and then smoothed by a capacitor to provide power to a load, with the result being greater efficiency.

[0091] In accordance with other embodiments the coils are mounted such that they can move laterally within the pad and within an area of their segments, while continuing to be connected to their driver electronics placed on the edges of the area. The floating coils and the drive circuit are sandwiched in between thin upper and lower cover layers that act to allow the coils lateral movement while limiting vertical movement. When a receiver is placed on the pad, the pad senses the position of the receiver coil and moves the coils to the right position to optimize power transfer. Magnets can be used to better orient the coils and improve greater power transfer efficiency.

[0092] Additional embodiments are also described herein. For example, in accordance with an embodiment the charging/power supply device includes an internal battery for self-powered operation. In accordance with other embodiments the charging/power supply device can include a solar cell power source, hand crank, or other means of power supply for occasional self-powered operation. Other embodiments can be incorporated into charging kiosks, automobiles, computer cases, and other electronic devices and applications.

[0093] Inductive Charging System

[0094] While the above mentioned technologies describe various aspects of inductive charging, they do not address the basic requirements that a consumer and manufacturer desire in such a product. These include the following desired features:

[0095] The pad should be able to charge or power a number of devices or batteries with various power requirements efficiently. A typical number may be one to six or even 12 or more devices

or batteries, including four or more low power (up to 5 W) devices or batteries simultaneously. When multiple devices or batteries are being charged, a method for energizing only those coils near a device or battery is preferable.

[0096] The same pad should be able to power low-power devices (mobile phones, PDAs, cameras, game consoles, etc.) or batteries with power requirements of 5 W or less, and higher-power devices such as notebook computers (which often have a power requirement of 60 W or higher) or high power batteries.

[0097] The power transfer efficiency between the primary coil and the receiver should be maximized. Lack of efficiency in the power transfer would necessitate larger and heavier AC to DC power supplies. This would add cost and decrease product attractiveness to customers. Thus methods where the entire pad is energized are not as attractive.

[0098] A simple method for verification of the manufacturer of the receiver, and possibly information for power requirements, should be supported as necessary to ensure product compatibility and to provide means of product registration and licensing.

[0099] The EMI radiation from the system should be minimized, and ideally, the system should radiate little or no EMI with no device present. A charger should preferably not emit any power until an appropriate device or battery is brought close to the charger or power supply itself. In this way, electric power is not wasted, and electromagnetic power is not emitted needlessly. In addition, accidental effects on magnetically sensitive devices such as credit cards, disk drives and such are minimized.

[0100] The pad and the receiver should be reasonably simple to construct, and cost effective. Since both parts can be integrated into mobile devices or batteries, the overall size, weight, and form factor should be minimized.

[0101] As used herein, the term "charger" can refer to a device for supplying power to a mobile or stationary device for the purpose of either charging its battery, operating the device at that moment in time, or both. For example, as is common in portable computers, the power supply can operate the portable computer, or charge its battery, or accomplish both tasks simultaneously. The charger may include circuitry for driving a coil appropriately to generate an AC magnetic field, power or current sense or regulation circuitry, microcontrollers, and means of communication with a receiver, battery, or device. It may also be able to communicate data with a device or battery or perform other functions. As used herein, the term `receiver` means an

inductive coil or coils and the circuitry for rectification and smoothing of received current, any possible control or communication circuitry for communication with the charger and regulation of power and any possible circuit for managing charging or measurement of status of a battery or a device to be charged or powered such as a charge management circuit, fuel gauge, current, voltage, or temperature sensor, etc. The receiver can also incorporate appropriate circuitry for data transfer between a device or battery and the charger. In accordance with an embodiment, the mobile device charger and/or power supply can have any suitable configuration, such as the configuration of a flat pad. The power received by the mobile device from the mobile device charger/power supply (such as the primary in the mobile device charger) can be rectified in the receiver and smoothed by a capacitor before being connected to the rechargeable battery which is represented by the load in the figures. To ensure proper charging of the battery, a regulator or charge management circuit can be placed between the output of the output of the rectifier/capacitor stage and the battery. This regulator or charge management circuit can sense the appropriate parameters of the battery (voltage, current, capacity), and regulate the current drawn from the receiver appropriately. The battery can contain a chip with information regarding its characteristics that can be read out by the regulator or charge management circuit.

Alternatively, such information can be stored in the regulator or charge management circuit for the mobile device to be charged, and an appropriate charging profile can also be programmed into the regulator or charge management circuit.

[0102] FIG. 1 shows a pad using multiple receiver/energizer coils in accordance with an embodiment. In its simplest format, the mobile device or battery charger or power supply preferably has a substantially flat configuration, such as the configuration of a pad 100, and comprises multiple coils or sets of wires 104. These coils or wires can be the same size as or larger than the coils or wires in the mobile devices, or battery and can have similar or different shapes, including for example a spiral shape. For example, for a mobile device charger or power supply designed to charge or provide power to up to four mobile devices of similar power (up to 10 W each) such as mobile phones, MP3 players, batteries, etc., four or more of the coils or wires will ideally be present in the mobile device or battery charger. The charger or power supply pad can be powered by plugging into a power source such as a wall socket or itself be powered or charged inductively. The pad can also be powered by another electronic device, such as the pad being powered through the USB outlet of a laptop or by the connector that laptops

have at the bottom for interfacing with docking stations, or powering other devices. The pad can also be incorporated into a docking station, such as may be used by notebook computers or built into a table or other surface.

[0103] In accordance with an embodiment, a mobile device can include a receiver that includes one or more coils or wires to receive the power from the mobile device charger or power supply. As described in further detail below, the receiver can be made part of the battery in the mobile device or of the shell of the mobile device. When it is part of the mobile device shell, the receiver can be part of the inside surface of the mobile device shell or of the outside surface of the mobile device shell. The receiver can be connected to the power input jack of the mobile device or can bypass the input jack and be directly connected to the battery or charge management circuit inside the mobile device. In any of these configurations, the receiver includes one or more appropriate coil or wire geometries that can receive power from the mobile device charger or power supply when it is placed adjacent to the mobile device charger or power supply. In accordance with an embodiment, the coils in the mobile device charger or power supply and/or the coils in the mobile devices or battery can be printed circuit board (PCB) coils, and the PCB coils can be placed in one or more layers of PCB.

[0104] In some embodiments, the charger or power supply can also itself be built into a mobile device or battery. For example, a laptop computer or other portable or mobile device can incorporate a charger or power supply section so that other mobile devices can be charged or powered as described above. Alternatively, using the same set of coils or wires, or a separate set of coils or wires, any mobile device or battery can itself be used as an inductive charger or power supply to power or charge other mobile devices or batteries.

[0105] In accordance with an embodiment, the mobile device charger/power supply or pad, and the various mobile devices or batteries, can communicate with each other to transfer data. In one embodiment, the coils in the mobile device charger/power supply that are used for powering or charging the mobile device, or another set of coils in the same PCB layer or in a separate layer, can be used for data transfer between the mobile device charger/power supply and the mobile device to be charged or powered or the battery directly. Techniques employed in radio and network communication, such as radio frequency identification (RFID), Bluetooth, WiFi, Wireless USB, or others can be used. In one embodiment a chip connected to an antenna (for example, the receiver coil or separate data antenna) or another means of transfer of information

can be used to provide information about, for example, the presence of the mobile device or battery, its authenticity (for example its manufacturer code) and the devices' charging/power requirements (such as its required voltage, battery capacity, and charge algorithm profile).

[0106] In accordance with an embodiment, a typical sequence for charger/power supply operation is as follows:

[0107] The mobile device charger or power supply can be in a low power status normally, thus minimizing power usage.

[0108] Periodically, each of the coils (or a separate data coil in another PCB layer) is powered up in rotation with a short signal such as a short radiofrequency (RF) signal that can activate a signal receiver in the receiver such as an RF ID tag or a circuitry connected to the receiver coil.

[0109] The mobile device charger/power supply then tries to identify a return signal from any mobile device, battery (or any receiver) that may be nearby.

[0110] Once a mobile device, or battery (or a receiver) is detected, the mobile device charger or power supply and the mobile device or battery to proceed to exchange information.

[0111] This information can include a unique ID code that can verify the authenticity and manufacturer of the charger or power supply and mobile device or battery, the voltage requirements of the battery or the mobile device, and the capacity of the battery. For security purposes or to avoid counterfeit device or pad manufacture, such information can be encrypted, as is common in some RFID tags or other verification systems.

[0112] In accordance with various embodiments, other protocols such as Near Field Communications (NFC) or Felica can be used, wherein the circuitry containing the ID and the necessary information is powered either by the mobile device or battery or remotely by the mobile device charger or power supply. Depending on the particular implementation needs, Bluetooth, WiFi, Wireless USB, and other information transfer processes can be used. Additional information regarding the charging profile for the battery can also be exchanged and can include parameters that are used in a pre-programmed charge profile stored in the mobile device or battery charger. However, the information exchanged can be as simple as an acknowledge signal that shows the mobile device charger that a mobile device or rechargeable battery is present. The charger or power supply can also contain means for detection and comparison of the strength of the signal over different locations on the charger or power supply. In this way, it can determine

the location of the mobile device or battery on the charger or power supply, and then proceed to activate the appropriate region for charging or powering.

[0113] In some embodiments that require greater simplicity, no communication need take place between the mobile device charger or power supply and the mobile device or battery. In some embodiments the mobile device charger or power supply can sense the mobile device or battery by detecting a change in the conditions of a resonant circuit in the mobile device charger or power supply when the mobile device or battery is brought nearby. In other embodiments the mobile device or battery can be sensed by means of a number of proximity sensors such as capacitance, weight, magnetic, optical, or other sensors that determine the presence of a mobile device or battery near a coil in the mobile device or battery charger or power supply. Once a mobile device or battery is sensed near a primary coil or section of the mobile device or battery charger or power supply, the mobile device charger or power supply can then activate that primary coil or section to provide power to the receiver coil in the mobile device's battery, shell, receiver module, battery, or the device itself.

[0114] Inductive Charging Circuit

[0115] Each mobile device and its battery have particular characteristics (voltage, capacity, etc.). In order to facilitate these different devices or batteries with a single universal mobile device charger or power supply, several circuit architectures are possible, some of which are described in further detail below.

[0116] FIG. 2 shows the main components of a typical inductive power transfer system 110. The circuit illustrated is used to illustrate the principle of inductive power transfer and is not meant to be limiting to an embodiment. In accordance with an embodiment, the charger 112 comprises a power source 118, and a switch T 126 (which can be a MOSFET or other switching mechanism) that is switched at an appropriate frequency to generate an AC voltage across the primary coil L_p 116 and generate an AC magnetic field. This field in turn generates a voltage in the coil 120 in the receiver 114 that is rectified and then smoothed by a capacitor to provide power 122 to a load R_I 124. For ease of use, a receiver can be integrated with a mobile device, such as integrated inside the mobile device or attached to the surface of the mobile device during manufacture, to enable the device to receive power inductively from a mobile device charger or integrated into, or on its battery.

[0117] In accordance with an embodiment, the circuit shown in FIG. 2 can receive energy fed to it from a power source, store the energy alternately in the inductor and the timing capacitor (much like a tank stores liquid), and subsequently produce an output as a continuous alternating current (AC) wave. As the voltage is applied to the primary side, the tank circuit supplies the energy to the receiver. One of the benefits of such a design is that the timing capacitor in the circuit can be easily replaced. For example, if a relatively higher value for capacitance (referred to in some instances as a timing capacitance) is used, then the frequency of operation is lowered. This increases the on-time for the circuit, and provides longer power transfer and current through the transformer, and thus more power. As such a higher value of capacitance can be used for high power applications. Conversely, if a relatively lower value for capacitance is used, then the frequency of operation is increased. This reduces the on-time and provides less power transfer and current through the transformer, and thus less power. Thus, a lower value of capacitance can be used for low power applications. Replacing the timing capacitance can be easily handled during manufacturing to tune the power requirement on a macro level, i.e. to get the output into an appropriate range for the chosen application. Additional techniques can then be used to set the voltage output on a more accurate basis.

[0118] The mobile device or its battery typically can include additional rectifier(s) and capacitor(s) to change the AC induced voltage to a DC voltage. This is then fed to a regulator/charge management chip which includes the appropriate information for the battery and/or the mobile device. The mobile device charger provides power and the regulation is provided by the mobile device. The mobile device or battery charger or power supply, after exchanging information with the mobile device or battery, determines the appropriate charging/powering conditions to the mobile device. It then proceeds to power the mobile device with the appropriate parameters required. For example, to set the mobile device voltage to the right value required, the value of the voltage to the mobile device charger can be set. Alternatively, the duty cycle of the charger switching circuit or its frequency can be changed to modify the voltage in the mobile device or battery. Alternatively, a combination of the above two approaches can be followed, wherein regulation is partially provided by the charger or power supply, and partially by the circuitry in the receiver.

[0119] Inductive Charger Pad

[0120] To allow the operation of the mobile device or battery charger or power supply regardless of position of the mobile device or battery, the total area of the mobile device or battery charger or power supply can be covered by coils or by another wire geometry that creates magnetic field.

[0121] FIG. 3 shows a charging pad using multiple coils in accordance with an embodiment. As shown in FIG. 3, in accordance with an embodiment the pad 140 is largely covered with individual receiver coils 144.

[0122] FIG. 4 shows a charging pad using multiple overlapping coil layers in accordance with an embodiment. This embodiment addresses the problem of voids between the multiple coils. As shown in FIG. 4, any areas of the pad 150 with minimal magnetic field between a first set of coils 152 can be filled by a second set of coils 154, so that the coils are tiled such that the centers of this coil array fill the voids in the primary set. This second set can be at a different layer of the same PCB, or in a different PCB. In each of these geometries, the sensing circuitry can probe each location of a coil in a raster, predetermined, or random fashion. Once a mobile device or battery on or near a coil is detected, that coil is activated to provide power to the receiving unit receiver of the appropriate device.

[0123] It can be seen from the above example that by providing more layers of the PCB with coils, or by providing coils of different geometry or size, one can obtain as much resolution or coverage as desired.

[0124] In accordance with an embodiment, to power mobile devices or batteries with power requirements that exceed maximum powers attainable by typical coils in a surface, the mobile device or battery, during its hand shake and verification process can indicate its power/voltage requirements to the mobile device or battery charger or power supply. Several geometries for achieving power/voltage levels otherwise not attainable from a single primary coil of the mobile device or battery charger or power supply are possible.

[0125] In accordance with one embodiment of the system geometry, the power receiving unit of the mobile device or battery has several coils or receiving units that are connected such that the power from several primary coils or sets of wires of the mobile device or battery charger or power supply can add to produce a higher total power. For example, if each primary coil is capable of outputting a maximum of 10 Watts, by using six primary coils and six receiver coils, a total output power of 60 Watts can be achieved. The number of primary and receiver coils need not be the same, and a large receiver coil (receiving unit) that is able to capture the majority of

magnetic flux produced by 6 or other number of primary coils or a large primary coil powering six or another number of receiver coils can achieve the same effect. The size and shape of the multiple primary coils and receiver coils also do not need to be the same. Furthermore, neither set of primary and receiver coils need to be in the same plane or PCB layer. For example, the primary coils in the examples shown above can be dispersed such that some lay on one PCB plane and the others in another plane.

[0126] In accordance with another geometry, the PCB of the mobile device or battery charger or power supply has multiple layers, wherein coils or wire patterns of certain size and power range can be printed on one or more layers and other layers can contain coils or wire patterns of larger or smaller size and power capability. In this way, for example, for low power devices, a primary from one of the layers will provide power to the mobile device or battery. If a device or battery with higher power requirements is placed on the pad, the mobile device or battery charger or power supply can detect its power requirements and activate a larger coil or wire pattern with higher power capabilities or a coil or wire pattern that is connected to higher power circuitry. One may also achieve similar results by using a combination of the different processes and geometries described above.

[0127] FIG. 5 shows the use of multiple coil types and sizes in overlapping pad layers in accordance with an embodiment. As shown in FIG. 5, the mobile device or battery charger or power supply or pad 160 can comprise two overlapping layers with a first layer 162 containing low power coils, and a second layer 164 containing high power coils.

[0128] Inductive Charging Receiver

[0129] As described above, the inductive charging or power supply pad is used to power a receiver, which in turn is used to power or to charge a portable or mobile device or battery. In accordance with one embodiment of the receiver, the power from the mobile device or battery charger or power supply is emitted at a magnitude that is sufficient to power any foreseeable mobile device or battery (such as 5 W or 10 W for small mobile devices or batteries). The receiver that is appropriate for each mobile device or battery has a power receiving part that when matched to the mobile device or battery charger or power supply is able to receive sufficient power for the mobile device or battery. For example a receiver for a mobile phone requiring 2.5 W can be a coil with certain diameter, number of turns, wire width, etc. to allow

receipt of the appropriate power. The power is rectified, filtered, and then fed into the battery or power jack of the device. As discussed above, a regulator or charge management circuit can be used before the power is provided to the battery or the mobile device.

[0130] To save energy, the power emitted by the mobile device or battery charger or power supply can be regulated. It is desirable to regulate the power emitted by the charger or power supply because if the charger or power supply is emitting 10 W of power and the receiver is designed to receive 5 W, the rest of the emitted power is wasted. In one embodiment, the receiver or the mobile device can, through an electrical (such as RF), mechanical, or optical method, inform the charger or power supply about the voltage/current characteristics of the device or battery. The primary of the charger or power supply in the circuit diagrams shown above then can be driven to create the appropriate voltage/current in the receiver. For example, the duty cycle of the switch in that circuit can be programmed with a microprocessor to be changed to provide the appropriate levels in the receiver.

[0131] In accordance with an embodiment, the programming can be performed by a look up table in a memory location connected to a microprocessor or by using an algorithm pre-programmed into the microprocessor. Alternatively, the frequency of the switch can be changed to move the circuit into, and out of, resonance to create the appropriate voltage in the receiver. In an alternate geometry, the voltage into the circuitry in the primary can be changed to vary the voltage output from the receiver. Furthermore, the induced voltage/current in the mobile device can be sensed and communicated to the charger to form a closed-loop, and the duty cycle, frequency, and/or voltage of the switch can be adjusted to achieve the desired voltage/current in the mobile device.

[0132] In accordance with an embodiment, the receiver is built onto or into the battery for the mobile device. The receiver can include one or more coils or wires shaped to receive power from the charger or power supply. The one or more coils or wires can be either printed on one or more PCBs, or formed from regular wires. As described above, the receiver can also contain rectifier(s) and capacitor(s) to produce a cleaner DC voltage. This output can be directly, or through a current limiting resistor, connected to one of the contacts on the battery. To avoid overcharging the battery, a battery regulator or charge management chip can also be used. This circuit then measures the various parameters of the battery (voltage, degree of charging, temperature, etc.) and uses an internal program to regulate the power drawn from the circuit to

ensure over-charging does not occur. The circuit can also include LEDs to show the receiver being in the presence of a magnetic field from the charger, complete charge LEDs and/or audible signals.

[0133] In typical commercial and end-user applications, such as in cell phones, PDAs, and MP3 players, the battery can be incorporated into the battery pack or the device by the original equipment manufacturer (OEM), or as an after-market size and shape compatible battery pack that can replace the original battery pack. The battery compartment in these applications is typically at the bottom of the device. The user can open the battery compartment, take out the conventional battery, replace it with a modified battery in accordance with an embodiment, and then replace the battery lid. The battery can then be charged inductively when the mobile device is placed adjacent a mobile device charger.

[0134] To enhance the ability of the receiver to receive power, it may be desirable to minimize the distance between the charger's primary coil and the receiver's coil or wire. In order to achieve this, in accordance with an embodiment the receiver's coil or wire can be put on the outside of the battery pack.

[0135] FIG. 6 shows a battery with an integrated receiver in accordance with an embodiment. As shown in FIG. 6, the receiver 170 comprises the battery 182, together with the receiver coil 172, and any rectifiers 174, capacitors 176, regulators or charge management chips 180 necessary for proper operation of the charging receiver. If the battery compartment lid of the device prevents a power receiving light emitting diode (LED) to be seen, the lid can itself be replaced with a see-through lid or a lid with a light pipe that will allow the user to see the charging indicator LED when the mobile device is placed adjacent to the charger.

[0136] In an alternative embodiment, the receiver battery can include a mechanical, magnetic, or optical method of alignment of the coils or wires of the charger and mobile device for optimum power transfer. In accordance with an embodiment, the center of the primary in the charger contains a magnet such as a cylinder or disk or ring with the poles parallel to the charger surface and the magnetic field perpendicular to the charger surface. The receiver also contains a magnet or magnetic metal part of a similar or different shape behind or in front of the coil or wire receivers. When the mobile device or battery is placed on or adjacent to the charger or power supply, the magnets attract and pull the two parts into alignment with the centers of the two coils or wires aligned. The magnets do not need to be especially strong to actively do this. Weaker

magnets can provide guidance to the user's hand and largely achieve the intended results.

Alternatively, audible, or visual signs (for example an LED that gets brighter as the parts are closer aligned), or mechanical means (dimples, protrusions, etc.) can be used for alignment.

[0137] In accordance with another embodiment, the coil or wires and the magnet in the charger or power supply are mechanically attached to the body of the charger or power supply such that the coil can move to align itself appropriately with the mobile device or battery when it is brought into close proximity to the charger or power supply. In this way, an automatic alignment of coils or wire patterns can be achieved.

[0138] In another embodiment, the receiver electronics described above are preferably made from flexible PCB which can be formed into a curved shape. Such a PCB can be placed on the surface of a battery pack, including one that is not flat, or that has a curved shape. The curve on the battery or back of a mobile device battery lid can be matched to a curved primary in the mobile device or battery charger or power supply and be used for alignment. One example of usage of this embodiment can be for example flashlights that have circular handles: the batteries can be charged with coils on the side of circular batteries, or circling the cylindrical battery. Similarly, the mobile device or battery charger or power supply can have a curved shape. For example, the charger or power supply surface can be in the shape of a bowl or some similar object. A mobile device or battery that may have a flat or curved back can be placed into the bowl. The shape of the bowl can be made to ensure that the coil of the mobile device or battery is aligned with a primary coil to receive power.

[0139] In another embodiment, the primary can be incorporated into a shape such as a cup. A mobile device can be placed into the cup standing on end and the receiver can be built-in to the end of the mobile device (such as a mobile phone) or battery or on the back or circumference of the device or battery. The receiver can receive power from the bottom or wall of the cup.

[0140] In another embodiment, the primary of the charger can have a flat shape and the mobile devices or battery can be stood up to receive power. The receiver is built into the end of the device or battery in this case and a stand or some mechanical means can be incorporated to hold the device or battery while being charged.

[0141] In another embodiment, the charger or power supply can be made to be mounted on a wall or a similar surface, vertically or at an angle (such as on a surface in a car), so as to save space. The charger or power supply can incorporate physical features, magnets, fasteners or the

like to enable attachment or holding of mobile devices to be charged. The devices or batteries to be charged or powered can also incorporate a retainer, magnet, or physical shape to enable them to stay on the charger or power supply in a vertical, slanted, or some other position. In this way, the device or battery can be charged or powered by the primary while it is near or on it.

[0142] For those applications where the lid of the battery compartment or the bottom part of the mobile device is made from a metal, a replacement non-metallic lid or backing can be used.

Alternatively, the coil can be attached to the outside of the metal surface. This allows electromagnetic (EM) fields to arrive at the power receiver coil or wires. The rest of the receiver (i.e. circuitry) can be placed behind a metal for the receiver to work. In some other applications where the battery has metal parts, these parts may interfere with the EM field and the operation of the coil in the receiver. In these cases, it may be desirable to provide a distance between the metal in the battery and the coils. This can be done with a thicker PCB or battery top surface. Alternatively, to provide additional immunity, ferrite material (such as those provided by Ferrishield Inc.) can be used between the receiver and the battery to shield the battery or device from the EM fields. These materials can be made so as to be thin, and then used during the construction of the integrated battery/receiver.

[0143] In accordance with another embodiment, the receiver in the battery or mobile device also includes a means for providing information regarding battery manufacturer, required voltage, capacity; current, charge status, serial number, temperature, etc. to the charger. In a simplified embodiment, only the manufacturer, required voltage, and/or serial number are transmitted. This information is used by the charger or power supply to adjust the primary to provide the correct charge or power conditions. The regulator or charge management chip in the receiver can then regulate the current and the load to charge the battery correctly and can end charge at the end. In another embodiment, the receiver can control the charging process fully depending on the time dependent information on battery status provided to it. Alternatively, the charging process can be controlled by the charger in a similar manner. As described above, the information exchange between the charger and the receiver can be through an RF link or an optical transmitter/detector, RFID techniques, Near-Field Communication (NFC), Felica, Bluetooth, WiFi, or some other method of information transfer. Similarly, the receiver can send signals that can be used by the charger to determine the location of the receiver to determine which coil or section of the charger or power supply to activate. The communication link can also use the same coil or wires as

antenna for data transfer or use a separate antenna. In some embodiments the received can use the actual capabilities of the mobile device (for example, the built-in Bluetooth or NFC capabilities of mobile phones) to communicate with the charging or power supply pad.

[0144] As described above, in accordance with some embodiments the receiver can be integrated into the body of the device or battery itself at a location that may be appropriate and can be exposed to EM radiation from outside. The output of the receiver can be routed to the electrodes of the battery internally inside the device and appropriate circuitry inside the device can sense and regulate the power. The device can include LEDs, messages, etc. or audible signs that indicate to the user that charging is occurring or complete or indicate the strength of the received power (i.e., alignment with a primary in the charger) or the degree of battery charge. In other embodiments, the receiver is built into an inner or outer surface of a component that is a part of the mobile device or battery's outer surface where it is closest to the charger. This can be done as original equipment or as an after-market item. The component can be the lid of the battery pack or the bottom cover of the mobile device. In yet other embodiments, the receiver can be integrated into the back or front of the battery compartment or an interchangeable shell for the mobile device for use in after-market applications. For example, in a mobile phone application, the back battery cover or shell can be removed and replaced with the new shell or battery cover with the receiver built in.

[0145] FIG. 7 shows a coupling of receiver with a device to be charged or powered in accordance with an embodiment. As shown in FIG. 7, the original mobile phone setup 190 includes a device 192 with shell 194 and power jack 196. The after-market modification 200 replaces the original shell with a combination shell 210 that includes the necessary receiver coils and battery couplings. The contacts from this circuitry can then make direct contact to the battery electrodes inside the mobile device or to some contact points inside the mobile device if such contacts exist or become provisioned by the device manufacturer during manufacture.

Alternatively, the receiver may be a component (such as a shell) that has a connector that plugs into the input power jack of the mobile phone or electrodes of a battery. The receiver can be fixed to, or detachable from, the mobile device or battery. This can be achieved by having a plug that is attached either rigidly or by a wire to the receiver (shell). Alternatively, the replacement receiver (shell) can be larger than the original shell and extend back further than the original shell and contain the plug so that when the receiver (shell) is attached, simultaneously, contact to

the input power jack is made. Alternatively, the receiver (shell) can have a pass-through plug so that while contact is made to this input power connector, the connector allows for an external regular power supply plug to be also used as an alternative. Alternatively, instead of a pass-through, this part can include a power jack in another location in the back so that a regular power supply can be used to charge the battery. In cases where the connector to the device performs other functions such as communication to the device, a pass-through connector can allow communication/connectivity to the device.

[0146] In accordance with another embodiment, the replacement receiver (i.e. the replacement shell) or the plug in unit, in addition to the power receiver components and circuitry, can include additional circuitry that can provide further functionalities to the mobile device. These can include, for example, the ability to exchange data through Bluetooth, WiFi, NFC, Felica, WiMax, RFID, or another wireless or optical mechanism. It can also provide extended functionalities such as Global Positioning System (GPS) location information, flashing lights, flashlight, or other decorative or electronic functions. As described above, various methods for improving coil alignment, or location, battery manufacturer, or battery condition information transfer can also be integrated into the receiver or replacement shell.

[0147] In another embodiment, the receiver is supplied in the form of a separate unit that is attached to the input jack of the mobile device or battery or integrated into a receiver protective skin for the mobile device. Many leather or plastic covers for mobile phones, cameras, and MP3 players already exist. The primary purpose of these covers is to protect the device from mechanical scratches, shocks, and impact during daily use. However, they typically have a mere decorative or advertising application. In accordance with one embodiment, the receiver is formed of a thin PCB with the electronics formed thereon, and the receiver coil or wire that is attached to the back of the device and plugs into the input jack similar to the shell described above. Alternatively, it can be connected through a flexible wire or flexible circuit board that is routed to a plug for the input power jack.

[0148] In accordance with another embodiment, the receiver can be a separate part that gets plugged into the input jack during charging and is placed on the charger and can then be unplugged after charging is finished.

[0149] In another embodiment, the receiver is built in the inside or outside surface or in between two layers of a plastic, leather, silicone, or cloth cover for the mobile device and plugs in or makes contact to the contact points on the device.

[0150] It will be noted that certain devices such as notebooks and some music players have metal bottom surfaces. The methods described above for changing the back surface or use of a plug in the mobile device or a secondary skin with an integrated receiver is particularly useful for these applications. As described previously, the effect of the metal surface can also be minimized, if necessary, by increasing the distance between the wires of the receiver and the metal surface or by placing a ferrite layer in between the receiver and the metal bottom.

[0151] It is also noted that the use of methods such as curving the receiver or integrating magnets, LEDs, audio signals or messages, etc. for alignment, or methods for location, manufacturer or charging condition identification, as described above are possible with all embodiments of an embodiment described above. In any of the above cases, the charger or power supply can contain lights, LEDs, displays, or audio signals or messages to help guide the user to place the mobile device or battery on a primary coil for maximum reception, to show charging is occurring, and to show the device is fully charged. Displays to show how full the battery is or other information can also be incorporated.

[0152] Flexible/Modular Charging Pad

[0153] In accordance with an embodiment a flexible mobile device charger or power supply is provided in the shape of a pad that can be folded or rolled up for carrying. In one implementation of an embodiment, the electronics of the charger or power supply are placed on a thin flexible PCB or the coils are made of wires that can be rolled up or shaped. The electronics components made of silicon chips, capacitors, resistors and the like may not be flexible but take up very little space. These rigid components can be mounted on a flexible or rigid circuit board, while the main section of the pad containing the coils or wires for energy transfer can be made to be flexible to allow conformity to a surface or to be rolled up. Thus the pad resembles a thin mouse pad or the like.

[0154] In some cases, it may be advantageous to the user to have a mobile device charger or power supply that is extendible in functionalities. The cases include but are not limited to:

[0155] A user may purchase a mobile device or battery charger or power supply for charging or powering a single low power device or battery but, at a later stage, may want to extend the capability to charge or power more devices or batteries simultaneously.

[0156] A user may purchase a mobile device or battery charger or power supply for charging or supplying power to one or more low power devices or batteries but may want to charge or supply power to more low power or high power devices or batteries.

[0157] A user may buy a mobile device or battery charger or power supply that can charge or supply power to one or more low-power or high-power devices or batteries and later wish to have the communication or local storage, or a rechargeable battery, or means of power generation such as solar panels or some other capability, added to the charger or power supply.

[0158] In all of the cases above and others, it can be useful to have a modular approach to expand the capabilities of the mobile device or battery charger or power supply.

[0159] FIG. 8 shows a pad 220 in accordance with an embodiment that allows for modular or multiple connectivity. In this case, the user can purchase a first unit 222 that is powered by an electric outlet 224. However, interconnects 226 for power and data are provided so that additional units 228, 230 can simply fit or plug into this first one directly or indirectly and expand the capabilities as the customer's needs grow. Data communications and storage units 234 can also be attached in a modular fashion. This approach would enable the customer to use the technology at a low cost entry point and grow his/her capabilities over time.

[0160] Some of the electronics devices that can benefit from these methods include: mobile phones, cordless phones, personal data assistants (PDAs), pagers, walkie-talkies, other mobile communication devices, mobile electronic mail devices, Blackberry's, MP3 players, CD players, DVD players, game consoles, headsets, Bluetooth headsets, hearing aids, head-mounted displays, GPS units, flashlights, watches, cassette players, laptops, electronic address books, handheld scanning devices, toys, electronic books, still cameras, video cameras, film cameras, portable printers, portable projection systems, IR viewers, underwater cameras or any waterproof device, toothbrushes, shavers, medical equipment, scientific equipment, dental equipment, military equipment, coffee mugs, kitchen appliances, cooking pots and pans, lamps or any battery, DC, or AC operated device.

[0161] In addition, inductive power transfer can provide power to devices that are not so far battery operated. For example, a mobile device charger or power supply in the shape of a pad

placed on a desk or a kitchen table can be used to power lamps or kitchen appliances. In one embodiment for the use in a kitchen, a flat charger, or power supply such as a pad, placed on or built into a counter can allow the chef to place devices on the charger or power supply to be inductively charged or powered during use and simply place them away after use. The devices can be, for example, a blender, mixer, can opener, or even pot, pan, or heater. This can eliminate the need for a separate cooking and work area. It will be noted that placement of a metal pan close to the inductive pad can directly heat the pan and the contents while keeping the charger or power supply surface cool. Due to this reason, inductive kitchen ranges have been commercialized and shown to be more efficient than the electric ranges that work by resistive heating of a coil.

[0162] In another embodiment, rather than direct heating of metal pans by nearby inductive fields, cooking pans may include a receiver and heating or even cooling elements. Once placed on a charger, the pan will heat up or cool down as desired by a dial or the like on the pan allowing precise temperature control of the pan and the contents.

[0163] Similarly, in an office or work area setting, if a charger or power supply is readily available for charging or powering mobile devices or batteries, it can also be used to power up lamps for illumination of the desk or used to power or charge office appliances, such as fax machines, staplers, copiers, scanners, telephones, and computers. In one embodiment, the receiver can be built into the bottom of a table lamp and the received power is used to power the incandescent or LED lamp.

[0164] In another embodiment, a mug, cup, glass, or other eating appliance such as a plate can be fitted with a receiver at its bottom. The received power can be used to heat the mug, etc. with a heating coil thus keeping beverages or food warm to any degree desired. Furthermore, in accordance with an embodiment, by use of devices such as thermoelectric coolers the contents can be cooled or heated as desired.

[0165] Similarly, many children's toys often run out of battery power due to extended use or simple forgetfulness to turn the device off. Often these batteries are included inside a battery compartment that for safety reasons can only be opened by a screwdriver. Inclusion of the receiver into toys or batteries inside can reduce the need to change the device batteries and allow recharging with a much simpler method.

[0166] In another implementation, the receiver can be built into medical devices or their batteries that are implanted or inserted in the body. Since batteries in these devices such as pace makers, cochlear implants, hearing aids, or other monitoring devices may need periodic charging, inductive power transfer can provide an ideal non-contact method for charging and testing the performance of the devices (i.e. check up) or downloading data that the devices have logged.

[0167] In another implementation, some active RFID tags include batteries that can send out information about the status or location of a package or shipment. An inexpensive method for charging these tags is to include a receiver with each tag. Thus, a charger can be used to power or charge these RFID tags.

[0168] It will be noted that the effective working distance of the inductive charger is dependent on the power and the frequency of the source and the size and geometry of the coil. By increasing the frequency to several or tens of MHz, one can obtain a working distance of several inches or feet depending on the application for the technology. It will also be noted that any of the above embodiments that eliminate the input power jack are especially important because they add to product reliability by removing a source of mechanical or environmental failure. In addition, elimination of the jack is imperative for water proof applications and for extra safety.

[0169] Efficiency Enhancements through Coil Circuit

[0170] In accordance with an embodiment, in order for the power efficiency to be maximized and to minimize losses in the coil, the coils should be manufactured to have as low a resistance as possible. This can be achieved by use of more conductive material such as gold, silver, etc. However the costs of these materials are sometimes prohibitive. In practice, reduced resistivity can be obtained by using thicker copper-clad PCBs or wider tracks. Most common PCBs use 1-2 oz copper PCBs. In accordance with some embodiments the coil PCB used for the wireless charger can be made from PCBs clad with between 2 and 4, or even 6 oz copper. The process of manufacture of the PCB can also be optimized to achieve higher conductivity. For example, sputtered copper has a higher conductivity than rolled copper and is typically better for this application. In operation, the coil and the circuitry demonstrate a resonance at a frequency determined by the parameters of the design of the coil (for example, the number of windings, coil thickness, width, etc.). Previous work has concentrated on circuits driven by square waves with a

MOSFET. This approach has the disadvantage that since a square wave is not a pure sinusoid, it produces harmonics. These harmonics are undesirable because:

[0171] The PCB coil produces optimum power transfer efficiency at a particular frequency. The harmonics in the primary signal are not transferred as efficiently and decrease the overall system efficiency.

[0172] The rapid voltage change in the leading and falling edge of the square wave creates oscillations that create further harmonics resulting further EMI.

[0173] The harmonics radiated by the primary create higher frequency components that contribute to the EMI that is more radiative (due to higher frequency). It is desirable to limit the frequency range of the operation of the overall system to as low a frequency as possible while maintaining the other requirements of the system (such as sufficient working distance, etc.), so these harmonics must be avoided.

[0174] At the instance of switch turn-on and turn-off, the change in the in-rush current to the coil causes huge voltage swings across the coil for a short period of time. All the power is transferred to the receiver during these times that are short.

[0175] Previous attempts to achieve 90% transfer efficiency with PCB coil primary and receiver have used a laboratory power supply to drive their circuit. While this approach has demonstrated the higher efficiency that can be achieved with a sinusoidal voltage on the coil, such power supplies are complex, costly, and too large to be able to be used for any practical charger application. In accordance with an embodiment, a capacitor is added in parallel to the drain/source contacts of the MOSFET.

[0176] FIG. 9 shows a figure of a circuit diagram 240 in accordance with an embodiment. The coil in the wireless charger system is driven by switching the FET at the resonance frequency of the circuit when the receiver is present. Without the receiver nearby, the circuit is detuned from resonance and radiates minimal EMI. The capacitor 244 acts as a reservoir of energy that discharges during switch off time and enhances energy transfer. As with the examples described above, changing the value of the capacitance allows for tuning the power and efficiency levels on a lower-power/high-power basis, and additional features and techniques can be used to fine tune the power output for particular devices.

[0177] The circuit designs illustrated in FIG. 2 and FIG. 9 use a zero-crossing power supply. Briefly, in a zero-crossing power supply, when the transistor in the primary coil is first turned on,

electrical current passes through the primary coil and the transistor to ground. When the transistor is then turned off, the voltage level at the transistor swings high (for example, if the input voltage is 5V, then the voltage level may swing to 10V, or even 100V). A non-zero-crossing circuit allows the current to drop to zero, before the cycle is restarted. A forward mode circuit can then use an inductor in series with the load to revive the current and charge up the inductor, while a diode allows charging in both directions (when full phase AC is used).

[0178] In a traditional transformer design, zero-crossing is not used, since it invariably results in lower efficiency compared to non-zero designs, at least with higher power or ferrite cores. This is primarily because the traditional ferrite cores act as capacitors and store energy, which in turn reduces the circuit efficiency. As described above, in accordance with an embodiment, when a non-ferrite coil there is no magnetic flux, so the efficiency is not affected to the same extent.

[0179] Furthermore, since the system does not use a ferrite or ferromagnetic core, the overall size and weight of the device can be reduced. In accordance with some embodiments the coil can be formed on a printed circuit board (PCB), with no heavy ferrite coils, no soldering and no wiring to the coils. In accordance with some embodiments there is no need for a magnetic core in the secondary in the receiver. Since magnetic cores are usually large and heavy this results in considerable size savings.

[0180] By way of example, in accordance with an embodiment that uses an IRFR0220 chip as a FET and use 4 oz copper coils with 9 turns and 1.25" diameter, the circuit in FIG. 2 above, can be loaded with RL of 10 Ohm and tuned to operate at 1.3 MHz. With matching coils in the primary and secondary in the receiver, without capacitor C, total circuit efficiency of the circuit including the clock and FET driver circuit approaches 48%. Addition of a 1600 pF capacitor in parallel to the FET increases the total circuit efficiency to 75% (a better than 50% increase in efficiency), while simultaneously decreasing the voltage across the FET and also the harmonics in the circuit. The coil to coil transfer efficiency with the capacitor placed in parallel with the FET is estimated to be approximately 90%. The advantages of this approach include:

[0181] High efficiency ($\approx 90\%$ coil to coil).

[0182] Low ringing oscillation and EMI.

[0183] Simplicity and low cost.

[0184] Lower FET source-drain voltage swing allowing use of a larger selection of FETs.

[0185] In many applications, it is also desired that the pad and the receiver are arranged so that the pad does not emit power unless the receiver is nearby.

[0186] FIG. 10 and FIG. 11 show circuit diagrams in accordance with an embodiment. In addition to high efficiency, one method that is required for minimizing EMI and maintaining high overall efficiency is the ability to recognize the presence of a receiver nearby, and then turning on the pad only when appropriate. Two methods for this are described below.

[0187] As shown in FIG. 10, in accordance with one embodiment, the pad circuit 260 incorporates a micro control unit (MCU1) 266 that can enable or disable the FET driver 268. The MCU1 receives input from another sensor mechanism that will provide information that it can then use to decide whether a device is nearby, what voltage the device requires, and/or to authenticate the device to be charged or powered.

[0188] One of the sensor mechanisms for this information are through the use of an RFID reader 280 that can detect an RFID tag of circuit and antenna in the receiver (i.e. device or battery to be charged or powered). The information on the tag can be detected to identify the voltage in the receiver required and to authenticate the circuit to be genuine or under license. The information on the tag can be encrypted to provide further security. Once a device or battery containing the tag is nearby the pad, the RFID reader can be activated, can read the information on the tag memory, and compare with a table to determine authenticity/voltage required or other info. This information table can also reside on the MCU1 memory. Once the information is read and verified, the MCU1 can enable the FET driver to start driving the coil on the pad and to energize the receiver.

[0189] In another embodiment the MCU1 relies on a clock 270 to periodically start the FET driver. The current through the FET driver is monitored through a current sensor 264. Several methods can be implemented with this implementation, including for example:

[0190] A small resistor can be placed in series with the FET to ground contact. The voltage across this resistor can be measured by a current sensor chip, such as a Linear Technology Current Sense Amplifier part number LT1787.

[0191] A Hall sensor, such as a Sentron CSA-1A, that measures the current from a wire running under it, can be placed on top of the PCB line from the FET to the ground to measure the current without any electrical connection to the circuit. The advantage of this approach is that no extra resistor in series with this portion of the circuit is necessary reducing the impedance.

[0192] Other techniques may be used to measure the current.

[0193] A Hall sensor or a Reed switch can sense a magnetic field. If a small magnet is placed inside the receiver unit of the system, a Hall sensor or Reed switch can be used to sense presence of the magnet and can be used as a signal to start the FET.

[0194] Other capacitance, optical, magnetic, or weight, etc. sensors can be incorporated to sense the presence of a secondary or receiver and to begin the energy transfer process.

[0195] FIG. 11 shows a figure of a circuit diagram 290 in accordance with an embodiment. In accordance with an embodiment, the MCU1 can periodically start the FET driver. If there is a receiver nearby, it can power the circuit. The regulator 296, or another memory chip in the circuit can be programmed so that on power-up, it draws current in a pre-programmed manner. An example is the integration of an RFID transponder chip in the path, such as ATMEL e5530 or another inexpensive microcontroller (shown here as MCU2 294), that upon power-up modulates the current in the receiver that can then be detected as current modulation in the primary. As with the previous example, other sensors, such as an RFID antenna 292 can also be used to provide positional and other information.

[0196] FIG. 12 shows a figure of a power transfer chart 300 in accordance with an embodiment, illustrating transferred power as a function of offset between coils.

[0197] Efficiency Enhancements in Coil Layout

[0198] An important aspect of power transfer efficiency relates to the alignment of coils with respect to each other.

[0199] FIG. 13 and FIG. 14 show figures of a coil layout in accordance with an embodiment. If position independence is required, the pad PCB can be patterned with a coil pattern to cover the full area. FIG. 13 shows a pad type charger or power supply 310 including a layer of coils 312 with minimal spacing 314 between the coils. Each coil has a center 316 associated with it. In accordance with an embodiment, the power transfer for a 1.25" diameter coil as the center of the receiver is offset from the center of primary. The power drops off to 25% of the maximum value when the two coils are offset by a coil. As described above, in order to better keep the coils aligned, use of magnets centered on the primary and the receiver coil can provide an automatic method of bringing the two parts into alignment.

[0200] In order to produce uniform fields, a number of coils around the receiver coil will typically need to be turned on to produce a field. However, with such a pattern, if a receiver coil is placed in between two primary coils, the voltage is still not optimized. Research has shown that to obtain uniform fields, three layers of coil patterns offset with respect to each other are required.

[0201] FIG. 14 shows a pad-type charger 320 with two of the three layers 322, 324 required to achieve position independent magnetic field pattern. For a receiver placed at the center of the circle, all the coils nearby (in and around the circle 328) will need to be turned on to achieve a uniform field in the desired location 326. While this approach solves the offset issue and can be used to provide position independence, it does not produce high transfer efficiency. The reason is that ten or more coils have to be turned on near the receiver center to create the uniform field in that area, which in turn leads to inefficient power transfer.

[0202] Efficiency Enhancements Through Independent Coil Movement

[0203] In accordance with some embodiments, techniques are included to provide high transfer efficiency while maintaining position independence.

[0204] FIG. 15 shows a figure of a charging pad with multiple coils in accordance with an embodiment. The area of the pad 330 is divided into a plurality of, or multiple segments 332, that are bounded 336 by a wall or physical barrier, or simply some tethering means with no physical walls but that otherwise restrict movement to within the segment. The coils 334 are mounted such that they can move laterally, or float, within the area of their segments while continuing to be connected to the drive electronics placed on the edges of the area. In accordance with an embodiment, the floating coils and the drive circuit are sandwiched between thin upper and lower cover layers that act to allow the coils lateral movement while limiting vertical movement. When a receiver coil is placed on the pad, the pad senses the position of the receiver coil and moves the coils to the right position to optimize power transfer.

[0205] FIG. 16 shows a figure of a charging pad with movable coils in accordance with an embodiment. When the mobile device, for example a cell phone 340, or a battery is placed on the pad 330, the nearest coil moves 342 within its segment to better orient itself with the mobile device or battery. In accordance with one embodiment, the method used for achieving this is by attaching a magnet to the bottom center of each coil in the pad. A matching magnet at the center

of the receiver coil attracts the primary magnet nearby and centers it automatically with respect to the receiver coil.

[0206] In accordance with an embodiment, each coil in this configuration can be suspended by the wires carrying power to the coil or by a separate wire/spring or by another mechanism so that each coil can move freely in the plane of the pad while it can receive power from an individual or shared driving circuit. In order to facilitate movement, the surface of the coils or the bottom surface of the top layer for the base unit (the area where the coils move against) or both layers can be made smooth by use of a low friction material, attachment of a low friction material, or lubrication. The wire/spring or current carrying mechanism described above can also be used to center each coil in an area at the center of desired movement sector for each coil. In this way, without a receiver coil in the vicinity, each coil in the base unit stays at the central location of its sector and responds and moves to match a receiver coil when a device or battery is brought nearby. Overlap of movement between adjacent charger or power supply coils can be controlled by means of limiting movement through limiting length of current carrying wires to the coil, arrangement of the suspension, or spring, or placement of dividing sectors, pillars or by any other mechanism.

[0207] In another embodiment, the pad will include a method for detecting the presence of the mobile device, battery/receiver and taking appropriate action to turn on the coil and/or to drive the coil with the appropriate pattern to generate the required voltage in the receiver. This can be achieved through incorporation of RFID, proximity sensor, current sensor, etc. A sequence of events to enable position independence and automatic pad turn-on can be:

[0208] Multiple movable coils are used to cover the pad surface area.

[0209] The coils in the pad are normally off and periodically powered up sequentially to sense whether the receiver is nearby by measuring the current through the primary coil. Alternatively, proximity sensors under each section can sense the presence of a magnet or change in capacitance or other parameter to know where a device is placed. RFID techniques with localized antennas under each section or such can also be used.

[0210] Once a device is identified as placed in a section, the pad can interrogate the device through one of the processes described earlier to authenticate and to understand its voltage/power, etc. requirements.

[0211] The MCU1 unit uses the information received above to set the PWM pattern which it will use to drive the FET drive to produce the appropriate voltage in the receiver.

[0212] The board continues to 'search' for other devices on the pad by scanning coils or using the RFID system, etc. and then turn on other coils as appropriate.

[0213] The pad also uses monitoring to find out when and if the first mobile device is removed from the pad, or when the end of charge is reached.

[0214] Efficiency Enhancements in Coil Registration and Switching

[0215] In accordance with an embodiment, a global RFID system that can identify the approach of a mobile device to the pad can be used to 'wake up' the board. This can be followed by sequential polling of individual coils to recognize where the device is placed in a manner similar to described above. Other embodiments can be used to provide safeguards against false charging of objects placed on the base unit. It is known that a metal object placed on coils such as the ones in the base of the charger or power supply system will cause current to flow in the primary and transfer power dissipated as heat to the metal object. In practical situations, this will cause placement of keys and other metal objects on the base unit to trigger a start and to needlessly draw current from the base unit coil and possibly lead to failure due to over-heating. To avoid this situation, in embodiments such as described above, the switching of voltage to the coil will not start unless an electronic device with a verifiable RFID tag is nearby thereby triggering the sequence of events for recognizing the appropriate coil to turn on and operate. In an alternate geometry, the total system current or individual coil current is monitored, and, if a sudden unexpected drawn current is noticed, measures to investigate further or to shut down the appropriate coil indefinitely or for a period of time or to indicate an alarm is taken.

[0216] In another embodiment, the regulators or battery charging circuit in mobile devices or batteries, or the regulator in a receiver electronics, typically has a start voltage (such as 5 V) that is required to start the charging process. Once the battery charge circuit detects the presence of this voltage, it switches on and then proceeds to draw current at a preset rate from the input to feed the battery for charging. The battery charger circuits operate such that an under or over voltage at the start will prevent startup. Once the startup occurs, the voltage at the battery charger output is typically the voltage of the battery and depends on the state of charge, but is for example 4.4 V to 3.7 V, or lower for Lithium-Ion batteries. With a wireless charge system such

as described here, the voltage on the receiver is highly dependent on relative position of the primary and receiver coil as shown in FIG. 5. Since typically the start voltage of the battery charger is within a narrow range of the specified voltage, under-voltage and over-voltage in the receiver coil due to misalignment or other variation will result in shutdown of the battery charger circuit.

[0217] Efficiency Enhancements through Coil Voltage Clamping

[0218] FIG. 17 shows a figure of a circuit diagram 350 in accordance with an embodiment. In accordance with one embodiment, a Zener diode 352 is incorporated to clamp the maximum voltage at the output of the receiver prior to the regulator or battery charger circuit, as shown in FIG. 17. Using a Zener allows more insensitivity to placement between the primary and receiver coil while maintaining the ability to charge or power the device. For example, the drive pattern on the primary can be set so that when the primary and receiver coil are aligned, the voltage on the receiver is above the nominal voltage for the battery charger startup. For example, for a 5 V startup, the voltage at center can be set for 6 or 7 volts. In this way, the Zener can be chosen to have an appropriate value (5 V) and clamp the voltage at this value at the input to the battery charger unit while the coils are centered or misaligned. Once the battery charger starts operation after detection of the appropriate voltage at the input, the battery charger circuitry will pull the voltage at this point to the pre-programmed voltage or voltage of the battery. In this way, the use of Zener diode enables less sensitivity to position and other operational parameters in wireless chargers or power supplies and is extremely useful.

[0219] Efficiency Enhancements through Coil Stacking

[0220] FIG. 18 shows an illustration of a means of stacking coils, in accordance with an embodiment. In accordance with an embodiment, to achieve higher flux densities, a coil is constructed with two or more layers, for example by using two or more layers of printed circuit board. Multiple layer boards can be used to allow compact fabrication of high flux density coils. By altering the dimensions of the coil in each layer (including the thickness, width, and number of turns) and by stacking multiple layers, the resistance, inductance, flux density, and coupling efficiency for the coils can be adjusted so as to be optimized for a particular application.

[0221] In accordance with an embodiment, a transformer comprising two PCB coils separated by a distance has many parameters that are defined by the design of the coil, including:

[0222] R_1 is the primary winding resistance,

[0223] R_2 is the secondary (in the receiver) winding resistance referred to the primary,

[0224] R_L is the resistive load,

[0225] L_{lk1} is the primary leakage inductance,

[0226] L'_{lk2} is the secondary leakage inductance referred to the primary,

[0227] M_{11} is the primary mutual inductance,

[0228] C_1 is the primary winding capacitance,

[0229] C'_2 is the capacitance in the secondary winding referred to the primary,

[0230] C_{12} is the capacitance between primary and secondary windings, and n is the turns ratio.

[0231] In accordance with the embodiment shown in FIG. 18, a multi-layer PCB coil 356 is created in separate PCB layers 357, which are then connected 358, and manufactured together via common techniques used in PCB fabrication, for example by use of a via or contacts. The resulting overall stack is a thin multi-layer PCB that contains many turns of the coil. In this way, wide coils (low resistance) can be used, while the overall width of the coil is not increased. This technique can be particularly useful for cases where small x-y coil dimensions are desired, and can be used to create higher flux densities and more efficient power transfer.

[0232] Efficiency Enhancements Through Coil Shape and Materials

[0233] In accordance with an embodiment, the system can use a non-ferrite material for both the primary and the secondary (receiver) coils. For example, the coils can be made of copper material that is sputtered, deposited, or formed onto a printed circuit board (PCB), as described above. As also described above the coils can be formed in any number of different shapes, including, for example, flat or planar hexagonal shapes, or spirals. The coils can also be distributed in layers of coils, spirals, and other various shapes.

[0234] One of the advantages of using a non-ferrite or non-ferromagnetic material for the primary and secondary (receiver) is that the coils can be made much flatter and thinner than a ferrite coil. Additionally, non-ferrite coils can be made to have a lower inductance than a comparable coil made from a ferrite material (the inductance is on the order of 1 micro Henry, although the actual value will vary depending on the frequency of the voltage applied to the

coil). The non-ferrite nature effectively eliminates hysteresis in the coil, and allows the system to be switched on and off more rapidly, and with less energy storage artifacts.

[0235] Variations in Coil Circuitry

[0236] In accordance with some embodiments, an inductance-capacitance (often referred to as an LC or "tank capacitor") circuit can be used to provide a range of power outputs to approximately suit the intended application. For example, the circuit can be optimized to suit either low-power applications, or high-power applications.

[0237] Depending on the particular intended application, the original capacitor (referred to herein as a "timing capacitor") in the circuit design can be removed and/or replaced with a different value of capacitor to obtain a different overall level of power output. From a manufacturing perspective this is a relatively simple and inexpensive procedure. This technique can also be used to easily manufacture different charger or pad embodiments for different end-user applications, in that the majority of the pad components can be designed to be common to each pad design, with the primary difference being the value for a single capacitor. This single capacitor can then be specified or changed during the manufacturing process. Although the timing capacitor can be used to adjust the system for, e.g. high-power or low-power applications, the final power output as it is received at the mobile device can be fine-tuned using additional techniques and features such as those described in further detail below.

[0238] Coil Waveform Generation

[0239] In accordance with an embodiment, a half-phase electrical waveform is used to charge the tank circuit, and to subsequently provide inductive power to the receiver coil in the mobile device. Unlike a full-phase waveform, the half-phase waveform can be used with a zero-crossing power supply. In accordance with this embodiment, when the transistor in the primary coil is first turned on, electrical current passes through the primary coil and the transistor to ground. When the transistor is turned off, the voltage level at the transistor swings high (anywhere from twice, to many times the value of the input voltage). This is the standard oscillation behavior of an inductor. When the current falls to zero the transistor is turned on again, and the process is repeated.

[0240] Many traditional transformer designs do not use half-phase waveforms, and instead use a non-zero-crossing design, since their ferrite core acts like a capacitor and stores energy during the off phase, which results in large losses in power efficiency if zero-crossing was used. However, in accordance with an embodiment, the use of non-ferrite coils, coupled with lower power (on the order of 2 Watts) allows for suitable efficiency with a half-phase and a zero-crossing circuit.

[0241] Furthermore, in accordance with some embodiments the half-phase waveform can be designed to have an exponential or curved shape, rather than an abrupt shape, so that higher frequency emissions are reduced. These higher frequency emissions might otherwise cause problems with portable and other devices, or conflict with federal communications regulations that prohibit high frequency emissions in consumer electrical devices.

[0242] Automatic Voltage Setting

[0243] In accordance with some embodiments, the system can include additional circuits, components, features, and techniques, which perform specialized tasks, such as mobile device identification, and automatic voltage or power-setting for different devices. As described above, although the timing capacitor can be replaced to modify the circuit frequency and the resulting output voltage of the system, this is not a practical solution for allowing a consumer to modify the voltage, or to modify the voltage to suit the particular requirements of individual mobile devices. In practice the timing capacitor can be used to provide a particular range of output power (i.e. high power applications; or low power applications). Additional techniques are then used to adjust the power for a particular device. This is particularly important when the charger or the pad is designed to power or charge multiple different devices simultaneously, since each of those different devices may have different power and voltage requirements. In accordance with various embodiments, different features can be used to support this, including:

[0244] Hardwiring the receiver coil to take the voltage requirements of its device into account, and to use the appropriate dimensions to receive the correct voltage for that device. However, while this approach works to adjust the voltage for that device, it is by its nature hard-wired and does not provide much flexibility to adjust the voltage for interoperability between different devices and different chargers or power supplies.

[0245] Use of dynamic programming to obtain a different voltage. In accordance with this embodiment, if the timing capacitance is known, then the frequency of the circuit can be adjusted to produce the required output voltage.

[0246] In a zero-switching circuit, clipping can be used to tune the voltage. This can include turning the circuit on, then allowing it to turn off but clipping the waveform earlier, and then turning it on again. The process is then repeated. The clipping may be less efficient than unclipped switching, but can be used to tune the voltage.

[0247] When used with the above capacitor-based techniques, the choice of timing capacitor can be used to determine the overall range of the charger, power supply, or pad (for example, whether it is best suited for low power, or for high power applications). The additional features can then be used to fine-tune the frequency and the output voltage. In accordance with some embodiments, additional features can be used to improve efficiency and to add functionality.

[0248] As described above, in accordance with one embodiment, the pad circuit 260 incorporates a micro control unit (MCU) 266 that can enable or disable the FET driver 268. The MCU receives input from another sensor mechanism that will provide information that it can then use to decide whether a device is nearby, what voltage the device requires, and/or to authenticate the device to be charged. The communicated feedback from the receiver to primary can be used by the primary to, for example, adjust the frequency, or to otherwise alter the output voltage to that receiver, using the frequency/output characteristics described above. Some traditional transformer designs use a third coil to provide a measure of feedback. However the use of an MCU as described herein eliminates the need for such extra coil feedback devices.

[0249] Also as described above, in accordance with one embodiment, a Zener diode 352 is incorporated to clamp the maximum voltage at the output of the receiver prior to the regulator or battery charger circuit. In each of the feedback designs described above, the actual communication between the receiver and the primary as to voltage requirements can be of open loop design, or of closed loop design. In an open loop design, the charging device, pad or power source provides the power to the primary, which is then inductively transferred to the receiver and the mobile device or battery other device to be charged. The primary itself determines how much power should be received at the receiver. In a closed loop design, such as in a switching mode power supply, the device/receiver communicates information back to the primary, and then the primary determines how much power should be sent to the receiver.

[0250] Device Identification and Verification

[0251] FIG. 19 shows a figure of a circuit diagram 400 for identification verification in accordance with an embodiment. In accordance with an embodiment, the circuit design can be used to ensure a device is valid, i.e. authorized to be used with the charger, power supply or pad. The information can also be used as part of an open-loop or closed-loop design to set the voltage for the device. In operation, the primary circuit is first turned on. An initial signal is generated as the circuit induces power in the receiver. This information is quickly compared with a number or value stored in the MCU, and is used to determine whether the mobile device (or the receiver associated with that mobile device or battery) is valid for operation with the base unit, charger, power supply, or charging pad. In addition to validation the information can similarly be used to set the charging voltage for the receiver, battery, or mobile device.

[0252] FIG. 20 shows a figure of a circuit diagram 420 for bidirectional communication in accordance with an embodiment. As shown in FIG. 20, in accordance with an embodiment the charger or power supply or primary can include means for communication with the receiver, battery, or mobile device, including for example radio frequency (RF) or other means of communication.

[0253] FIG. 21 shows a figure of a circuit diagram 440 for output controller in accordance with an embodiment. As shown in FIG. 21, in accordance with an embodiment the output controller in the receiver waits until power is sufficient, and then turns the power on to the mobile device or battery.

[0254] FIG. 22 shows a figure of a circuit diagram 480 for receiver with regulator or charge management circuit in accordance with an embodiment. As shown in FIG. 22, in accordance with an embodiment the receiver includes a regulator for regulating the voltage.

[0255] FIG. 23 shows a figure of a circuit diagram 500 for MCU regulation in accordance with an embodiment. As shown in FIG. 23, in accordance with an embodiment the MCU can provide the voltage regulation.

[0256] FIG. 24 shows a figure of a circuit diagram 540 for unidirectional communication and data transfer in accordance with an embodiment. As shown in FIG. 24, in accordance with an embodiment the receiver can include a means of transferring data to the mobile device to which it is coupled.

[0257] FIG. 25 shows a figure of a circuit diagram 560 for time-based regulation in accordance with an embodiment.

[0258] Zero Voltage Switching

[0259] In accordance with some embodiments, the system can use a technique such as Zero Voltage Switching (ZVS) to provide more efficient power transfer and power supply control. These techniques can also be used to provide more efficient regulation for power transfer between coils of small induction value, such as those created by spiral patterns in PCBs, stamped metal coils, and low number of turns wound wire coils. In switching mode power supplies used today, the common geometries used are boost buck, flyback, boost, or a variation of these types. In most of these geometries, the input voltage is switched rapidly by a transistor such as a FET and the energy is transferred across a transformer to a load. In accordance with an embodiment, by adjusting the duty cycle of the switching circuit, regulation of transferred power is achieved.

[0260] FIG. 26 shows a high level view of a flyback power supply geometry 580 in accordance with an embodiment. During the time that the FET is closed, the current through the primary coil stores energy in this coil and during the period that the FET is open, this energy is transferred to the secondary (receiver) coil and into the load. The energy stored in the coil is directly proportional to the inductance of the coil and values of several hundred Henry are typical for 10's or 100's of Watts of power supply power.

[0261] In contrast, Printed Circuit Board Coils (PCBC's) are typically spiral circular, rectangular, or other shape coils that are printed on rigid or flexible PCB material or stamped out of sheets of copper or by other methods where the coil or transformer in a power supply is primarily flat and takes very little space. Two of these coils placed with a distance between them (such as on both sides of a PCB material) or with an air or material gap (such as in wireless power applications where a charger transmits power to a receiver in an electronic or electric device that can be separated or removed from the charger) can be used to form a transformer such as the one shown in FIG. 26. Switching of these coils at high frequency (≈ 1 MHz depending on the coil geometry and size) can transfer power across an air or material gap and an efficient power supply with a very small transformer can be developed. Uses of such compact coils for wireless powering of mobile devices such as mobile phones and MP3 players have been demonstrated. However, many prior techniques used a laboratory power supply to provide a

sinusoidal or similar voltage to the primary coil and study the transferred power, rather than a compact efficient circuit for a power supply.

[0262] In accordance with a ZVS geometry embodiment, a capacitor is added to the circuit so that in the switch OFF position, the capacitor and the coil inductor create a resonant circuit. During the switch ON time, current passes through the inductor while the voltage across the capacitor is zero. During the period where the switch is turned off, the voltage across the capacitor rises to a maximum value of twice the input voltage and then resonates back to zero. A characteristic of this geometry is that the switch is closed exactly when this voltage arrives back to zero (hence the name Zero Voltage Switching), thereby minimizing power usage and achieving high efficiencies. Some of the benefits of this geometry include: High efficiency and 'loss-less' transitions; Reduced EMI/EMC due to soft switching and use of sinusoids rather than square waves; Peak current is not higher than square wave switching; and Relatively simple control and regulation. In addition, this geometry can work very efficiently with low inductance values and is therefore better suited for the PCBC applications. In accordance with various embodiments the geometry can be configured to operate in various topologies, for example buck, boost, buck-boost, and flyback.

[0263] Some embodiments provide more efficient power transfer and power supply control and regulation for power transfer between coils of small induction value such as created by spiral patterns in PCBs, stamped metal coils, low number of turns wound wire coils, etc. In addition, typically, magnetic cores are not used if the coils are driven at high frequency. For a spiral coil, the inductance of a coil is given by:

$$L = \frac{r^2 N^2}{(2r + 2.8D) \times 10^5}$$

Where

L = inductance (H)

r = mean radius of coil (m)

N = number of turns

D = depth of coil (outer radius minus inner radius) (m)

[0264] For example, for a coil of 10 turns, an outer radius of 15 mm, and inner radius of zero, then $L=1$ H. While larger values can be obtained by increasing the number of turns or stacking a number of coils vertically and connecting them in series, this larger induction comes at the price of increased resistance and therefore loss in the inductor.

[0265] Spiral coils printed on PCBs without use of any magnetic core can provide high power transmission efficiency if operated at high frequency. An analogous method to the above technique is one referred to as Zero Current Switching (ZCS). ZCS operates by similar principles; however switching is done during zero current passing through the switch thereby achieving low switching losses. In the following discussion, ZVS switching is generally discussed; however, the ZCS geometry can equally be applied to the following. In accordance with some embodiments, methods are described for achieving and optimizing high power transfer with such small and/or thin coils with low induction values and describe several techniques for control and regulation of this power in real world power applications. While this technology is generally described for any type of power supply using such inductors, in accordance with a particular embodiment the two coils in the transformer are separated, with the primary being in an inductive charger and the receiver embedded in a device, battery, casing, skin, or other part of an electronic or electric device. In this case, a wireless charger or power supply can be created which is especially useful for charging or powering mobile electronic or electric devices or batteries.

[0266] The advantages of use of ZVS geometry in general, and in particular for coils with small inductance and no magnetic cores, has been described above. However, another important aspect of power supply design is the Control and Regulation Circuitry that is implemented. Regulation of the power to a load can be achieved by a linear or switching regulator at the output stage. However, if the regulation of the power is achieved in this way and constant power is supplied from the primary coil, under light load conditions (such as when a battery is fully charged or a device is on stand-by, then the power generated and transmitted by the primary is mostly wasted leading to a low efficiency power supply. A better solution is achieved by adjusting the power into the primary coil under different load conditions, to maintain high efficiency during different load conditions or battery charging stages.

[0267] In accordance with an embodiment, such control of output power in a ZVS power supply can be achieved by changing the frequency of the operation. In this embodiment, the output

power is inversely proportional to the operating frequency and control can be achieved by an appropriate control circuit.

[0268] FIG. 27 shows how the output voltage to the load is monitored and with changes in the load condition, a chip or a Micro Controller Unit (MCU) varies the frequency or the duty cycle of the FET driver to achieve optimum operation and controlled output voltage with a changing load. As shown in FIG. 27, a digital control 600 for operation is shown. However, analog operation can also be achieved and may be simpler and faster in response time to load changes and preferable in some applications. In the implementation shown, the primary (Control Circuit, Clock, FET Driver, FET, primary coil, etc.) and the receiver (secondary coil, rectifier, capacitor, other circuitry, etc.) are able to communicate through a wired connection.

[0269] Switching Mode Power Supply with Wireless Communication

[0270] In accordance with an embodiment that includes a charger or power supply wherein the charger or power supply and the receiver are separable from each other (wireless or inductive charging or supply of power to devices), the charger or power supply can contain the basic control and switching functions while the receiver contains the rectifier diode and capacitor for smoothing of the output voltage and additional circuitry. In this embodiment the two parts need to communicate with each other wirelessly.

[0271] FIG. 28 shows an implementation of a more sophisticated charger or power supply. According to this embodiment, where the primary stage and the secondary (receiver) stage communicate wirelessly. In the geometry shown in FIG. 28, a digital control scheme is implemented. The primary (charger or power supply) 620 is controlled by a Micro Control Unit (MCU1) that receives signals from a Current Sensor in series with the coil. The communication between the charger and the receiver 630 is achieved through the same coil as the power transfer. However, these functions can be separated.

[0272] In the geometry shown, the secondary (receiver) contains circuitry that enables this part to modulate the load as seen by the primary. In accordance with an embodiment this is achieved through modulation of switch Q2 by an MCU2 in the receiver. This can be a very small Programmable IC (PIC) and can easily fit into very small form factors. As the primary charger or power supply sends power to the secondary receiver, the circuit in the receiver turns on. The power received is rectified and filtered by rectifier D1 and Capacitor C2 respectively. Since

MCU2 requires constant voltage input at all times, a small, low current regulator (Voltage Regulator) for powering MCU2 only is incorporated. This can be a linear or switching regulator. Since the power usage of MCU2 is very small and the unit can also be put into hibernation between tasks, use of this regulator does not affect the overall efficiency much. The output of the rectified stage is input to a device or Charge Management IC for the case of a battery charger configuration. This Charge Management IC is integrated into most Original Equipment Manufacturer (OEM) mobile devices that operate by rechargeable batteries or can be integrated into or on a rechargeable battery to directly charge the battery when the battery is in proximity to the charger. The Charge Management IC typically, for a fully drained battery, will pass on the maximum input current to the battery to enable rapid charging when the battery is at low voltage. This presents a low impedance load to the power supply circuit and requires the power supply to sustain the voltage at the required value while supplying the current. The Charge Management IC is in communication with the MCU2 which also monitors the output voltage (Vout) and tries to maintain this Vout within a pre-programmed range. This is achieved by MCU2 sending a digital signal to Q2 to modulate the switch. This modulation is prior to the rectifier stage and is at high frequency so the rectified and smoothed Vout is not affected. However, this modulation of the impedance of the secondary stage affects the current through the primary coil stage and can be easily detected by the Current Sense circuit in the primary.

[0273] In accordance with an embodiment the Current Sense circuit can comprise a small resistor in parallel to a voltage amplifier, a Hall sensor, etc. The output of the Current Sensor is connected to MCU1 and the digital sequence is detected by an A/D converter. The firmware in MCU1 determines whether the output voltage is too high or too low and then executes the appropriate step to adjust accordingly by sending a signal to a clock to adjust the frequency of the FET drive to bring the output of the power supply to within acceptable range. Higher drive frequency corresponds to lower output power by shortening the time for integration of power in the resonant ZVS cycle and lower frequency corresponds to higher output power.

[0274] In accordance with an embodiment, one method for implementing the variable frequency is to use a variable frequency source whose output frequency changes with change in the voltage to its input. Using a programmable resistor and changing this resistor value by varying a voltage signal from MCU1, the frequency for driving FET 1 can be changed. Other methods for achieving this change are also possible.

[0275] As an example of the method for control, in a typical application, the operating frequency of the circuit can be 1-2 MHz and the data transmission for control is at 14.4 kbits/sec. If the full output power range is achieved by moving the frequency in the 1.2-1.4 MHz, this range is broken into 256 steps. In one implementation, the receiver sends a digital code corresponding to the output voltage and MCU1 compares this to the earlier output voltage value and makes a determination about which direction and by how many steps to move the frequency. The frequency is then changed accordingly. In another implementation, MCU2 sends one of 2 values corresponding to a voltage high or low condition. If the voltage is within range, MCU2 does not communicate with the primary. When a voltage high signal is received, MCU1, takes a pre-determined step towards higher frequency to lower the output power and the process is repeated until output voltage is within required range. A voltage low signal has the opposite effect. Many variations of these basic methods are possible to allow rapid, efficient locking of the output voltage. Proportional-Integral-Derivative (PID) techniques, etc. can also be used. Depending on the geometry, the circuit may also use a switch Q3 in series with the load. This optional switch may be opened during communication to create a better signal to noise ratio. Since communication occurs in several msec, opening and closing Q3 rapidly does not have a large impact on charging time of a load battery that can be in many hours.

[0276] In accordance with an embodiment, as the battery charges and its terminal voltage rises, the Charge Management IC throttles the incoming current back, and switches to a mode where the voltage across the battery terminal is maintained at or near its final value. The supply will sense a higher output impedance and MCU2 and MCU1 work in concert to keep the output within range throughout the charging cycle. At the end of the charge cycle, the Charge Management IC can signal end of charge cycle to MCU2 which sends a pre-determined code to MCU1 to shut down the charger, move to hibernation mode or take some other pre-determined step.

[0277] It is important to note that, in the embodiment, the voltage regulator in the receiver does not regulate the output voltage to the load itself. If the regulator was performing this function, then the control and regulation described here would not be necessary. However, the overall system efficiency is much lower and, with a constant power going into the receiver, some fraction of this power is wasted as the battery reached a full charge or as the load became lighter and less power was required. This wasted energy can heat up the receiver, the load, or the device

battery depending on the geometry. All of these cases are undesirable. In the geometry described here, the primary can in these cases adjust to send less power to the receiver, thereby maintaining high efficiency regardless of load condition.

[0278] Verification and Data Transmission

[0279] In accordance with an embodiment, the digital transmission process described here is bi-directional, and can be used for verification process at start of charge or power transfer to ensure that the right kind of device is present and about to be charged, or to inform the charger or power supply about the voltage/power requirements of the device or battery to be charged or powered. In accordance with an embodiment, this bi-directional data transfer can also be used for actual data communication between a device and a charger or power supply. For example, the charger or power supply can be powered by the USB outlet of a laptop and simultaneously receive data from the laptop to be transferred to a mobile device. When a mobile device or battery is on the charger or power supply, it can be charged or powered, and its data can also be synchronized simultaneously through this channel.

[0280] Extension to Other Geometries

[0281] While the above discussion has focused on one implementation of the control with a Zero Voltage Switching power supply, the basic concepts for the control, verification, and data transmission are applicable to other geometries and topologies, and can be implemented in a similar manner. In accordance with some embodiments, the Charge Management Circuit is optional and is only used when a battery is present at the load. For example, as shown in FIG. 28, If V_{out} is used to directly operate a load, the Charge Management Circuit is not used and V_{out} is directly connected to the load.

[0282] Fully Regulated Switching Mode Supply with Wireless Communication

[0283] FIG. 28, described above, shows the basic building blocks for a digitally controlled wireless control circuit for a Zero Voltage Switching (ZVS) circuit were described. The geometry shown in FIG. 28 can regulate the output power through a wide range. However, as a battery charges or the load condition changes to require very low output powers, the accuracy

required for control of the Vout may require many finer steps or not be possible with the geometry of FIG. 28 alone.

[0284] FIG. 29 shows an embodiment that includes an enhancement that can be used to address the ZVS issue.

[0285] In the fully regulated power supply shown in FIG. 29, a voltage regulator (Voltage Regulator 1) that can switch the input voltage between 2 values or more is used. In normal operation, Q2 is closed and the Voltage Regulator 1 is shut down through its enable pin. Therefore, the input voltage is directly available for the Coil L1 and is regulated as described earlier. However, if the output requires extremely low powers (such as end of charge stage for batteries), and the charger determines that a switch to a different range is required, Q2 is opened, and Voltage Regulator 1 is switched on to change the input to Coil 1 to a lower voltage value. Regulation is maintained at this range by shifting to the appropriate frequency to achieve required output power. For example, if Vin is 5 V, this lower voltage level may be 3 V. Multiple voltage levels are also possible.

[0286] Since for most cases, and in high power conditions, Q2 is open and Voltage Regulator 1 is turned off, high overall system efficiency can be achieved. Only during the lowest current conditions, the input voltage is changed by switching this Voltage Regulator 1 on and regulating at this level. Depending on the type of regulator used, some efficiency loss can be expected in this regime. However, this occurs at very low output power levels only. Voltage Regulator 1 can be a high efficiency Switching DC-DC supply or a lower frequency, less complicated and less costly linear regulator depending on efficiency/cost trade-offs.

[0287] Regulated Switching Mode Power Supply with Opto-Coupler Feedback

[0288] The geometries described above use a digital method for transmission of information between a primary and receiver circuit. However, in some cases, the load changes instantaneously. Examples are when in a laptop computer, the screen or the hard drive start or shut down, etc. To handle these cases, the feedback loop has to be extremely fast to avoid having severe and rapid voltage overshoots and undershoots. This becomes especially important for high power applications.

[0289] FIG. 30 shows an embodiment in which instead of a digital feedback circuit, an analog circuit based on coupling between an LED and a light detector can be used.

[0290] In this case, the output voltage, V_{out} is continuously compared to a reference voltage and the intensity of light from a diode changes rapidly in proportion to the voltage value. A detector in the charger stage provides a voltage value to a frequency controller that controls the FET drive. An MCU in the charger, MCU1 also monitors the process and can switch on an optional lower voltage input to the primary coil (through Q2 and Voltage Regulator) if necessary. It can also sense the end of charge or perform verification or other tasks.

[0291] In some embodiments a high power completely wireless inductive charger for a laptop requiring up to 90 W continuously can be implemented with this scheme. In accordance with an embodiment the transformer coils are PCB spiral coils that have 4" or more diameters and comprise 7 turns with a total inductance of 1 micro Henry. The rapid response time of the analog circuit allows maintaining of the output voltage with rapid swings in the load. The charger or power supply comprises a pad where the charger or power supply circuitry and a flat spiral PCB coil are integrated into and the receiver comprises circuitry and a similar coil integrated into the bottom of a laptop. The optical components are mounted such that the light from the transmitter is detected by the receiver in the charger or power supply.

[0292] Digital communication through the optical parts is also possible to achieve this result, but requires a higher bandwidth and high speed processing.

[0293] It will be evident that these features, or any other geometry described here, can be combined to achieve the desired results. For example, while the control process for regulation may be through the opto-coupler feedback described here, a separate digital data link through the coil can be established for data transmission or verification of the charger, power supply, or vice versa.

[0294] Regulated Switching Mode Power Supply with Isolated Transformer Feedback

[0295] In accordance with an embodiment, another geometry for the regulation uses a similar analog feedback technique with the feedback information being transferred through a separate isolated transformer.

[0296] FIG. 31 shows an embodiment in which the opto-coupler is replaced by a Voltage Controlled Oscillator (VCO) and FET and in the primary, the signal is sent to adjust a frequency controller to provide optimum output voltage. An optional voltage regulator and switch Q2 can also be used to provide precise control at low output powers. Similarly, this communication can

be implemented digitally, and also requires a high bandwidth to allow for rapid response. Since the circuit in FIG. 31 is completely wireless and does not require optical components, it may be preferable in cases where an optically transmissive window in the charger or power supply or the receiver may not be possible.

[0297] Regulated Switching Mode Power Supply with RF Feedback Regulation

[0298] In accordance with another embodiment, the information between the charger and the receiver can be exchanged through a wireless link in the two parts. The advantage with this embodiment compared to the optical case is that the two parts do not need to be optically transmissive. In addition, compared to the earlier-described versions (optical and through a transformer), the relative alignment is not as important. However, in most practical application, the charger or power supply and the receiver coil will be aligned for power transfer, so an alignment of some degree will occur and with the right geometry, can enable transformer or optical feedback alignment and regulation to be implemented.

[0299] FIG. 32 shows an embodiment in which the wireless link can be analog or digital (requires higher bandwidth and complexity) or can be integrated into the device to take advantage of existing wireless links in the device (Bluetooth, WiFi, Wireless USB, WiMax, etc.).

[0300] FIG. 33 shows a basic schematic for an inductive single coil charging system in accordance with an embodiment. As shown therein, the coil inductor in the charger pad is switched by Switch T which is typically a FET transistor. A capacitor in parallel with the FET may be used to improve performance. The receiver in the right hand side comprises a similar coil, rectifying diode, and a capacitor to provide DC output to a load R_L .

[0301] FIG. 34 shows the main components of a more advanced wireless power/charging system. Charge Management IC in the receiver also controls the charging of the battery to ensure appropriate charging. The MCU1 and current sense chips in the charger and MCU2 can provide bi-directional communication between the charger or power supply and the receiver for optimum charging or supply of power. The optional voltage regulator in the receiver is used to provide a constant low current voltage to MCU2 and is not regulating the power into the battery. The Receiver is integrated into or on a mobile or electronic device or a rechargeable battery. Points A, B and C are described later and can be used for placement of switching circuits. Q3 is a

switch that can disconnect the battery during communication for higher signal to noise ratio and is optional.

[0302] An embodiment of the system incorporates a MicroControl Unit (MCU1) that can enable or disable the FET driver. This system also uses a Charge Management IC in the receiver which controls the charging of the battery to ensure appropriate charging profile is followed and the battery is not overcharged. Most mobile devices today already include a Charge Management IC in their power circuit between the input power jack and the rechargeable battery of the device to control charging of their internal battery. This chip can be incorporated into the receiver circuitry to enable a battery to directly receive power from an inductive source as shown in FIG. 34.

[0303] FIG. 34 also shows a Zener diode (Z1) incorporated at the receiver. This Zener is used to ensure that the output voltage from the rectifier does not exceed a pre-determined value. In some instances this may be important, since the output of the receiver is fed into a Charge Management IC that may have a finite turn-on time. At the beginning of charging (when a device is placed on a pad first), the Charge Management IC may seem like a high impedance load. Without the Zener diode, such a load may cause the voltage the input to the Charge Management Circuit to increase to high values, potentially exceeding its safe operating conditions. A fast Zener diode can clamp the voltage under this or other unusual conditions and may be incorporated into the receiver. Depending on the architecture, other methods for avoiding such conditions may be incorporated. Incorporating a Zener Diode is an effective and inexpensive method for dealing with these potential issues.

[0304] In accordance with an embodiment, the receiver may also incorporate a voltage regulator just to provide a constant voltage (or voltage in the acceptable range for operation) to MCU2. This voltage regulator just provides the low power necessary for this and is not in the path of the main power going into the battery. Any power loss due to this regulator is small, because it is very low power and does not affect the overall system efficiency much. It is mainly used to keep the MCU active during startup or other changes so the communication with charger or power supply is maintained.

[0305] The MCU1 receives input from another sensor mechanism that provides information that it can use to decide whether a device or battery is nearby, what voltage the device or battery requires, and/or to authenticate the device or battery to be charged or powered. Several examples of the mechanisms for providing this information are:

[0306] The MCU1 periodically starts the FET driver. The current through the FET is monitored through a current sensing method. The inductance of L1 is highly dependent on the presence of objects nearby that affect its magnetic field. These objects include metallic objects or another nearby coil such as L2. Switching L1 at high frequency (100 kHz to several MHz) through a Field Effect Transistor (FET) such as Q1, the value of current being drawn is highly dependent on the L1 Value. This property can be used to sense the presence of nearby devices or batteries capable of drawing power and also to enable bi-directional communication if desired. Several methods for this are possible:

[0307] A small resistor can be placed in series with the FET to ground contact. The voltage across this resistor can be measured by a current sensor chip such as Linear Technology Current Sense Amplifier part number LT1787.

[0308] A Hall sensor such as Sentron CSA-1A that measures the current from a wire running under it can be placed on top of the PCB line from the FET to the ground to measure the current without any electrical connection to the circuit. The advantage of this approach is that no extra resistor in series with this portion of the circuit is necessary reducing the impedance.

[0309] Other techniques can be used to measure the current.

[0310] By monitoring the current and comparing it to a baseline measurement taken at power up, and periodically with no devices nearby, MCU1 can determine whether a device or battery is near the coil and drawing power. This provides a first level verification of an object capable of drawing power being nearby. However, there may be a possibility of false starts with metallic objects or wires in any electronic device or battery drawing power. A second level of verification may be desirable.

[0311] To enable a more secure verification, in accordance with an embodiment the MCU1 can periodically start the FET driver. If current is being drawn, MCU1 may activate the Q1 in a predetermined state (for example, this may be a low power state). This can provide a first level indication that a receiver may be nearby. If there is a genuine receiver nearby (versus, say, a metallic object, electronic device, or a non-approved receiver), the emitted power from L1 will power the receiver circuit. The charge control circuit in the figure or another chip in the Receiver circuit can be pre-programmed so that on power-up, it draws current in a pre-programmed manner. An example of this is the integration of the MCU2 and chip model number 10F220 Programmable IC by Microchip Inc. or another inexpensive microcontroller that upon power-up,

executes a predetermined program that modulates the current being drawn in the receiver in a predetermined code (which can be encrypted). This receiver modulation can be detected as a current modulation in the current through the L1 by the charger or power supply current sensor in FIG. 34.

[0312] After the initial handshake and verification, the MCU1 and current sense chips in the charger or power supply and MCU2 can provide bi-directional communication between the charger or power supply and the receiver for optimum charging or supply of power. The system can also regulate the power and voltage received at the Charge Control Circuit to insure overvoltage conditions do not occur. As shown in FIG. 34, switch Q3 is a switch that can disconnect the battery during communication for higher signal to noise ratio and is optional.

[0313] If the handshake and verification between the charger or power supply and the receiver is not successful, the MCU1 will assume that the device drawing power is not an appropriate receiver and will terminate powering it. This process invalidates false starts due to objects being accidentally placed on the pad, and also provides protection against counterfeit or non-approved receivers. An RFID, Near-Field Communication (NFC) or other wireless data transmission method reader that can detect an RFID, NFC, or other tag included with the receiver circuit and antenna (i.e. device or battery to be charged). The information on the tag can be detected to identify the voltage for the receiver required, and to authenticate the circuit to be genuine or under license.

[0314] The information on the tag can be encrypted to provide further security. Once a device containing the tag is near the charger or power supply pad, the tag reader is activated, the system reads the information on the tag memory, and compares it with a table to determine authenticity/voltage required or other info. In some embodiments, this information table can also reside on the MCU1 memory. Once the information is read and verified, the MCU1 can enable the FET driver to start driving the coil on the pad and to energize the receiver.

[0315] A Hall sensor or a Reed switch can sense a magnetic field. If a small magnet is placed inside the receiver unit of the system, a Hall sensor or Reed switch can be used to sense presence of the magnet and can be used as a signal to start the FET.

[0316] Other capacitance, optical, magnetic, or weight, etc. sensors can be incorporated to sense the presence of a receiver and to begin the energy transfer process.

[0317] The methods for verification and communication between the charger or power supply and the receiver are provided above by way of example, and in accordance with various embodiments. In practice a combination or a variation on the above methods may be used. It will also be evident that different embodiments can use different verification techniques, in addition to or instead of those described above, and various combinations of such.

[0318] Efficiency Enhancements through Lateral Offset Between Coils

[0319] FIG. 35 shows a typical experimental curve for power transferred and Power Transfer Efficiency through a pair of circular spiral coils as a function of lateral offset between the center of the coils. The power transferred is shown at the receiver after rectification and other electronics, and is the DC power available for charging/powering a device. Power Transfer Efficiency is defined as the DC Power out from the receiver divided by DC power into the charger or power supply circuit; so it includes any power consumed by the FET driver, the FET, rectifier diode, and other electronics. This efficiency includes all losses (electronics, coil to coil losses, rectifier, etc.) and is a more practical number for efficiency than the ratio of AC power out of a receiver coil to AC power into a charger or power supply coil commonly used. It can be seen that very efficient power transfer efficiency can be obtained with inductive methods. In accordance with the example shown, the coils can be identical and 1.25" in diameter and comprise 10 turns.

[0320] As can be seen from FIG. 35, for the coil geometries used here, at an offset between the center of coils of half the radius, the power transferred can be 75% of the maximum value. Improvements in flatness of the curve may be possible with changing the design of the coil to overlap more of the field on the outer areas of the coil or by using hybrid coils.

[0321] However, it is important to note that while the transferred power decreases with offset between the coil centers due to reduced overlap of the coil areas, the power transfer efficiency (ratio of DC power out from receiver to DC power into charger or power supply) remains relatively constant in the range of offset $< 3r/4$. This is a more critical factor in design of an efficient system. If one assumes that a system can be designed such that the coil offset is never larger than $r/2$, then in a wireless charging or power transfer system, then, one can design the system such that the power transferred at this maximum possible offset is equal or greater than the maximum transferred power necessary.

[0322] For example, if FIG. 35 represents the maximum power transfer possible given the particular coil type, size, and geometry and the switching circuit (FET) and circuit design, then 3 W or more power can be transferred depending on the offset between the coils assuming that the coil offset is always smaller or equal to $r/2$. For a power supply application where regulated, constant power to a device is necessary, using regulation of the output power or a feedback to the charger or power supply to change the frequency or duty cycle, etc. to keep the power constant can insure that the received power to a device is independent of the offset between the coils. For example in this case, using regulation, one can ensure that up to a maximum power of 3 W can be provided to a load independent of coil offset (up to the maximum allowable offset--assumed to be $r/2$ here). In this case, the 3 W is sufficient for most mobile devices (mobile phones, cameras, Bluetooth headsets, etc.). Again, it is noted that the overall efficiency of the system remains high in all cases, since the offset (within the range of possible offset values) and regulation of the power (if it is performed at the charger or power supply by changing duty cycle, etc.) do not have a large impact on efficiency.

[0323] Position Independence using Layers

[0324] From the discussion above, one can achieve the goals of high efficiency and position independence if a method is found wherein the offset between the charger or power supply and receiver coils is always kept equal or less than $r/2$. In the case of hexagonal spirals with side= r , the maximal diameter is $2r$ (similar to a circle with radius r). So for a given hexagon with side= r , the same relation holds. As described herein, several methods of achieving this are proposed.

[0325] FIG. 36 shows an embodiment in which a coil mosaic is used to cover the surface area of the pad. The circuitry can include means of sensing the presence of a receiver coil to start the appropriate driver to provide power. The drive and sense circuits and other electronics are shown here as components in the perimeter of the coil area but can be located anywhere. The approximate Effective Area is also shown. If the center of a receiver coil is placed anywhere within the effective area, the receiver will receive the specified power with only one appropriate coil in the charger or power supply activated.

[0326] In the geometry described here, each coil is driven by its own drive circuit. A sensing mechanism senses the presence of a receiver coil on top or close to a charger or power supply coil and starts the drive circuit to power the appropriate coil. The sensing mechanism can be a

current sense mechanism. Each coil drive circuit can periodically start driving the coil at an appropriate frequency and a current sense circuit can monitor the drawn current to sense when a receiver is nearby thereby affecting the inductance of the charger or power supply coil. Driving the charger or power supply coil circuit at an appropriate frequency determined by the inductances of the charger or power supply and receiver coils and the capacitance of the load, can provide very high sensitivity to this change in the inductance.

[0327] Additional verification can be obtained by exchanging a verification code through the coils or by exchange of information through a second wireless data communication link (such as RFID, NFC, WiFi, etc.) between the pad and the device(s) to be charged. The code exchange can also provide information to the charger or power supply coil regarding the necessary voltage, power, temperature, or other diagnostic information for achieving reliable charging.

[0328] The approximate Effective Area is shown in FIG. 36. Any point within the Effective Area shown has the property that a receiver coil placed with its center within this area is always within half a width or less of the center of at least one charger or power supply coil. If the system is designed such that moving the receiver coil within half the width of the center of any given activated coil provides at minimum the maximum output required (i.e. 3 W in the earlier example), the Effective Area has the property that a receiver coil with its center anywhere within this area can receive the necessary maximum output power or more with only one appropriate charger or power supply coil activated.

[0329] For the geometry shown in FIG. 36 comprising 75 hexagonal coils with side= r in 3 layers, the effective area is approximately $12r$ wide and $6mr$ high where mr is the minimal radius of the hexagon= $3r$. The total area is approximately $62r$. In accordance with an embodiment, the Coverage Efficiency (CE) is defined as the Effective Area in units of coil radius (for circular coils) or length of side (for Hexagonal coils) divided by the number of Coils used. $CE \approx 0.83$ in this example.

[0330] To consider an example, one can take the maximum offset between the receiver and charger or power supply coil to achieve sufficient output power to be half the width of a coil (assuming symmetrical coils). Using coils with different width or radii (in the case of circular coils) or other geometries would change this value. It can be shown that a hybrid coil with a PCB coil and a wound wire coil are placed on top of each other is shown to have a more flat power transfer efficiency curve as a function of offset between the charger or power supply and receiver

coil offsets. The general results and the operating principles for the embodiments discussed herein are valid regardless of what type of coil, geometry, or regulation is used to allow larger (or smaller) insensitivity to charger or power supply/receiver coil offset.

[0331] For the remaining portions of this document, embodiments are generally described which use half the width of the charger or power supply coil as the maximum allowable offset between the charger or power supply and receiver coil before the transferred power becomes lower than the desired maximum transferred power value.

[0332] The sense and control mechanism in the Configuration shown in FIG. 36 may be shared between a number of drive circuits to reduce parts count or may be integrated with each drive section. A number of other sense mechanism such as magnetic, optical, or capacitance sensors may also be used.

[0333] FIG. 37 shows an alternative embodiment in which the number of drive (and sensing) circuits may be reduced by using $1 \times N$ electrical or electronic switches. In this embodiment, a number (N) of coils are connected to a $1 \times N$ switch that is on the other side connected to a coil drive and sense circuitry. The switch periodically switches each of the coils in rotation to the coil drive and sense circuitry. Once an appropriate receiver coil in the vicinity of a charger or power supply coil is detected, that coil may be interrogated further to verify a chargeable device is nearby and then charging or powering of the device begins.

[0334] One drawback of this scheme is that since each drive electronics module can at most only be connected to 1 coil out of N coils in each segment, 2 devices placed on 2 different coils in that segment may not be powered or charged simultaneously. In practice, since each device to be charged will cover a certain amount of area on the surface, by appropriately segmenting the pad and choosing the size of charger or power supply and receiver coils, one can minimize the impact of this effect.

[0335] For an extreme case that $N=NC$ (i.e. the number of coils in the pad), one can use a single drive and sense electronics module to monitor and power any coil in the pad thus greatly simplifying the architecture and potentially the cost of the charger or power supply. However, only one receiver coil, and hence only one device may be powered up or charged at any given time. The desirable characteristics of the $1 \times N$ switch are:

[0336] Low ON resistance: This would reduce wasted power in the form of heat at the switch.

[0337] High current capability: For power charging applications, depending on application and device to be charged, 0.5 A and higher, up to several Amps of current may be carried in ON state.

[0338] High reliability: Failure of a switch would render the related segment dysfunctional.

[0339] Fortunately, the switching speed of the $1 \times N$ switch is not critical for this application. For example, if it is desired for the pad to have a 1 second response time (time it takes for the pad to sense a device and begin charging), the switch must be able to disconnect and establish a new connection in under $1/N$ seconds (ignoring the time it takes for the sense and control circuitry to work which can be extremely fast). As an example, for $N=10$, this switch disconnect and connect time is under 100 msec, which is quite achievable. Even lower switching speeds are acceptable for longer response times.

[0340] In accordance with an embodiment, the $1 \times N$ switches may be implemented by electronics circuits or SPDT or DPDT IC switches, relays, MOSFETs, or Micro-Electro-Mechanical Systems (MEMS) switches. Other methods for switching may also be employed.

[0341] As an example of an IC switch for this application, a series of Single Pole Double Throw (SPDT) switches with relatively low R_{ds} of $80 \text{ m}\Omega$ that can be used in this application. An example of the SPDT is available in a Quad (four switches) pack and is capable of carrying 500 mA which is sufficient for most low power applications. If larger current carrying capability is desired, two or more of the switches may be used in parallel. This particular IC also incorporates over current, short circuit, and temperature sense circuitry which provides additional safety features for a system. A $1 \times N$ switch can be created by connecting several of such switches.

[0342] In accordance with one embodiment, the surface of a charging pad is divided into segments where within each segment, a significant Effective Area wherein the center of a receiving coil can be placed to receive power is created.

[0343] FIG. 38 shows a case where a three-coil layer PCB is arranged to provide a cluster for uniform power in an area using only one coil powered at any given time. In this case, layer 1 comprises six coils arranged around a central coil for a total of seven coils. The second and third layers comprise six coils total. In total, nineteen coils exist in the three layers of the PCB.

[0344] FIG. 39 shows the coils are arranged such that by powering only one of the coils in the cluster, any receiver coil (for the receiver) placed with a center within any location in the effective area receive the specified power if the appropriate charger or power supply coil is

activated. When the three layers are stacked together, seen from above, the structure is as shown in FIG. 39. As described above, any point within the Effective Area shown has the property that a receiver coil placed with its center within this area is always within half a width of the center of at least one charger or power supply coil. Therefore, it can receive the necessary minimum power or more with only one appropriate charger or power supply coil activated.

[0345] For the case shown in FIG. 38 with nineteen distinct coils, five of the quad SPDT chips mentioned above can provide the necessary Switching capability to allow a single drive and sense circuit to sense the presence or absence of a receiver coil near each coil. In accordance with an embodiment, the sequence can be:

[0346] The switches are set so that the coil 1 in Layer 1 shown as (1,1) in FIG. 38 is connected to a switching and sense circuitry similar to the left side of FIG. 34 (i.e. the charger or power supply in FIG. 34).

[0347] MCU1 gives a command to the FET driver to begin switching the coil. The duty cycle may be set very low to generate a low voltage in any potential nearby receiver coil.

[0348] If a receiver coil is nearby, it begins drawing power from the charger or power supply coil. This can be sensed as a higher than normal current draw in the current sense circuit of the charger or power supply.

[0349] Additionally, the charger or power supply and receiver coil can exchange a code to confirm that a valid device or battery with appropriate circuitry is nearby and verified.

[0350] At this point, the amount of current through the sense circuit is digitized by MCU1 and saved in its memory.

[0351] Alternately, the receiver circuit can note the amount of voltage or power being received and report back to the charger or power supply. This information can be encoded by modulating the input impedance of the receiver circuit by MCU2. This information is then sensed by the charger or power supply sense circuitry, digitized by MCU1 and saved.

[0352] The FET driver and therefore the FET are disabled.

[0353] The switches are configured to connect the drive and sense circuitry to the next coil (Coil (1,2) in this example).

[0354] Commands 2 through 8 are executed until all coils have been activated and tested.

[0355] MCU1 compares the values received for sense currents and determines which coil has the highest sense current when turned on. This is the closest charger or power supply coil to the

receiver coil. If additional circuitry for confirmation of valid receiver through exchange of code is implemented, the closest coil has to also pass this test.

[0356] The appropriate coil is turned on and charging starts. An additional verification can be performed prior to start of charge.

[0357] The charging continues in open or closed loop depending on the system architecture until end of charge is achieved. This is either indicated to the charger or power supply by the MCU2 or sensed in the charger or power supply sense circuit by a change in the amount of current being drawn.

[0358] Depending on the characteristics desired and cost/performance tradeoffs, it may be decided that for each cluster, 2 or more drive and sense circuits and a smaller number of switches are used.

[0359] FIG. 40 shows one configuration wherein the number of switches required is reduced to three to switch to any of the 20 coils in FIG. 39. The first switch connects the V_c to one of the ports (outside or inside contact point of the spiral coil) on every coil in one of the three layers. The other ports of groups of three of coils from different layers are connected together and input into the switches 2 & 3 as shown in the figure. The outputs of Switch 2 & 3 are connected together, and connect to the FET for switching. The center coil (1,7) is connected to the poles of the switches by itself. This coil is often the most likely coil for the receiver coil to be adjacent to since it is central. Comparing FIG. 40 with FIG. 34 shows that using this scheme, any one of the coils in the system can be connected by the switches to be driven by the FET.

[0360] Depending on cost/performance trade-offs involved, it may be advantageous to cut the number of switches by schemes such as shown in FIG. 40. Such a scheme can also be used to cut down the number of switches in a larger array. For example, the array in FIG. 36 comprising 75 coils would require 19 Quad SPDT ICs to implement. However, by using one Switch to choose one of the 3 layers and 7 switches to choose one of the 25 coils in each layer, one can achieve the same results with 8 total switches.

[0361] With further cascading of switching layers, it is possible to further reduce this number. However, it must be noted that cascading of switching layers increases the Series Resistance along the current path of the charger or power supply coil which is undesirable.

[0362] In the examples given above, the switching is shown for Point A in FIG. 34 prior to the coils. However, Point B can also be used for this purpose.

[0363] The associated electronics are shown on the perimeter of the coils but can be placed in other locations too.

[0364] FIG. 41 shows a multi-charger or power supply pad that incorporates four of the clusters shown in FIG. 39. A device to be charged or powered would have to be placed such that the center of the receiver coil is within one of the effective areas in one of the clusters or segments. As an example, if the cluster is made of hexagons with side lengths r , a hexagonal Effective Area in the center of the cluster with a maximal diameter of $5r$ is created. The Effective Area $\approx 19r$ achieved with 19 coils giving a Coverage Efficiency=Effective Area (in coil radius or side length Units)/Number of Coils=1.

[0365] For a typical coil of $r=0.625$ " side, this leads to a maximal diameter of 3.125 ". Such an almost circular Effective Area with a diameter of over 3 " can be marked on the surface of the charger or power supply pad and allows the user to easily place the receiver coil inside (or on) a mobile device such as camera, mobile phone, batteries, game players, etc. in the right location for charging without much alignment and effort. Each of the clusters in the configuration shown in FIG. 41 can have their own coil drive and sense circuits or may share this circuitry through multiplexing with switches.

[0366] In this way, a practical system for providing a large Effective Area in each charging area (i.e. segment) while maintaining high power transfer efficiency is developed. A significant advantage is also that simultaneous charging of multiple devices can be achieved.

[0367] It should be noted that the charger or power supply coils can be designed to be larger than the receiver coils. By doing so, one can obtain an even larger effective area and insensitivity to placement of the receiver coil. The Effective Area has a maximal diameter of $3r$. Other combination of coil patterns to achieve local position independence with a number of coils can be constructed.

[0368] FIG. 42 shows a cluster of 2 layers of 3 coils and a central coil (total 7 coils) that can create an effective area of $3r$. In practice, such an area may be sufficient for many applications. It will be noted that while Hexagonal coils are shown in many of these figures, a combination of Hexagons and/or circles, or other shapes can be combined to provide the best efficiency/position independence performance. Similarly, the size and shape of the receiver can be non-Hexagonal.

[0369] For example, in FIG. 42, the central and the receiver coil can instead be circular (spiral coil) and the central charger or power supply coil is the most likely charger or power supply coil

for the receiver coil to be on top of. If the receiver coil is placed on any other position, a hexagonal coil is the closest coil and be powered. In accordance with other embodiments, the central coil in FIG. 16 can be larger than the receiver coil and cover most of the likely central area. The remainder of the coils would only be used if the receiver is placed in extreme outside locations.

[0370] It must be noted that the foregoing description describes the situation wherein the transmitted power drops to acceptable levels when the coil centers are offset by half the radius. In practice, this value can be different and by using a combination of coil patterns and sizes and regulation of the transmitted power, uniform power transmission across an area can be maintained.

[0371] While the use of IC switching elements has been discussed above, other switching mechanisms such as MEMS, relays, etc. can be used to achieve the results. In accordance with other embodiments, the switching may be implemented by creating a deformable layer under the coil layers to act as the switch. Each spiral coil discussed here has 2 ports with one at the outside diameter wherein the coil starts and one at the center wherein the coil terminates.

[0372] FIG. 43 shows a mosaic of hexagonal coils with the central port to each coil shown as circles. In accordance with an embodiment, one of the ports of all of the coils in the 3 layers (in this case, the outside port) is connected to a common point, called here P1. The other port of each coil (shown as the central one here) in the mosaic pattern of FIG. 42 is brought down through vias to a common layer at the bottom of the multi-layer PCB and connected to a copper pad with a certain surface area. Such a pattern seen from above (the same side as FIG. 43) is shown in FIG. 44.

[0373] FIG. 44 shows the top view seen from the same side. The side view of the pad has integrated MEMS switch for contacting individual coil contact pads.

[0374] In an earlier U.S. patent application Ser. No. 11/669,113, the use of attracting magnets placed at the centers of an inductive charger or power supply's PCB coil and the center of the receive coil to align and center the 2 parts conveniently has been described. Such techniques were used in the charger or power supply for mobile device or battery alignment.

[0375] In accordance with a present embodiment, a planar conductive layer or conductive traces patterned with conductive pads similar to the coil port pattern shown in Top part of FIG. 44 and all connected to a common point (called P2 here) is created on a flexible material film. Examples

of the material for the flexible film are mylar, polyimide, flexible PCB material such as Kapton, etc. or plastic. At the center of each of the pads, a small magnet or ferromagnetic material is attached to the other side of the film. Alternatively, a layer of ferromagnetic material is deposited and patterned to have a pattern similar to FIG. 45 top so that only material with a pattern similar to the PCB port pad remains. The flexible film is attached to the bottom of the PCB such that a small gap between the top layer of the film and the bottom of the PCB is created by a spacer. The side view of the MEMS charger or power supply pad is shown in FIG. 44.

[0376] The entire package shown in the bottom of FIG. 44 has 2 electrical connection points. One from the PCB, called P1 that is connected to one of the ports of all of the coils in the 3 layers of the PCB (in this case the edge port). The other connection is to the common pads on the flexible film. This is called P2. Looking at FIG. 34, the entire package can be treated as L1, and connect P1 to point A in this circuit and P2 to point C.

[0377] Ordinarily, none of the coil center ports are connected to the contact pads on the flexible film and therefore the circuit is not completed. If a receiver coil with a magnet attached to the back of its PCB coil and the magnet oriented with correct polarity is brought close to the pad, it attracts the magnet or patterned ferromagnetic layer at the center of the nearest charger or power supply coil and at the bottom of the flexible film towards itself. This causes the top conductive layer on the flexible film to make contact with the center port of the appropriate coil and close the circuit. In this way, current can flow only through the appropriate coil and then activate it.

[0378] In accordance with an embodiment, to avoid oxidation of the contact pads at the bottom of the PCB and the flexible film contacts, these surfaces can be protected by deposition of additional layers such as gold or other material on top of the copper. Such processes are often used in PCB manufacture to protect exposed contacts. In addition, the PCB pad package can be hermetically sealed to avoid dust contamination on the contacts. Additionally, the volume inside can be filled with an inert gas such as nitrogen.

[0379] By optimizing the surface area of the contact pad and the flexible film contact areas and material composition, low contact resistance can be obtained. Other parameters to optimize are the area of the magnet or magnetic material and the type of material used.

[0380] The configuration above is provided by way of example. In accordance with other embodiments, it is possible to connect the components in a different manner, or to place in an external drive circuit in a different configuration to achieve the desired result. A 3 layer board

has also been used to demonstrate this approach. Simpler constructions with 1 or 2 layers or configurations wherein the coils in the different layers have different functions or sizes and provide different power levels can also be implemented. The advantages of this approach are:

[0381] 1--High efficiency: Only the appropriate coil for high coil overlap is activated.

[0382] 2--Position Independence: The receiver coil can be placed anywhere with its center in the Effective Area and achieve specified power transfer.

[0383] 3--Low cost: The pad does not use any IC switching elements for connecting to the appropriate coil.

[0384] As described above, in accordance with an embodiment the entire package in FIG. 44 is connected between points A and C in the circuit of FIG. 34. One example of the operation of the system is described in more detail here:

[0385] MCU1 gives a command to the FET driver periodically to begin switching the coil. The duty cycle may be set very low to generate a low voltage in any potential nearby receiver coil.

[0386] Ordinarily, none of the coils is connected to point C in FIG. 34. Therefore, no current is sensed in the current sense circuit.

[0387] If a receiver coil is placed on the pad, it will cause the appropriate charger or power supply coil center port to contact the pad on the flexible film and therefore the appropriate coil is contacted to points A and C in FIG. 34.

[0388] The receiver coil begins drawing power from the charger or power supply coil. This can be sensed as a higher than normal current draw in the current sense circuit of the charger or power supply.

[0389] Additionally, the charger or power supply and receiver coil can exchange a code to confirm that a valid device or battery with appropriate circuitry is nearby and verified.

[0390] Once MCU1 determines that an appropriate receiver coil is on the pad and ready to draw power, the FET is turned on and charging starts. An additional verification can be performed.

[0391] The charging continues in open or closed loop depending on the system architecture until end of charge is achieved. This is either indicated to the charger or power supply by the MCU2 or sensed in the charger or power supply sense circuit by a change in the amount of current being drawn.

[0392] The description provided above describes what happens when the activation of the MEMS switch occurs through magnetic attraction. In accordance with some embodiments, the

switch can be designed such that it closes at the appropriate location due to static attraction, pressure, temperature change, or other mechanism.

[0393] In the MEMS system described above, a disk or other magnet in the receiver coil attracts a magnet or patterned ferromagnetic layer attached or deposited under the flexible film to close the contact beneath the appropriate charger or power supply coil to the FET. However, in other embodiments a ferromagnetic layer can also be used in the middle of the receiver coil (on the front of the PCB, its back or separate layer from the coil layer) and use either permanent magnets or deposit or sputter, etc. a patterned ferromagnetic layer that is permanently magnetized behind the flexible layer film. In this way, the charger or power supply pad would contain multiple magnetic points corresponding to the centers of the coils. When a ferromagnetic material is brought close to the pad, the appropriate coil is activated. To avoid false starts with metallic objects placed on the pad, secondary verification techniques, as described above, can be used, including in some embodiments an exchange of code between the charger or power supply and receiver coil.

[0394] Examples of metals that can be used are Ni, Fe, Co, or various commonly used alloys. These can be deposited on a flexible film in a variety of ways such as sputtering, evaporation, e-beam, plating, etc.

[0395] The system shown in FIG. 44 is mostly designed to operate with a single FET and allow charging of a single device somewhere on the pad. If 2 devices are placed on the pad and 2 coils are connected to the pad, the power transferred may not reach the full specified power and it may not be clear which device is sending or receiving the control signals during charging.

[0396] In accordance with an embodiment, to overcome these issues, a segmented pad where clusters of charger or power supply coils are attached to individual drive and sense circuits and are independent of each other can be used.

[0397] The X-Y area is divided into segments (in this case 4 shown). One coil in each section can be driven by an appropriate FET and sense Circuit for that segment. Top: The pattern for contact pads at the bottom layer of the PCB. Each pad is connected to the central port of a coil in one of the 3 layers above. The top view is shown here. Bottom: The side view of the pad with integrated MEMS switch for contacting individual coil contact pads. Spacers at the edges and the walls of the segment areas keep the flexible film at a pre-determined distance from the bottom layer of the PCB.

[0398] FIG. 45 shows the architecture of the segmented MEMS charger or power supply pad in accordance with an embodiment. Each segment comprising a number of coils is connected to points A and C of a different driver and sense circuit. Thus, devices placed inside each segment can be driven with their own driver and are independent. In this way, several (in this case 4) devices can be charged or powered simultaneously.

[0399] In FIG. 45, additional spacers are placed at the boundaries of the segments. These spacers may help with keeping the flexible film/PCB gap constant and operation of the flexible film uniform along the X and Y direction. Such spacers interspersed in the X-Y plane between the PCB and flexible film layer may be used regardless of whether the pad is segmented electrically or not.

[0400] In accordance with some embodiments, the MEMS switching method described here can also be applied to the cluster geometry shown in FIG. 41 or any other geometry.

[0401] Conductive Multi-Charger or Power Supply Surface

[0402] As discussed above, in accordance with some embodiments, another method for charging or powering multiple devices on a common charger or power supply surface is to incorporate a number of connector points or strips into the pad. The user can place a device with an appropriate connector on a pad or similar object and receive power through matching contacts on the pad. FIG. 46 shows a general diagram for this approach is shown in. In this approach, one or more regulated power supplies are connected to the charger or power supply pad. The pad comprises an array of contacts or strips of exposed connector.

[0403] FIG. 47 shows an array of contacts on the surface of a pad. In FIG. 47, each position comprises a Voltage and Ground contact. In this picture, the connector is shown as a recessed circle similar to a washer where one contact is in the middle and the other contact is in the body or outside of the circle. Other connector geometries are possible.

[0404] A device with an appropriate mating connector at its bottom or in a plug-in unit for after-market applications can be placed on the pad and the connectors on the device make appropriate contacts to the pad contacts if placed on one of the contact points. In accordance with an embodiment, the connectors on the surface of the charger or power supply pad are connected to a number of switches which are connected to regulated power supplies and sense circuits as shown through switch arrays as shown in FIG. 46. MCU1 periodically turns ON one of the regulated

power supplies. The switches are set such that a connection is made to the 2 contacts of a contact point in the pad. The sense circuit detects any possible flow of current. If a current flow is detected, the system may verify the presence of a valid receiver through exchange of information through the contact with a MCU2 in the receiver. If no current is being drawn or the verification process fails, the MCU1 reconnects the supply to the next contact position. By rastering the entire pad periodically, contact to several devices on the pad for charging or power can be established. A diode D1 can be used for protection against reverse voltage, a Capacitor (C1) to filter any potential noise on the regulated power supply output, and MCU2 to enable communication between the Charger or power supply and the Receiver are shown. The receiver may also incorporate a voltage regulator to provide a constant voltage (or voltage in the acceptable range for operation) to MCU2. This voltage regulator just provides the low power necessary for this, and is not in the path of the main power going into the battery. Any power loss due to this regulator is small because it is very low power and does not affect the overall system efficiency much. It is mainly used to keep the MCU active during startup or other changes so the communication with charger or power supply is maintained. However, these components are optional and may not be present depending on the architecture used. The description provided herein does not depend on use of these components for operation.

[0405] If the ground (through a sense circuit) contact for all positions is connected together, then Switch Array 2 can be eliminated. Care must be taken to interpret the received signals in interpreting the current sense values since it is the sum of currents from all devices being charged.

[0406] The switching arrangements discussed above for the Inductive cases can be modified and used for this type of conductive switching as well. In addition, the MEMS based approaches shown above are applicable to this application.

[0407] An embodiment for a universal charging pad using conduction is shown in FIG. 48. In this case, one of the contact points for each position (e.g. Ground contact) is connected together throughout the pad and connected to the appropriate location (Ground through the sense circuit in this case). The other contacts are brought through the charger or power supply surface to the bottom of the surface and contact pads are formed.

[0408] Top: The pattern for contact pads at the layer below the connectors. One of the contact points for each position (e.g. Ground contact) is connected together throughout the pad and

connected to the appropriate location (through Sense circuit to Ground in this case). Bottom: Side view of the pad with integrated MEMS switch for contacting individual contacts to the power supply. Spacers at the edges keep the flexible film at a pre-determined distance from the bottom layer of the PCB.

[0409] In accordance with an embodiment, a planar conductive layer or conductive traces patterned with conductive pads similar to the charger or power supply surface contact pattern shown in Top part of FIG. 48 and all connected to a common point (called P2 here) is created on a flexible material film. Examples of the material for the flexible film are mylar, polyimide, flexible PCB material such as Kapton, etc. or plastic. At the center of each of the pads, a small magnet or ferromagnetic material is attached to the other side of the film. Alternatively, a layer of ferromagnetic material is deposited and patterned to have a pattern similar to the Top in FIG. 47 so that it only material with a pattern similar to the charger or power supply surface pad pattern remains. The flexible film is attached to the bottom of the charger or power supply surface such that a small gap between the top layer of the film and the bottom of the charger or power supply surface is created by a spacer.

[0410] FIG. 48 shows the side view of the MEMS conductive charger or power supply pad. Using the MEMS conductive charger or power supply pad eliminates the need for switching arrays.

[0411] In accordance with an embodiment, the entire package shown in the bottom of FIG. 48 has two electrical connection points. One from the top surface, called P1 that is connected to one of the connector points of all of the connector positions on the charger or power supply surface (Ground in this case). The other connection is to the common pads on the flexible film. This is called P2, and is connected to the other position in the circuit. For example, for the geometry discussed here, P1 can be connected to Point B in FIG. 49 and P2 connected to Point A. FIG. 49 is a generalized block diagram of a charger or power supply pad with multiple regulated power supplies.

[0412] The case discussed here and the pad in FIG. 48 enable connection of one regulated supply to one or more devices placed on the pad. However in the case of multiple devices on the pad, the voltage characteristics of the device would have to be identical to the first one and the sum of powers being drawn from the supply not exceed the maximum rating of the power supply. A

more generalized approach wherein different voltages/power can be supplied to different devices is discussed in further detail below.

[0413] Ordinarily, none of the connectors are connected to the contact pads on the flexible film and therefore the circuit is not completed. In accordance with an embodiment, if a receiver with a magnet attached to the back or perimeter of the connector and the magnet oriented with correct polarity is brought close to the charging surface, it attracts the magnet or patterned ferromagnetic layer at the center of the nearest contact pad and at the bottom of the flexible film towards itself. This causes the top conductive layer on the flexible film to make contact with the contact pad for the appropriate connector at the bottom of the charger or power supply surface and close the circuit. In this way, current can flow only through the appropriate connector into the receiver circuit and the device to be charged.

[0414] As described above, to avoid oxidation of the contact pads at the bottom of the charger or power supply surface and the flexible film contacts, these surfaces can be protected by deposition of additional layers such as gold on top of the Copper. Such processes are common to protect exposed contacts. In addition, the pad package can be hermetically sealed to avoid dust contamination on the contacts. Additionally, the volume inside can be filled with an inert gas such as nitrogen.

[0415] By optimizing the surface area of the contact pad and the flexible film contact areas and material composition, low contact resistance can be obtained. Other parameters to optimize are the area of the magnet or magnetic material and the type of material used.

[0416] Top: The pattern for contact pads at the layer below the connectors. One of the contact points for each position (e.g. Ground contact) is connected together throughout the pad to form contact point P1. Bottom: Side view of the pad with integrated MEMS switch for contacting individual contacts to the power supply. Spacers at the edges and the walls of the segment areas keep the flexible film at a pre-determined distance from the bottom layer of the PCB. The contact pads in each segment of the flexible film are connected together to form contact P2 for each segment.

[0417] FIG. 49 shows another embodiment where several regulated power supplies provide power to the pad. This allows charging of several devices simultaneously.

[0418] FIG. 50 shows an alternative embodiment using a segmented surface. The operation of this is similar to previously described except that the top and bottom contact points for each

segment P1 and P2 are connected to the appropriate positions in B and A in FIG. 49 so that each regulated power supply is connected to one of the segments in the charger or power supply surface when the circuit is closed. In this way, a device placed on each of the segments can be powered by the regulated power supply at its required voltage and power level.

[0419] Electromagnetic Shielding

[0420] Electromagnetic Interference (EMI) is an important aspect of performance of any electronic device. Any device to be sold commercially requires adherence to regulation in different countries or regions in terms of radiated power from it.

[0421] For an inductive charger or power supply comprising a number of coils and electronics switches and control circuitry, the main sources of noise include:

[0422] Any potential radiated noise from switching FETS, drivers, etc. or sense and control circuitry. This noise can be at higher frequency than the fundamental drive frequency of the coils and can be emitted away from the charger or power supply because of the frequency. This noise can be minimized by optimizing the drive circuit to avoid sharp edges in the drive waveform and associated noise.

[0423] Noise from copper traces with ac signals. This noise can also be at higher frequency and emit away from the charger or power supply. The length of these paths must be minimized.

[0424] EM emission from the switched coil. For coils described here and driven in the 100s of kHz up to several MHz, the wavelength of the Electromagnetic (EM) field generated can be in the hundreds of meters. Given the small length of the coils windings (often 1 m or less), the coils used are not efficient far-field transmitters of the EM field and the generated EM field is in general highly contained near the coil surface. The magnetic flux pattern from a PCB coil is highly contained in the area of a coil and does not emit efficiently away from the coil.

[0425] Care must be taken when designing the current paths, and in some embodiments shielding of the FETs or other ICs or electronics components may be necessary. In addition, switching the coils with waveforms that have higher frequency components, gives rise to noise at higher frequencies. In any of the above geometries described, incorporation of conductive layers and/or ferromagnetic layers in the system can shield the outside environment from any potential radiative fields. The conductive layers may be incorporated in the PCB to eliminate the need for additional separate shielding layers.

[0426] In the examples provided above, while the 3 coil layers can be incorporated into PCB layers, the electronics components can be placed on the lower most surface of the PCB to allow a flat surface on the top and allow receiver coils to get as close as possible to the charger or power supply coils. One possible arrangement for the location of the electronics components at the bottom surface of the total PCB stack is shown. In this case, in some or all of the layers above, the PCB layers can incorporate Copper sections in the areas shown in black in this figure. By appropriately grounding these sections and providing additional conductive and/or magnetic layers below the electronics components, the EMI can be significantly reduced.

[0427] In accordance with an embodiment, another method for minimizing the effect of the copper traces in the PCB is to sandwich them between layers of conductors in the PCB. In a multi-layer PCB, the copper trances and connections to all the components and coils can be for example, be in a middle layer and the necessary connections to the ICs or other layers be made through vias. Given that the magnetic flux is highly contained within the coil area, the layer containing the coil or another layer below or above can contain a substantially continuous layer of copper covering everything except the area of the flux generated by the PCB (very close to the outside ring of the coil). By having two or more conductive PCB layers for shielding sandwiching the signal and current paths, most of the noise generated can be shielded very close to the source. Since the noise from the PCB is minimal and does not radiate, the remaining source of noise, the electronics, FETS, etc. can be shielded by covering the section with these devices with a metallic cover or shield.

[0428] Similar types of judicious incorporation of grounded Copper layers in the PCB layers in any of the designs above can significantly reduce any potential EMI issues without requiring additional shielding layers.

[0429] FIG. 51 shows a standard used within the European Union for measuring emissions from a product. In this case, the emissions from a product are measured at 10 m distance. This test (EN 55022) looks for emissions from 30 MHz to 1 GHz. Limits for Class A and Class B certification are shown in the Figure.

[0430] FIG. 51 shows a typical scan of emissions from an inductive multi-charger or power supply pad. As discussed above, the radiation at the fundamental operating frequency (100's of kHz to several MHz), can be self-contained within the coil area. However, noise at higher

frequencies (such as the test range of 30 MHz to 1 GHz) must be reduced to avoid interference with other nearby electronic devices.

[0431] Metallic and/or Ferromagnetic layers are often included in electronic devices to reduce their EM emission. An example of such layers is described in U.S. Pat. Nos. 6,888,438, and 6,501,364. In these instances, PCB coils are formed on two sides of a PCB, and ferromagnetic and copper layers are placed on each side of the PCB to limit emissions from a package containing such a transformer.

[0432] Frequency Selective Electromagnetic Shielding

[0433] In accordance with some embodiments of the inductive universal charger or power supply pad described herein, the inclusion of metallic and/or Ferromagnetic layers at areas that are potential sources of emission such as FETs, etc. may be beneficial. However, a method that would wholly cover the charger or power supply pad package to eliminate potential for escaping EM fields may provide benefits.

[0434] Given that the inductive charger or power supply pad operates by generating an oscillating magnetic field, such an approach does not seem feasible as it would block such a field from being sensed by the receiver coil.

[0435] In accordance with an embodiment, a method is described herein that allows the inductive pad to emit EM waves efficiently for operation while simultaneously providing shielding to high frequency EM fields. Such operation is achieved by taking advantage of the skin effect in conductors.

[0436] The skin effect is the tendency of an alternating electric current (AC) to distribute itself within a conductor so that the current density near the surface of the conductor is greater than inside the material. That is, the electric current tends to flow at the "skin" of the conductor.

[0437] The skin effect causes the effective resistance of a conductor to increase with the frequency of the current and has practical consequences in the design of radio-frequency and microwave circuits.

[0438] The current density J in an infinitely thick plane conductor decreases exponentially with depth δ from the surface, as shown below:

$$J = J_s e^{-\delta/d}$$

where d is a constant called the "skin depth". This is defined as the depth below the surface of the conductor at which the current density decays to $1/e$ (about 0.37) of the current density at the surface. It is given by:

$$d = \sqrt{2\rho/\omega\mu}$$

Where:

ρ = resistivity of conductor

ω = angular frequency of current = $2\pi \times$ frequency

μ = absolute magnetic permeability of conductor = $\mu_0 \cdot \mu_r$, where μ_0 is the permeability of free space and μ_r is the relative permeability of the conductor.

It is important to note that d decreases rapidly with frequency. The magnetic and electric fields similarly get attenuated traveling through a sheet of a conductor. Using the values for conductivity of copper (5.8×10^7 Siemens/m), the absorption going through a single layer of copper with various thickness can be calculated.

[0439] FIG. 52 shows the absorption through a copper layer of 70 μm and 7 μm . While the 70 μm layer provides very high attenuation in the region of interest (30 MHz to 1 GHz), the attenuation is excessive in most cases and is only needed in extraordinarily noisy circumstances.

[0440] As described herein, the transmitted power is considered through a very thin conductive layer.

[0441] FIG. 53 shows how the attenuation values are shown for Copper and Aluminum (conductivity of 3.76×10^7 for 99.99% Al) layers for several thicknesses.

[0442] For these calculations, the placement of the layer with respect to the source of the EM field needs to be included. In these calculations, the source is assumed to be 0.5 mm under the layer. This is similar to placing the layer essentially directly on the source of the field.

[0443] It will be noted that, for very thin layers of Copper and Aluminum, down to 1 micron thickness, very high attenuation values at frequencies over 1 MHz are obtained. The attenuation of 1 μm layers of Copper and Aluminum at 10^9 Hz are respectively 32 dB and 28 dB and are comparable. However, at 1 MHz or below, the attenuation in either material for such a thin layer is minimal. In accordance with some embodiments, this behavior or characteristic can be exploited.

[0444] FIG. 54 shows Transmitted EM Power through Copper and Aluminum layers of varying thickness for an incident EM field at 1 MHz which is a typical operating frequency for the type

of inductive universal charger or power supply described herein. Below 5 μm thickness, the transmitted power exceeds 95%. Aluminum in particular (due to its lower conductivity), has a wide range of thicknesses that allows a 1 MHz radiation to transmit through without much attenuation.

[0445] As discussed above, in some embodiments of the inductive charger or power supply device described herein, the generated EM field at the operating frequency of the charger or power supply (typically ≈ 1 MHz), is generated by an inefficient PCB coil antenna and is mostly confined to the area immediately near the coil (to be picked up by the receiver coil). However, any noise generated by driving the coil at this fundamental frequency (due to nonlinearities at the components, non-sinusoidal signal, or at the FET or the FET driver) or any noise generated at any other location in the charger or power supply device current paths or components or the receiver (including noise generated at the receiver rectifier), can have components that are much higher in frequency. It is desirable to suppress such noise to the extent possible.

[0446] In accordance with an embodiment, a very thin layer of a conductor (such as Copper or Al, organic conductors, nanotech materials, nanotubes, or other material), covering all or part of the charger or power supply and/or receiver circuit can be used to allow the desired low frequency components (Several MHz or below) to travel through without attenuation while severely reducing the higher frequency noise. In accordance with some embodiments, the entire inside or outside surface of the charger or power supply and/or receiver package circuitry or part of it is covered to achieve this frequency selective shielding without dramatically affecting the fundamental operation of the device.

[0447] In one embodiment, the entire inside or outside of the package for the inductive charger or power supply and/or the receiver for such a charger or power supply is covered by a thin layer of a conductor (15 μm thick or less or preferably less than 5 μm thick). The conductor can be metallic as discussed above, metal alloys, organic, nanotech materials, nanotubes, etc. At high frequencies, such a layer reduces the emitted EM power considerably (greater than 20 dB or even 30 dB) while allowing most ($>90\%$) of the fundamental operating frequency power to transmit through the layer. The conductive layer can be directly deposited on the parts. To avoid shorting of any electronics or connectors, contacts, a dielectric layer, paint or other material must be first deposited. Alternatively, the conductive parts can be masked off so as not to contact the EM shielding conductive layer.

[0448] The deposition of the conductive material can be done in a variety of manners (sputtering, evaporation, electroplating, coating through dipping, Langmuir Blodgett, painting, etc.) for different materials. Recently, an inexpensive method (Ecoplate) for conformally coating any material with metallic or metal alloy layers at room temperature has been developed. In this process, a spray of molten metal at controlled temperature and velocity instantaneously cools on incidence with a substrate and forms a conformal layer covering the entire or part of a part. The EM conductive shield can also be deposited onto a substrate such as a polymer (e.g. mylar, polyimide, polyurethane, plastics, etc.), rubber, etc. and the conductive layer coated polymer be applied to the inside or outside of the part. Anti-static bags are an example of a metalized polymer material. Aluminum is commonly used for this application.

[0449] In another embodiment, the PCB boards, electronics components, and the coils in the charger or power supply and/or the receiver are covered by a nonconductive layer (such as a dielectric, paint, etc.) and then covered completely or locally by a conductive layer of appropriate thickness either directly deposited on the board and the electronics or indirectly with a polymer or similar backing (as described above).

[0450] The optimum thickness of the conductive material is highly dependent on its conductivity. By choosing the material composition and thickness, one can obtain the desired combination of EM noise suppression and transmission of fundamental frequency.

[0451] It is also possible to combine conductive layer materials and thicknesses to construct a more tailored frequency response. Such an approach is commonly taken in the optical domain to fabricate wavelength dependent filters.

[0452] In those embodiments wherein the conductive layer covers the charger or power supply and/or receiver coil, it may be desirable to generate an EM field with a charger or power supply coil and then, after passing the emitted field through such a conductive layer, turn it back to DC power through the receiver coil and rectification. Since the conductive layer is a frequency dependent filter, in this process, this removes or weakens any higher frequency signals and enables the receiver to receive a cleaner, and depending on the design, more sinusoidal signal. Such high frequency noise is often related to not-only EMI disturbance and lack of signal to noise ratio in the electronic device to be charged. In addition, the higher frequency noise causes non-optimum operation of the receiver and possibly heating of the receiver or other components.

By removing the generated noise, electrical and thermal/environmental performance of the charger or power supply and receiver system may be improved.

[0453] Such a physical filtering of an electrical system is analogous to an optical signal being filtered in the wavelength domain (by an optical filter, grating, etc.) before reaching a receiver. The SNR and efficiency of the system is improved in this way.

[0454] Use of Magnets for Alignment of the Coils

[0455] FIG. 55 shows a method for obtaining local alignment independence between the coils in the charger or power supply and the receiver are shown therein. In accordance with an embodiment, by using small magnets behind (on the side opposite to the side facing the surface of the charger or power supply) the center of each coil in the charger or power supply, and behind (on the side opposite to the side facing the surface of the charger or power supply) the coil in the receiver, such that the magnets attract each other, a charger or power supply system can be provided wherein the user can easily find the location where the charger or power supply coil is located, without providing any physical features and/or marking on the surface of the charger or power supply. This may be advantageous in enabling charger or power supplies which can be used with any device to be charged without need for special alignment or size features. This allows charging of any size and shape device and/or battery. In this geometry, shown in FIG. 55, the magnets can be thin flat or other shape magnets placed at the center of the coil and allow the device or battery to be charged to be rotated around the charger or power supply coil with no effect.

[0456] As described above, by enabling the coil in the charger or power supply to move laterally (and somewhat vertically) in the plane of the charger or power supply surface, automatic alignment of the charger or power supply and device and/or battery coil can be achieved when a device and/or battery is laterally brought close to the center of the charger or power supply coil.

[0457] If magnets used for this application are electrically conductive, then some of the field generated by the coil will generate currents in the magnet and heat the magnet, decreasing the efficiency of the system and generating unwanted heat. This effect especially becomes important as the field strength of the coil is increased for higher powers.

[0458] In accordance with some embodiments, methods for dealing with this problem can be included, such as: Since the currents are created by eddy currents generated in the magnets, use

of non-conductive and/or low conductivity magnetic material can improve this condition. The magnet can be constructed of thin flat magnet material with laminate in between the layers to decrease the current flow and loss of power.

[0459] FIG. 56 show an embodiment in which the magnets can be broken or divided into sections, such as semi-circles with a gap or non-conductive material in-between to avoid current circulation. By having each set of magnets behind a coil to be made of two or more sections, the electrons are disrupted from circulating and generating strong eddy currents leading to heating and power loss. In this figure, each set of magnets behind a coil are made of semi-circular magnets. The poles of the magnet are aligned with the South or North pole facing the surface of the charger or power supply. The magnet in the device or battery have the opposite polarity so that the magnets of the charger or power supply and the device and/or battery attract. By having each set of magnets behind a coil to be made of two or more sections, the electrons are disrupted from circulating and generating strong eddy currents leading to heating and power loss. In FIG. 56, each set of magnets behind a coil are made of two semi-circular magnets.

[0460] FIG. 57 shows an embodiment in which one or more alignment magnets can be used behind each coil. However, in accordance with an embodiment the magnets are placed such that each magnet does not cover an area extending beyond the center of the coil. In other words, the surface of the magnet does not cover the center of the coil and thereby does not allow circular currents to be set up in the magnet as effectively. In this way, the eddy currents set up are much weaker and much smaller power dissipation in the magnets occurs. Alignment magnets at center of charger or power supply and device and/or battery coils for alignment of the two coils are attached to the back of the coils in such a way that the area of the magnet does not extend beyond the center of the coil. In this way, the eddy currents created are much weaker and much less power is lost to the magnets. In this figure, two magnets are shown per back of each coil (four total for a pair of charger or power supply and receiver magnets). However, any number of magnets from one to many can be used.

[0461] Additional Applications--Charger/Power Supply with Self-Powered Operation

[0462] FIG. 58 shows an illustration of a device for inductive power charging that includes an internal battery for self-powered operation, in accordance with an embodiment. As shown in FIG. 58, an inductive charging unit such as an inductive pad 360 includes a rechargeable battery

364. The unit is normally operated with, or is occasionally coupled to, power input from an electrical outlet, or from a dc source such as a standard automobile 12 volt dc outlet, or from an outlet in an airplane or an external dc source, or from another power source such as the USB outlet from a computer or other device. Alternatively, the power can come from a mechanical source such as a windmill, or a human-powered crank handle. The unit can include coils 362 that are energized to transfer power to receiver coils in mobile electronics devices such as mobile phones, MP3 players, radios, cd players, PDAs, and notebook computers. At the same time, the input power charges the rechargeable battery inside the unit itself. When the external power source to the unit is disconnected, or when no input power is provided, the unit automatically switches its operation from its charged internal battery. Alternatively, the unit's operation can be switch-operated by user. In this way, users can continue to charge their devices by placement on the unit without any outside power source. This use can continue until the external power is restored or until the internal battery is completely discharged.

[0463] The ability of the unit to continue charging depends on the capacity of the battery included. Thus, for example, with a 1500 mAH internal battery, the unit is able to charge a mobile phone with a 1000 mAH battery completely if the losses due to conversion efficiency, operation of the circuitry in the unit, and other losses are up to 500 mAH.

[0464] In other embodiments of an embodiment, the unit can be powered by other power sources such as a fuel cell that generates power from methanol or other sources. The unit can also be connected to the electric grid through an outlet or to an external DC power source such as power from an outlet in a car or airplane or be itself charged or powered inductively by another unit. However, when not connected to outside power, the unit can be powered by its internal power generator from the fuel cell and can charge devices placed on it inductively.

[0465] FIG. 59 shows an illustration of an alternate embodiment of an inductive charger or power supply unit or pad 370 with a solar cell power source for self-powered operation, in accordance with an embodiment. As shown in FIG. 20, the surface of the unit can be covered by a solar panel or solar cell 376. In normal operation, the unit can be powered-up or charged by connection to an electric outlet or external DC source. But without external electric power, the panel generates electric power that is used to power the charger or power supply which in turn can charge devices placed on it through the inductors in the unit. In some embodiments the unit can also include a rechargeable battery 374 that can be charged when the unit is either connected

to external electric power or charged by the solar cells on the surface of the unit. This battery can then operate the unit when the unit is either not connected to external electric power or the solar cell is not generating enough power to run the unit such as during operation at night.

[0466] FIG. 60 shows an illustration of an inductive charger or power supply unit with an incorporated communications and/or storage unit, in accordance with an embodiment. As shown in FIG. 21, in accordance with some embodiments the charger or power supply, including for example the regular charger or power supply 380, and the solar-cell powered charger or power supply 382, can further comprise an optional communications and/or storage unit, for storage of data and transmission of data to and from a mobile device being charged. Examples of components that can be incorporated include Bluetooth, Near-field Communications (NFC), WiFi, WiMax, wireless USB, and proprietary communications capabilities, including means of connecting to the Internet.

[0467] Additional Applications--Inductive Charger Applications and Kiosk

[0468] The technology described herein may also be used for other applications. In some applications, it may be desirable to build the inductive (as described above) or wire free charger or power supply into a case for an electronic device, a briefcase, or other carrier such as a box, holder, or container in a car or otherwise. An example can be a brief case, hand bag, or back pack where the bottom part or the outside surface has an integrated charger or power supply. Any device enabled to receive power from such a charger or power supply (device containing coils and the appropriate electronics to receive power or with appropriate contacts for wire free charging) can be placed on or inside such a briefcase and be charged. The charging circuitry can be powered by plugging the briefcase, handbag, or back pack into an outlet power or having internal batteries that can be charged through power from a wall plug or by themselves being inductively charged when the briefcase, handbag, or backpack is placed on an another inductive or wire free charger or power supply. Uses can be applied to any bag, container, or object that can be used to essentially charge or power another device. This first object can itself be charged or powered through an outlet directly by wires or wirelessly through an inductive or wire free charging system. As an alternative, the first object (the charger or power supply) can be powered by solar cells, Fuel cells, mechanical methods (hand cranks, pendulums, etc.).

[0469] In all of the above case, it is possible for the functions of the inductor or wire free charger or power supply and the power source for the charger or power supply (battery, fuel cell, solar cell, etc.) to be separated. Furthermore, in some cases, the charger or power supply part can be separated from a portable power source to operate it (such as a rechargeable battery) which is in turn powered or charged by another source (power outlet, fuel cell, solar cell, mechanical source, etc.). The three parts can be in the same enclosure or area or separate from each other.

[0470] An additional example may be an after-market inductive or wire free charger or power supply for a car where the inductive or wire free charger or power supply or pad including a solar cell on the pad or in another area and connected to the pad by wires is used to charge mobile devices. Such a device placed on the dashboard or tray between seats or a special compartment can be used to charge a number of devices such as phones, MP3 players, cameras, etc. Devices such as GPS navigation systems, radar detectors, etc. can also be powered from such a device. In another application, mugs, cups, or other containers with a receiver circuitry and means of heating or cooling the contents can be used in combination with the inductive charger or power supply to keep the contents hot or cold. A dial or buttons on the cup or container can set the temperature. The charging device or pad can also contain rechargeable batteries that allow the device or pad to store energy and operate in the absence of any external power if necessary.

[0471] Other applications of this technology include clothing, jackets, vests, etc. that have an integrated inductive charger or power supply such that a user can power or charge a device by simply placing it on or near a pocket or an area where wireless inductive power is available. The jacket or clothing can in turn be powered by solar cells, Fuel cells, batteries, or other forms of energy. It can also be powered by batteries that are recharged through solar cells sown onto the clothing or be recharged by placing or hanging the clothing item on a rack or location where it is recharged wirelessly or inductively. By using inductive charging, the user does not have to plug in devices into individual wires and connectors at the appropriate jacket pocket.

[0472] In some cases, it may be desirable to build the charger or power supply or the secondary part (receiver for a charger or power supply) into the protective case of another device. For example, many products exist today that are after-market or optional items such as a skin or case for a music player, phone, PDA, or notebook computer. In one implementation, the case or skin can contain the electronics and the coil necessary to allow the device to be charged or charge other devices or both. The charger or power supply can be powered by the device it is attached to

or can receive power from a separate source such as a solar cell, fuel cell, etc. that is integrated with the charger or power supply or in another location and electrically connected to the charger or power supply. For example, in a briefcase, while the charger or power supply is inside the briefcase and can charge devices inside, the surface of the briefcase can have solar cells that power the charger or power supply inside. The briefcase can also contain rechargeable batteries that store power generated by the solar cells and use them when necessary to charge devices inside. Similarly, the charger or power supply can be built on the outside or inside surface of the case and charge devices placed on or near the surface.

[0473] It is also possible to provide a charger or power supply with modular components that allow other capabilities to be added later or simultaneously as an option. In one embodiment, an inductive charging pad that contains a rechargeable battery can have a separate top surface module or all around cover or skin that contains a solar cell array and simultaneously electrically connect to the charger or power supply pad to enable the battery internal to the unit to be charged without any external power input. It is also possible to have the cover or the outside skin to provide other capabilities such as communications, or simply provide a different look or texture so that the pad fits in with the user's taste or decor.

[0474] FIG. 61 shows an illustration of a kiosk that incorporates an inductive charger or power supply unit in accordance with an embodiment. As shown in FIG. 61, the kiosk 390 includes a control screen 392 and an inductive charging pad 394, to allow individuals to walk-up and purchase an occasional charge for their mobile device. Currently, the usage model of typical mobile user consists of charging their most essential device (phone, MP3 player, Bluetooth headset, etc.) during the night or at the office or car. In cases where the user is outside their environment for a long time such as traveling, this may not be possible. A variety of public mobile device charging stations have appeared that allow the user to charge their device in a public setting by paying a fee. An inductive or wire free public charging station or kiosk would allow the user to place their mobile device that is 'enabled' (i.e. has the appropriate receiver or components to allow it to receive power from the charger or power supply) on or in the wire free or inductive charger or power supply station and charge the device. The customer can pay for the service or receive the service for free depending on the service providers' approach. The payment can be cash, credit card, debit card, or other methods.

[0475] In accordance with an embodiment, a single pad with multiple stations can charge multiplicity of devices simultaneously. The user may be asked to pay for the service before charging a device or the service may be for free. Alternatively, each charging station can be in a compartment and the device is secured by a door that can only be opened through a code given to the device owner when charging starts or payment occurs. The door can also be secured by a combination lock or physical key.

[0476] Alternatively, the charging station or kiosk can be open and not physically secure but when the user pays for the service, a code is issued. The user proceeds to place their device to be charged but when the charging ends or the user wants to pick up the device, the code must be entered first. If no code is entered, an alarm is sounded or the device is deactivated or some other warning occurs. In this way, a thief or the wrong user can not remove the device without attracting attention that may act as a deterrent. A combination of the above techniques may be used in implementing a public charging kiosk.

[0477] Since a typical charging process can take up to 30 minutes or more, it is possible to also synchronize data, download songs, movies, etc. into the device during this time. Many of current mobile devices have Bluetooth or WiFi capability. Other communication protocols such as WiMax can increase the data rate further. By combining the charging and information transfer process, the service provider can charge for additional services. In addition, if a camera is being charged and has wireless capability, it can download the pictures or movies to a designated website or online storage area or be emailed to a designated email address while charging. In this way, a traveler can simultaneously charge a camera while downloading the contents of its memory to a location with larger memory. This would enable the traveler to free up limited memory space in their camera or other mobile device. Such a service would enable devices that have limited or short range wireless communication capabilities (such as mobile phones, MP3 players, cameras, etc.) to be able to connect to the internet and send or receive data indirectly. It is important to recognize that without the charging capability, a device conducting such downloading or synchronization through an intermediate device (Bluetooth to internet gateway for example) often run out of power due to the length of time this takes. In this manner the charging capability of the kiosk enables a more effective operation.

[0478] Additional Applications--Inductive Charger Applications and Kiosk

[0479] With increased functionality in mobile devices, there is an ever-increasing focus on maximizing the battery life. Currently, the rate of increase of power usage continues to outpace new and improved battery technologies. Given the desire to minimize mobile device size, the battery power limitation has required some mobile device manufacturers to begin shipping mobile devices with several batteries and a desktop charger to keep all of those batteries regularly charged. The user is sometimes expected to change the batteries for the device during the day while using the device. Such a situation is not ideal and puts the burden on the user to carry multiple batteries, and to keep those batteries charged.

[0480] Methods for extending the battery life in mobile devices, but which do not greatly increase the size and weight of the mobile device, are extremely useful for new power hungry enhanced multi-media mobile devices. By way of example, one solution that has been proposed is described in U.S. Pat. No. 6,184,654. However, such a technique and geometry is incompatible with the variety of mobile devices and connectors in use today, and requires the user to plug the device into a connector inside the holster while fastening it to hold it securely.

[0481] Described herein is a system and method for extending the battery life of mobile devices by integrating a wireless charger into the case, carrier, or holster for the device. The system and method has the advantage of keeping the size and weight of the mobile device low while enabling the user to automatically recharge the device when placed in the case thereby dramatically increasing the device run time.

[0482] In one embodiment, the case recharges the mobile device inductively, and can itself be recharged by an inductive base charger. Various embodiments including additional integrated functionality such as data storage and communication in the case are also described herein.

[0483] FIG. 62 illustrates some common regular (non-charger) mobile phone holders types, including a belt holder 1000 and case 1002.

[0484] Powering Mobile Devices and Inductive Charging Case

[0485] Mobile devices continue to converge and to combine multiple functions and protocols into ever-smaller packages. While mobile TV, radio, high resolution cameras, GPS, etc. are becoming standard in many mobile phones, the power usage of the devices continues to rise. One solution that has been applied to several devices is the use of external battery packs.

[0486] FIG. 63 illustrates various products for a music player, (e.g. an iPod or MP3 player) that include an external rechargeable battery pack.

[0487] As shown in, the external battery pack provides extra running power for the device when it is plugged into the music device and clipped to its back, by providing power through the battery pack's internal higher capacity batteries. However, this battery pack is expected to remain connected to the device at all times and increases the size and weight of the device considerably. This is very undesirable from the customer perspective and inhibits mobility/use and adoption.

[0488] In accordance with embodiments of an embodiment, the battery power of the mobile device is extended by providing a holster, case, pouch, bag, wallet, or an equivalent holding, carrying, or storage device (which for convenience are herein referred to as a "case") for the mobile device (e.g. mobile phone, Bluetooth headset, camera, laptop, PDA, MP3 player, game player, etc.). The case can incorporate one or more rechargeable batteries, and one or more inductive charger or power supplies. A mobile device can be 'enabled' to receive power inductively by providing a receiver (such as a coil, etc.), and circuitry integrated by the manufacturer, or by a battery with a built-in receiver, or by a plug-in unit to receive power, etc. A suitably enabled device can thus receive power when placed in the case. In accordance with some embodiments, the case can also include means of recognition of the device automatically by, for example, RFID, Felica, detection of coil from change in the case's coil's induction, or by verification using proprietary techniques, etc. In some embodiments, the system or coil can be enabled to turn on automatically as necessary and to begin charging the device. Alternatively, the case and/or coils can turn on when a device is placed in it by sensing the presence of a device through a magnetic, mechanical, or other form of switch. Alternatively, the case can include a mechanical or sensory switch that must be manually activated by a user to begin charging the device.

[0489] In accordance with some embodiments, the case can accommodate more than one device. For example, the case can include a location for a Bluetooth headset and a mobile phone. Either or both of these devices can be inductively charged by the case when placed inside the case. This enables the user to have a simple way to carry both parts or devices together, and to extend the battery capacity of both without needing them to be any larger, thus providing great advantages for the consumer.

[0490] In accordance with an embodiment, the batteries inside the inductive charger case can themselves be charged by either a regular charger/power supply, or through another inductive charger or power supply. For example, a desktop inductive charger can charge the inductive charger case, and simultaneously charge the mobile devices (mobile phone, Bluetooth headset, camera, etc.) or battery. Alternatively, the desktop charger or power supply or base can be designed so that it can also charge the mobile device directly when the device is placed on it (without any case present). As described above, the inductive case can also be designed so that it will charge its internal batteries, and the devices inside, when it is connected to a regular power supply/charger.

[0491] Some embodiments of the case can include data storage, communication or other capabilities (for example, GPS, WiFi, etc.).

[0492] FIG. 64 illustrates a multi-function device that includes a hard drive, rechargeable battery, Bluetooth, and WiFi connectivity.

[0493] Typical multi-function devices such as that shown in FIG. 64 are of the size of a credit card and about 10 mm in thickness. The multifunction device allows a mobile phone user to store the majority of their digital data (pictures, movies, music, etc.), and to have that data available wirelessly on their mobile devices. The mobile phone and multifunction device can also connect wirelessly to a computer or laptop, for download or upload of information.

[0494] In accordance with an embodiment, a multifunction device such as that shown in FIG. 3 can be integrated into the case, and can have a wireless charger or power supply built into it. Once a mobile device is placed into the case or on the modified multifunction device, it can establish communication, and/or can be charged simultaneously. Since a typical multifunction device already has internal rechargeable batteries, the same batteries can be used to power the charger for the mobile device. The multifunction device case can also be charged wirelessly (using an inductive charger or power supply pad or similar device), or through conventional means.

[0495] In other embodiments, the wireless charger or power supply case can be integrated into a compartment in a briefcase, handbag, backpack, carrier, clothing, automobile, airplane, or other transport vehicle, etc. Some of these applications are described in further detail in U.S. patent application titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM"; application Ser. No. 11/669,113, incorporated herein by reference.

[0496] FIG. 65 illustrates a system for use with a charger or power supply case to inductively power or charge a mobile device. As shown therein, an inductive charger or power supply base or pad charges a case, holster, or other small, portable charger that in turn can charge or power a mobile device or battery placed in proximity to it. The second part (charger case) can be a stand-alone device or be integrated into another device, as in the case of the multifunction device example described above. In other embodiments, the charger or power supply case can be charged or powered through a conventional, wired charger or power supply. In accordance with an embodiment, the system comprises:

[0497] Inductive Charger or Power Supply Base: In accordance with an embodiment, this part can be a stand-alone charger or power supply or desktop charger or power supply that comprises a Field Effect Transistor (FET) that periodically turns the current through a coil on and off. In one embodiment, for a typical 9 turn PCB coil with 1" diameter, a drive frequency of 1-2 MHz is ideal, and the power transfer efficiency is increased when a capacitor of appropriate value is placed in parallel with the FET. When the circuit is driven at a resonant frequency, the amount of current through the FET can vary greatly by proximity of another coil (L2) to L1. To allow the system to operate automatically, a current sensing system can be used to sense the secondary (L2) being in close proximity to the primary (L1). In other embodiments, a separate circuit for positive identification of a device to be charged being in proximity can be integrated. These can include wireless identification systems such as RFID, Felica, Bluetooth, WiFi, WiMax, etc. In another embodiment, the system of the charger or power supply case can be designed so that a chip in the charger or power supply case (near L2) senses an input voltage and modulates the current through L2 in a pre-programmed manner. This results in a modulation in the current in L1 that can be sensed with the current sensor and positively identifies the charger or power supply case and initiates power transfer and operation if the pattern matches a pre-stored pattern for verification. In some embodiments, the inductive charger or power supply base can have the shape of a formed piece that the inductive case would fit into, or a pad for placement of the inductive case and/or mobile devices or both.

[0498] Inductive case: In accordance with an embodiment, the case has means for receipt of power inductively (from the charger or power supply base) and charging another device (or number of devices) inductively. Alternatively, it may be possible for the case to be designed so that it operates by being charged or powered directly by a wired power supply/charger. The case

has a receiver part that is connected to a battery charger circuit that charges one or more internal batteries and simultaneously, can also operate the circuitry in the charger or power supply case to charge a nearby mobile device or battery. The case has charger or power supply circuitry similar to the charger or power supply base that can be powered by its internal battery or the power from the charger or power supply base. The case can in turn recognize a nearby mobile device automatically or through mechanical or other means as described earlier and commence charging when a mobile device is placed in or near the case/holster. In another embodiment, the charger or power supply case may contain two or more charger or power supply sections so that several devices in the case (e.g. mobile phone and a headset) can be charged simultaneously. As described earlier, the circuitry/functions described here can be integrated into a device that also extends the functionality to storage, WiFi or Bluetooth connectivity, etc. In one embodiment, the batteries in the charger or power supply case are identical to the batteries used in the mobile device and are removable. In this case, the user may exchange the batteries between the charger or power supply case and the mobile device (such as a mobile phone) in an emergency to allow quick use of the mobile device without waiting for the charging of the mobile device to occur. This can provide an additional desirable feature for the user.

[0499] Mobile Device Receiver: In accordance with an embodiment, the mobile receiver part comprises a coil and circuitry that can be either integrated into a mobile device by the manufacturer (i.e. an OEM), integrated into a battery that can be swapped with the original battery to enable a mobile device to receive power inductively, or provided as a plug in unit that plugs into the existing power jack of a device and has the coil and the circuitry to enable the device to receive power inductively. Alternatively, the receiver can be built into a jacket or skin for a device that plugs into the device and allows the device to become 'enabled'. Variations of these are described in further detail in U.S. patent application titled "INDUCTIVE POWER SOURCE AND CHARGING SYSTEM"; application Ser. No. 11/669,113. The above-referenced patent application also describes the use of attracting magnets placed at the center of an inductive charger or power supply's PCB coil, and the center of the receive coil, to align and center the two parts conveniently. Such techniques can be used in the base to case coil alignment, or the case to mobile device alignment or both. In addition, the alignment can be achieved through visual or mechanical marks, indentation, or mechanical design of the parts to enable easy alignment.

[0500] Heat Reduction and Dissipation

[0501] In order to generate the magnetic field for an inductive charger and/or power supply, a coil made of wires or printed on PCB is typically used. Such a coil can be in a simple way, modeled by an inductive and resistive element in series. The resistance of the coil can be estimated by using the dimensions of the wire or PCB trace, its length, and the resistivity of the material used (such as copper). At higher frequencies, the resistance increases due to the skin effect whereby the electrical current travels near the surface of the wire or trace rather than throughout its cross section, thereby decreasing the wire's or trace's effective cross section. In order to obtain reasonable inductive values, several turns of wire or PCB trace are necessary.

[0502] For example, in a PCB spiral coil of 1.25" diameter, about 10 turns are necessary for a 1 micro Henry inductance value. To design a high efficiency inductive power transfer coil, the resistivity of the coil must be minimized while the resulting induction is kept at desired levels. It must be noted that any heat generated at the coil will increase the resistivity of the coil material in turn leading to higher heat generation and temperature increase. To avoid this positive feedback for heat generation, the main methods for reduction of temperature at the inductive coil include reduction of heat generated and dispersal of heat away from the coil.

[0503] In addition, electronic devices generally need to satisfy regulatory and safety requirements which include the requirement not to interfere with the operation of nearby devices. For an inductive charger and/or power supply that creates a time varying magnetic field to transfer energy to a receiver, care must be taken to keep the level of interference to below allowed limits.

[0504] In general, the magnetic created by a small coil (≈ 1 " diameter) of several turns when it is driven by an electrical voltage at around 1 MHz, does not radiate more than several mm beyond the coil and is confined to the near field. To reduce the effect of such radiation (for example, as provided in Near Field Power.TM. radiation devices) at higher frequencies, which are of bigger concern for most devices, the driving voltage of the circuit must be made to have weaker higher harmonics.

[0505] Another concern for generation of Electromagnetic Interference (EMI) is the electronic circuitry and switching Field Effect Transistor (FET) incorporated in the circuit. Such

components can be additional noise sources. Described herein are some ways of reducing the effect of above EMI sources.

[0506] Another important factor in efficient operation of an inductive charger/power supply is the alignment of the charger/power supply coil and the receiver coil in the device to be charged/powered. Various methods of alignment of the coils using magnets have been described in prior applications. In addition, also described are the use of moving coils and other methods by which several coils or clusters of coils can be used to provide position tolerance between the coils for efficient power transfer.

[0507] In accordance with an embodiment, to reduce the temperature increase at the inductive coil, several methods can be used.

[0508] In accordance with an embodiment, the coil can be optimized by using the minimum number of turns necessary thereby decreasing the length and resistance of the coil. The diameter, thickness, or width of the wire or PCB trace can be optimized to provide optimum resistance.

[0509] For coils such as PCB coils discussed above, the magnetic field created is strong inside the coil, and drops very rapidly as the radial distance to the center of the coil exceeds the radius of the coil. This dependence can be verified using electromagnetic modeling (such as described in Xun Liu; Hui, S. Y., Optimal Design of a Hybrid Winding Structure for Planar Contactless Battery Charging Platform, IEEE Transactions on Power Electronics, Volume 23, Issue 1, Jan. 2008 Page(s):455-463), and also by experimental means. The heat generated at the coil can be dispersed away from the coil by use of high heat conductivity PCB substrates or material for the coils. Since the magnetic field is minimal in the area outside the coil, use of high conductivity metal layers will not have a large effect on the field and will not create undesirable eddy currents. Therefore, the surface of the area surrounding the coil can be designed to have metal or other material that have high heat conductivity and remove the generated heat rapidly.

[0510] FIG. 66 is an illustration that shows a geometry for an arrangement 1030 in which the area surrounding a PCB coil is designed to have metal on the top, bottom or another layer of the PCB. As shown in FIG. 66, the area surrounding a PCB coil is designed to have metal on the top, bottom or another layer of the PCB. The metal pattern can be incorporated at the same layer as the coil or a separate PCB layer. This metal layer can be continuous or have a gap in one area to avoid generation of eddy currents due to circulating electrons due to magnetic fields generated by the coil. In a typical PCB, the coil and the metal layer are made of copper. In this manner, any

heat generated at the coil is dispersed laterally rapidly and thus does not result in large temperature increase. In accordance with an embodiment, such a PCB can be itself the top layer of an inductive charger in which case, any heat carried away by the metal layer can be additionally evaporated to the surrounding environment. Alternatively, the heat can be further dispersed by removal to another area or surface or use of elements such as fins or slits. Similarly, the receiver coil and the circuitry for receiving power that is integrated into a device, battery, outside carrier of an electronics device, etc. can have a similar geometry to enable dispersal of heat generated.

[0511] In accordance with an embodiment, for typical applications with a PCB, the metal layer can be made from copper material similar to that of the PCB coil itself, and it is desired to have sufficient thickness to provide a low thermal conductivity path for the heat. For example, a copper layer of several microns or even 10 s of micrometers can be used.

[0512] Any such high thermal conductivity or metal layer may begin at the edge of the PCB coil or with a gap to the PCB coil. Since the layer is not covering the PCB coil, it may not cause eddy current loss in the layer. In those instances that eddy currents are generated, a gap in the metal layer as shown in FIG. 66 can be used to reduce the effect of circulating currents, and reduce the resultant heating and power draw. In accordance with an embodiment a metal layer can be used on top of the coil (with a thin non-conducting layer or dielectric in between) if its thickness is small. For example, in previous applications as referenced above, the use of a thin layer of metal (several micrometers) on top of a PCB coil was described to act as an EMI shield for high frequencies while transmitting low (around 1 MHz and below) frequencies of the inductive charger. Such a layer may also be used in addition to the metal layer surrounding the coil to facilitate heat dispersal.

[0513] FIG. 67 is an illustration that shows, in a multi-charger or power supply where multiple coils are used, such a high heat conductivity layer 1040 may be repeated around each coil or cover all areas between the multiple coils.

[0514] FIG. 68 is an illustration that shows a similar method may be used for heat removal from wound coils of other shape and type 1050, 1056. In accordance with the geometry of this embodiment, to facilitate heat removal from a coil that may be a wound coil around a core, the coil may be attached to a high heat conductivity layer or a metal layer. In the case of a metal layer, such a layer can be designed to be in the area surrounding the outside of the coil to avoid

interference with the field generated inside the coil. Similarly, to avoid eddy currents, the metal layer or the core of the wound coil or both can have a gap or discontinuous portion to reduce circulating currents.

[0515] In above examples, a metal or high heat conductivity layer has been shown. FIG. 69 shows an illustration of an embodiment 1060 in which the layer can be patterned to provide heat conductivity channels rather than a continuous layer if needed.

[0516] In accordance with any of the above geometries, additional means of heat removal such as use of fins, fans, additional surfaces, heat pipes, thermal grease, thermally conductive epoxies, etc. can be incorporated to facilitate heat removal. In addition, it is possible to incorporate heat conducting layers, such as ceramics or polymers can be incorporated below or above the main PCB to help in heat removal.

[0517] In the above discussion, round shape coils are generally shown. It will be evident that the techniques described herein are applicable to coils of other shape or multiple coils in a cluster or separated to power or charge separate devices. In many instances, the increase of the temperature at the center of a PCB coil is largest. To remove this heat, in accordance with an embodiment the surface of the charger or a layer behind the coil that contains high heat conductivity material can be used to disperse the generated heat laterally. An example of such a layer is ceramic material. High alumina ceramics can provide high heat conductivity and low electrical conductivity, which characteristics are important for this application.

[0518] Reduction of EMI from Inductive Charger and/or Power Supply

[0519] An advantage of the metal layers discussed above is that any EMI generated inside the inductive charger or power supply will be greatly shielded from the outside and will be attenuated outside the charger or power supply device by the metal layer.

[0520] Additionally, in the above geometries, the metal layer on the top layer can be made to contact electrically to other metal layers on the side and/or bottom of the charger and/or power supply, thereby forming a box or other enclosed shape where only the coil is not covered by metal. Such an enclosure will greatly attenuate EMI from the switching electronics or other parts in the charger. To reduce the effect of the potential eddy currents generated in the metal box due to the magnetic field, in some embodiments it is useful to eliminate use of metal directly below the coil area where magnetic fields may exist. In addition, to avoid generation of eddy currents in

the walls of the metal box or similar outside surface, the wall can be cut in one or more location so that a continuous metal circuit or ring is not formed, and does not allow the electrons to circle unimpeded. This gap can be filled with a non-conductive material to provide rigidity.

[0521] In the geometries shown above, it is possible to use a PCB whereby the coil is formed in one area and the electronics is on the same PCB. In accordance with an embodiment, to provide shielding and heat dissipation discussed above, the metal layer around the coil may be in a layer on top (closer to the outside surface) of the PCB. For example, the coil may be formed on the top layer of the PCB along with the heat dissipation and/or EMI shield layer and the PCB electronic components may be on the bottom layer of the PCB. Alternatively, the metal layer can be in a separate layer in the middle or even the bottom layer with the PCB electronic components.

However, the EMI shielding effects from the electronics components will be reduced if the metal layer surrounds the electronics area and does not provide an electrical barrier directly above it.

[0522] FIG. 70 shows an illustration of the electronics for the PCB coil inductive charger and/or power supply or the inductive receiver as fabricated on the same PCB as the coil in accordance with various embodiments 1070, 1076. The electronics in this case may be at the bottom layer, while the coil and the metal layer surrounding the coil are on the top layer and shield any electronic noise generated by the electronics from the outside.

[0523] Any of the shapes and geometries discussed above may be equally appropriate for incorporation into the charger and/or power supply coil or the receiver coil and for dispersal of heat and reduction of EMI from a device to be charged/powered inductively as well as the coil in the charger/power supply itself.

[0524] Magnetic Alignment of Coils

[0525] In accordance with an embodiment, to enable efficient power transfer in an inductive charger and/or power supply, the coils in the charger and/or power supply and the receiver must generally be aligned with one another.

[0526] FIG. 71 shows an embodiment 1080 in which magnets placed at the center of a stationary coil or a moving, floating charger and/or power supply coil and the receiver coil can provide a method for alignment of the coils and to achieve this result.

[0527] A problem with this method is that, since the magnetic material is composed of electrically conductive material, eddy currents can be generated when the coils are operated to

generate a time-varying magnetic field. This can cause lost power, and can also cause heating in the magnets which is not beneficial.

[0528] To address this problem, FIG. 72 illustrates an embodiment 1090 in which two or more magnets that do not cross the center of the coil are used. This geometry reduces the eddy currents created greatly. In accordance with an embodiment, the system can use an alternative magnet geometry that provides a simple and inexpensive method for alignment of coils. In addition, this method provides for a considerable amount of alignment tolerance when placing a device on the charger and/or power supply.

[0529] To provide alignment magnets that will not draw current due to eddy currents created in them when a magnetic field is applied, in accordance with an embodiment the magnets are placed outside the PCB coil area.

[0530] FIG. 73 is an illustration of two embodiments 1094, 1098 that shows how the magnets may be placed outside the PCB coil area. The magnet shown in FIG. 73 comprises a ring that surrounds the coil or overlaps each coil such that little effect on eddy current generation or loss is created. If any eddy current effects are observed, then in accordance with an embodiment gaps can be inserted in the magnet ring by cutting after manufacture or by inserting this separation during manufacture. In this manner the eddy currents can be significantly reduced or eliminated. The magnet in the case shown is magnetized perpendicular to the surface of the ring. By attaching one magnet to around the charger and/or power supply coil and another magnet with opposing polarity to the receiver coil, the two coils can easily be aligned with minimal effort by the user.

[0531] In addition, the use of a ring has the advantage of allowing circularly symmetric operation so that the two coils can be rotated with respect to each other with no effect on charger/power supply operation or efficiency.

[0532] A typical geometry for the charger/power supply can comprise the PCB shown in FIG. 8 such that the coil can be fabricated on the top surface of the PCB, and the magnetic ring is attached to the bottom side of the PCB where the electronics may be located. A similar receiver can have a magnet attached with opposing polarity so that when the receiver is brought close to the charger/power supply, the two magnets can attract and pull the coils into alignment. With this geometry, the magnetic field of the coils creates attraction and alignment as long as the coils have any overlap.

[0533] For example for coils of 1.25" outside diameter and using ring magnets of 1.25" inner diameter, as long as the centers of the coils are less than 1.25" away laterally, the coils can be brought into alignment when the two magnets are vertically (distance in the axis perpendicular to the plane of the coil) brought close enough to allow the magnetic fields to sense each other. Thus in this case, if the user brings the center of the receiver coil to be within a circle of 1.25" radius of the center of the charger/power supply coil, the coils can attract and provide automatic alignment of the parts.

[0534] For most applications, this amount of alignment tolerance is sufficient. By using marks to outline the location for the coil on the surface, this degree of tolerance allows the user to place a device or battery incorporating the receiver coil very easily into the right location.

[0535] Examples of magnets that can be used include those manufactured from various magnetic materials such as Neodymium Iron Boron, Samarium Cobalt, AlNiCo, ceramics, bonded magnetic material, etc. The magnetic strength can be designed to provide alignment or secure attachment without being too strong or difficult for separation.

[0536] Alternatively, the coils can be manufactured on the lower surface close to the magnet and the electronics or can be manufactured on another layer in between. Various geometries are possible. In any case, the magnets can be used to align the two coils for optimum operation.

[0537] In above description, ring shaped magnets are described. However, in many cases, size and spacing requirements may require use of a different geometry.

[0538] FIG. 74 shows an embodiment 1100 in which magnetic arc shaped parts around a circular coil are used. This case may be combined with the matching magnet on the other coil having the same shape or a ring shape similar to FIG. 73. For example, in a mobile battery application where the battery with an integrated inductive receiver is charged by placement on an inductive charger pad, the size of the coil determines the received power and may require the width of the battery to be equal or similar to the receiver coil. To allow attachment of alignment magnets, two arcs as shown in FIG. 9 can be attached to the coil. In this case, the magnets can be placed in between the battery and the coil PCB to allow the coil to be on the top surface and therefore closest to the charger coil. The matching magnet in the charger can be a ring or a similar set of arcs or another shape or size to facilitate alignment. If a ring is used behind the charger coil, then central symmetry between the two parts is retained and the parts can be rotated with respect to each other while keeping alignment for optimum operation.

[0539] Other geometries are possible. For example, FIG. 75 illustrates embodiments 1120, 1126 in which the use of bar magnets on or around the coil is shown. Such geometry does not have the symmetry offered by a ring magnet. However, this may be useful if only one dimension of alignment insensitivity is desired.

[0540] In any of the above geometries, use of two magnets with opposing polarity to attract each other is described. However, in accordance with some embodiments it is preferable for one of the parts to be non-magnetized. This may be advantageous in cases where it is not desirable for the mobile device to attract metallic parts when not being charged or powered by the inductive charger/power supply. An example may be a mobile phone where it is not desirable for the phone to attract metallic objects during normal use. In this case, the charger and/or power supply can contain a magnetized part and the other matching part in the mobile device/battery, can be made of appropriate magnetic material but not magnetized. For example, the charger/power supply may contain a magnetized ring as described above and a mobile phone can have a matching ring or arc made of magnetic material but not magnetized.

[0541] In addition, it is possible for the charger and/or power supply magnet to be activated electrically and be normally non-magnetized. For example, a wire winding or PCB trace is placed around the perimeter of the power transfer coil and powered to create a DC magnetic field for alignment of the two coils for power transfer/charging. In this way, neither of the two alignment parts needs to be normally magnetized and therefore eliminate any concerns regarding unintended attraction of metallic objects or effects on magnetically sensitive parts such as credit cards, etc. The generated magnetic field can be further strengthened by using a non-magnetized magnetic material on or near the alignment trace area. As an example, a circular path around the main charger/power supply PCB coil can be powered by a DC current periodically or when a user desires to charge or power a mobile device. This can be done by the user or can also be activated automatically by a sensor that senses the approach of an appropriate device to be charged or powered through RF, optical, magnetic, or other methods. Once the magnetic field (such as a ring pattern as described above), is generated it will attract and align a magnetic metal part or magnet of appropriate shape in the mobile device or battery into the correct alignment and placement and help the user place the mobile device in the correct position. Once the device is placed in the right location, the DC magnetic field may no longer be necessary and can be shut down or reduced to save power. Thus only for a very brief period this alignment magnet may be

needed. During other times, neither the charger and/or power supply nor the mobile device needs to be designed to have any magnets or contain weaker magnets

[0542] The use of magnets as described above is especially useful for cases where movement between the power supply and/or charger and the device or battery to be charged or powered may occur. As an example, in an automobile environment, it is desirable to keep a mobile device such as a phone from moving during charging. Thus the use of the magnets described above, in addition to the above benefits, can enable use in moving environments. In addition, in some cases, it may be beneficial to have the charger and/or power supply in a position that is not horizontal. For example, a charger can be installed vertically. In this case, the magnets can be designed to be strong enough to hold the mobile device or battery in place vertically during the charging or powering process.

[0543] In any of the above geometries, if any additional eddy currents are generated as a result of the presence of the magnets, the effect can be minimized by fabricating the coil from low electrical conductivity materials or ceramics, layering the magnet into thin sheets to increase resistivity, using bonded material in an epoxy matrix, roughing the surface, cutting gaps in the material to reduce circular motion of electrons, or other common techniques to increase the resistivity. The magnet can also be manufactured from segments that are not electrically connected to prevent electrons to be able to travel around a circular path. For example, the ring magnet can be manufactured, formed or attached to the coils from two or four ring arcs that are not electrically in contact or attached to each other, using a non-conducting epoxy to form a full ring, or parts of a ring.

[0544] In addition, the coils shown above are generally circular. However, the methods and discussion above can be applied to coils of any shape and size as well as an array or cluster of coils and can provide in performance of any size and type of coil.

[0545] The foregoing description of an embodiment has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit an embodiment to the precise forms disclosed. The embodiments were chosen and described in order to best explain the principles of an embodiment and its practical application, thereby enabling others skilled in the art to understand an embodiment for various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of an embodiment be defined by the following claims and their equivalence.

[0546] Some aspects of an embodiment may be conveniently implemented using a conventional general purpose or a specialized digital computer, microprocessor, or electronic circuitry programmed according to the teachings of the present disclosure. Appropriate software coding can readily be prepared by skilled programmers and circuit designers based on the teachings of the present disclosure, as will be apparent to those skilled in the art.

[0547] In some embodiments, an embodiment includes a computer program product which is a storage medium (media) having instructions stored thereon/in which can be used to program a computer to perform any of the processes of an embodiment. The storage medium can include, but is not limited to, any type of disk including floppy disks, optical discs, DVD, CD-ROMs, microdrives, and magneto-optical disks, ROMs, RAMs, EPROMs, EEPROMs, DRAMs, VRAMs, flash memory devices, magnetic or optical cards, nanosystems (including molecular memory ICs), or any type of media or device suitable for storing instructions and/or data.

[0548] The foregoing description of an embodiment has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit an embodiment to the precise forms disclosed. Many modifications and variations will be apparent to the practitioner skilled in the art. Particularly, while the embodiments of the systems and methods described above are described in the context of charging pads, it will be evident that the system and methods may be used with other types of charger or power supplies. Similarly, while the embodiments described above are described in the context of charging mobile devices, other types of devices can be used. The embodiments were chosen and described in order to best explain the principles of an embodiment and its practical application, thereby enabling others skilled in the art to understand an embodiment for various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of an embodiment be defined by the following claims and their equivalence.

What is claimed is:

1. A charger or power supply for providing substantially continuous charging or for supplying wireless power to one, a plurality, or a combination of electrical, electronic or mobile devices and/or batteries, on a surface of the charger or power supply, comprising:

a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply, wherein the effective charging area is larger than a single coil surface area, and the coils are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil; and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within the charger or power supply or to shield nearby environment.

2. The charger or power supply of claim 1, wherein the plurality of coils is arranged in an overlapping arrangement.

3. The charger or power supply of claim 1, wherein the coils are made of circles, hexagons or other shapes to fill the effective charging area.

4. The charger or power supply of claim 1, further comprising means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface.

5. The charger or power supply of claim 1, wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

6. The charger or power supply of claim 1, wherein the coils have substantially similar diameters, sizes, and/or characteristics.

7. The charger or power supply of claim 1, wherein the coils within each layer have different diameters, sizes, and/or characteristics.

8. The charger or power supply of claim 1, wherein the coils are located in different layers and have different diameters, sizes, and/or characteristics.

9. The charger or power supply of claim 1, wherein coils in each layer are arranged in a similar arrangement pattern and the pattern is shifted between the layers relative to one another other along the surface.

10. The charger or power supply of claim 1, wherein no two coils in the charger or power supply share a center.

11. The charger or power supply of claim 1, wherein coils sharing a center have different diameters, sizes, and/or characteristics.

12. The charger or power supply of claim 1, wherein the coils are made of wires, Printed Circuit Boards, or a combination thereof.

13. The charger or power supply of claim 1, wherein each coil layer is constructed of a Printed Circuit Board patterned with multiple coils.

14. The charger or power supply of claim 1, wherein multiple coil layers are constructed on a single multi-layer Printed Circuit Board.

15. A wireless charging or power system, comprising:
one or more of electrical or electronic or mobile devices, or batteries, each comprising a receiver coil to generate power when placed near a time varying magnetic field; and
a wireless charger or power supply to generate a time varying magnetic field for supplying wireless, the charger or power supply including

a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply, wherein the effective charging area is larger than a single coil surface area, and the coils are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil, and

a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or power to one or more device, product or battery over an effective charging area of the surface of the charger greater than the area of a single coil; and the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is equal or less than the radius or side of the center of at least one charger or power supply coil; and

ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply to shield components within the charger or power supply or to shield nearby environment.

16. The wireless charging or power system of claim 15, wherein the plurality of coils is arranged in an overlapping arrangement.

17. The wireless charging or power system of claim 15, wherein the charger or power supply further includes means for switching coils at an appropriate frequency to detect an approximate location of the one or more devices, the one or more products or the one or more batteries on the surface.

18. The wireless charging or power system of claim 15, wherein the coils are arrayed in each layer and multiple layers such that any location on the effective charger area is located at a distance equal to or less than half a radius or half a side-to-center length of at least one coil.

**IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE
(WIRELESS) CHARGING**

ABSTRACT

A charger or power supply is provided that effects substantially continuous charging to one or more devices and/or batteries, on a surface of the charger or power supply. The charger or power supply comprises: a plurality of coils arrayed in one or multiple layers to provide substantially continuous charging or to supply wireless power over an effective charging area of the surface of the charger or power supply, wherein the effective charging area is larger than a single coil surface area, and the coils are arrayed such that any location on the effective charging area is at a distance equal to or less than a radius or a side-to-center length of at least one coil. Ferromagnetic and/or electrically conductive layers or structures positioned within the charger or power supply shield components within the charger or power supply (or shield the nearby environment of the charger or power supply).

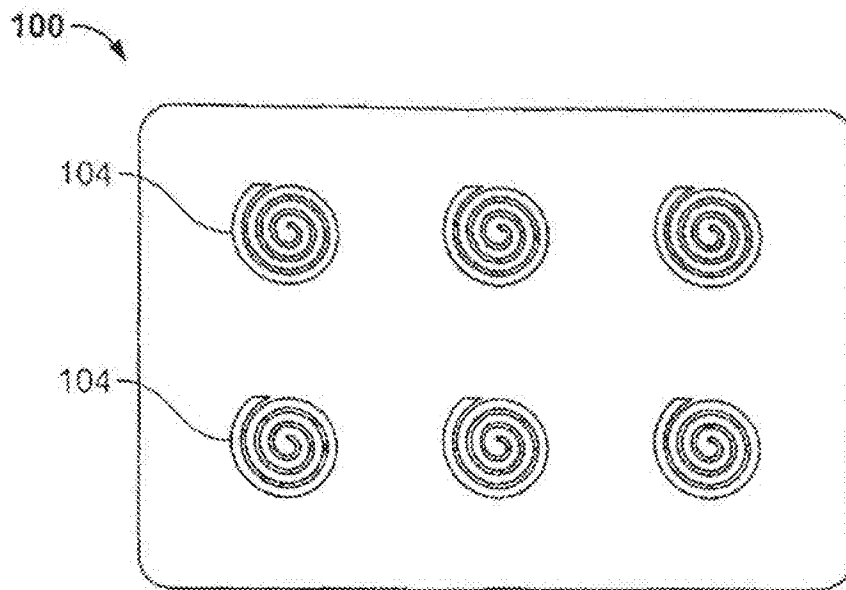


FIG. 1

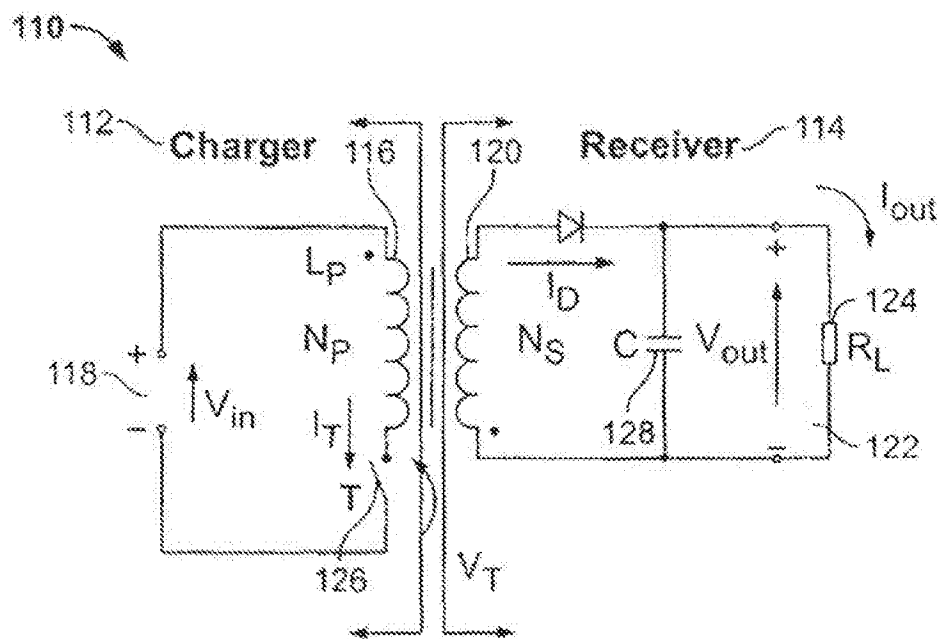


FIG. 2

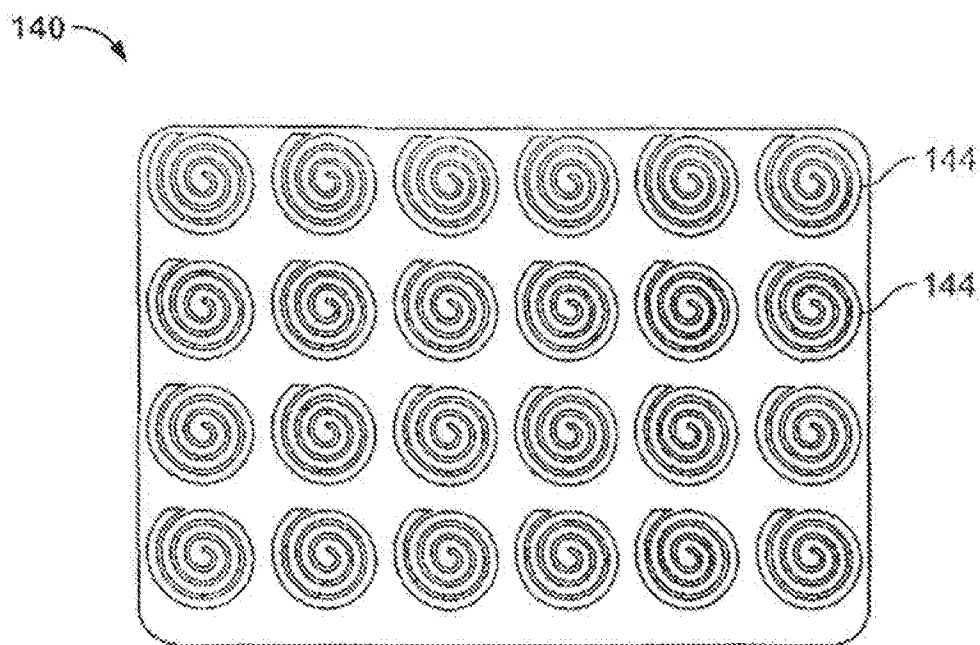


FIG. 3

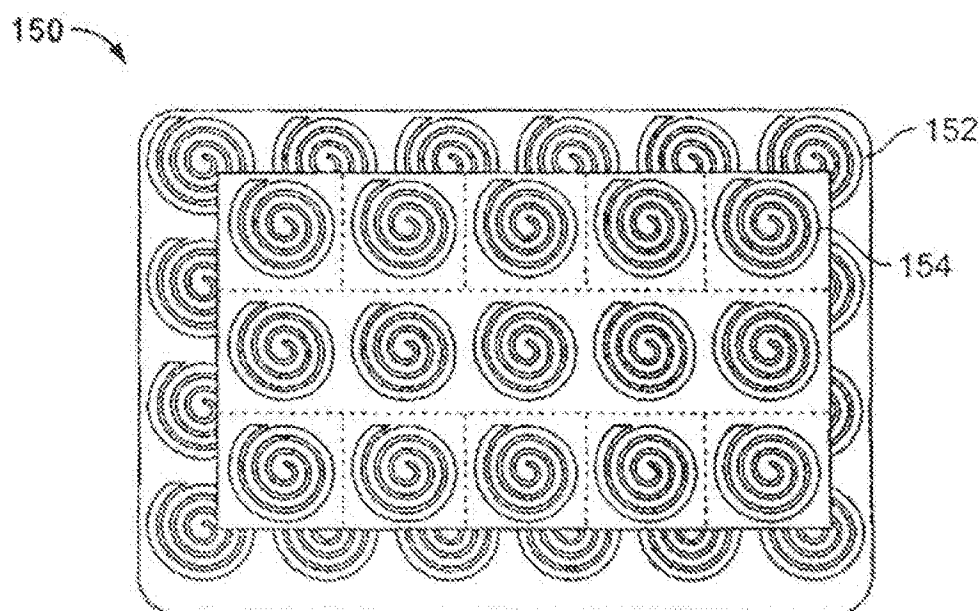


FIG. 4

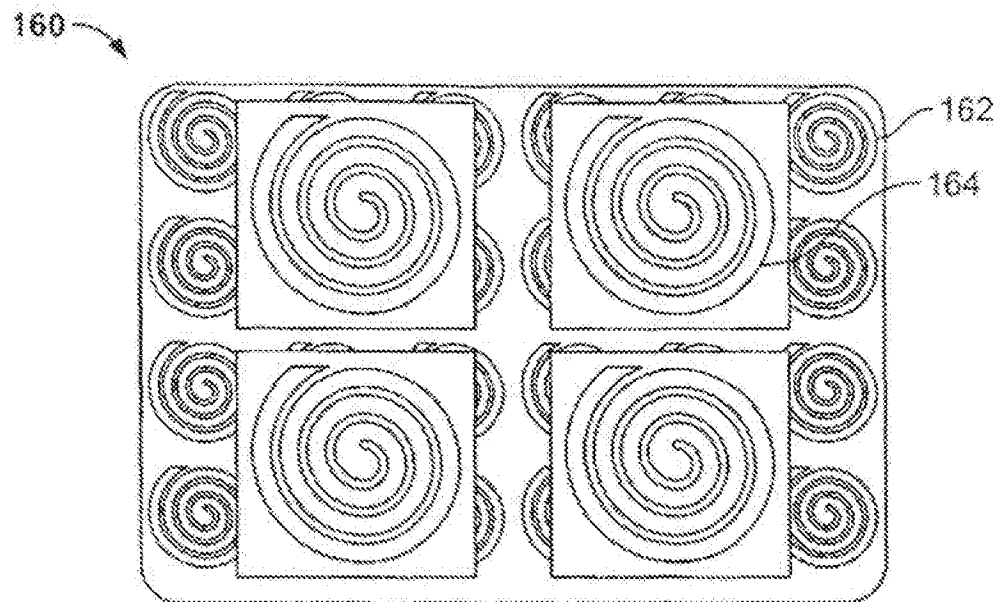


FIG. 5

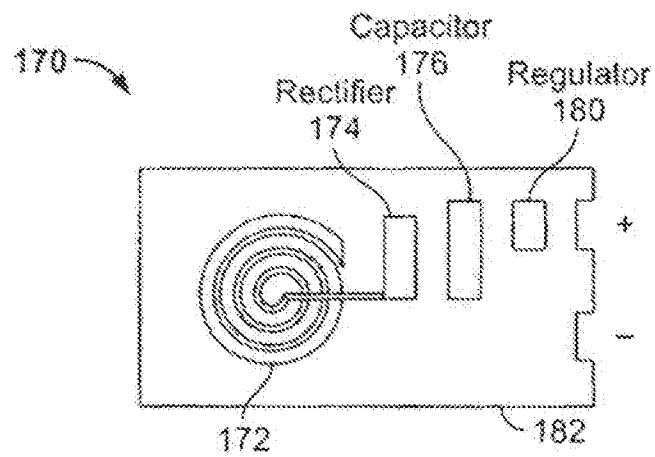


FIG. 6

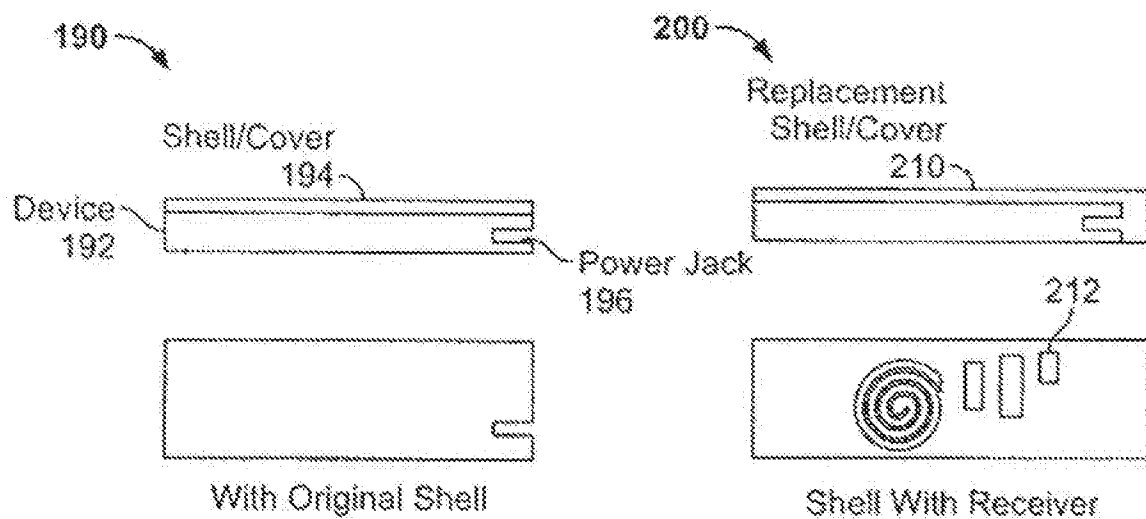


FIG. 7

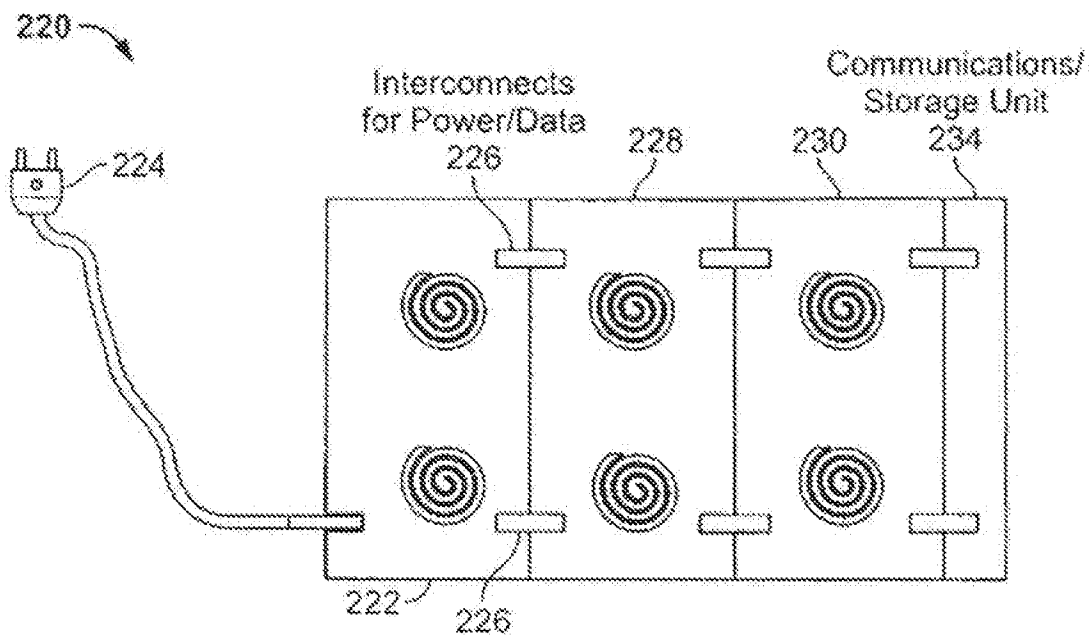


FIG. 8

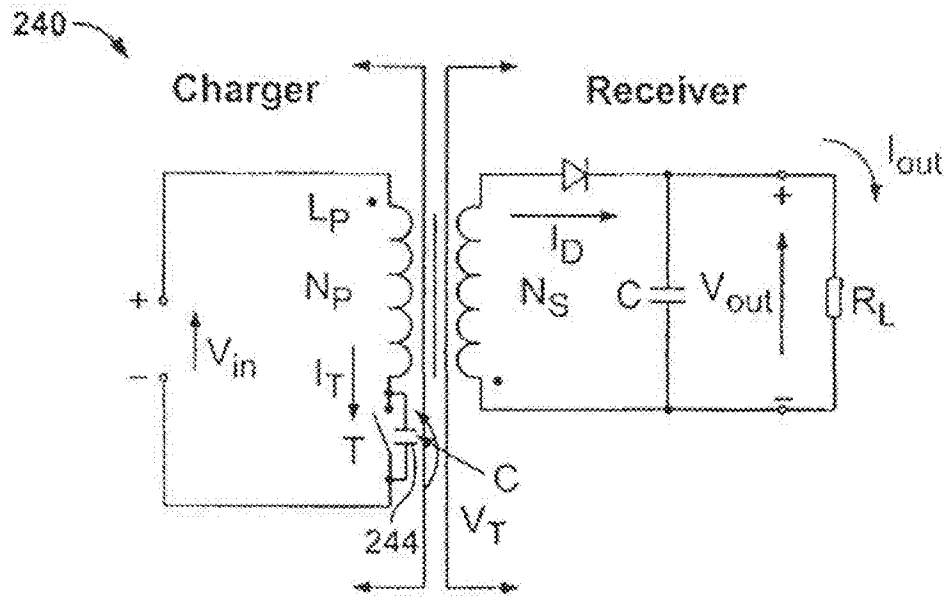


FIG. 9

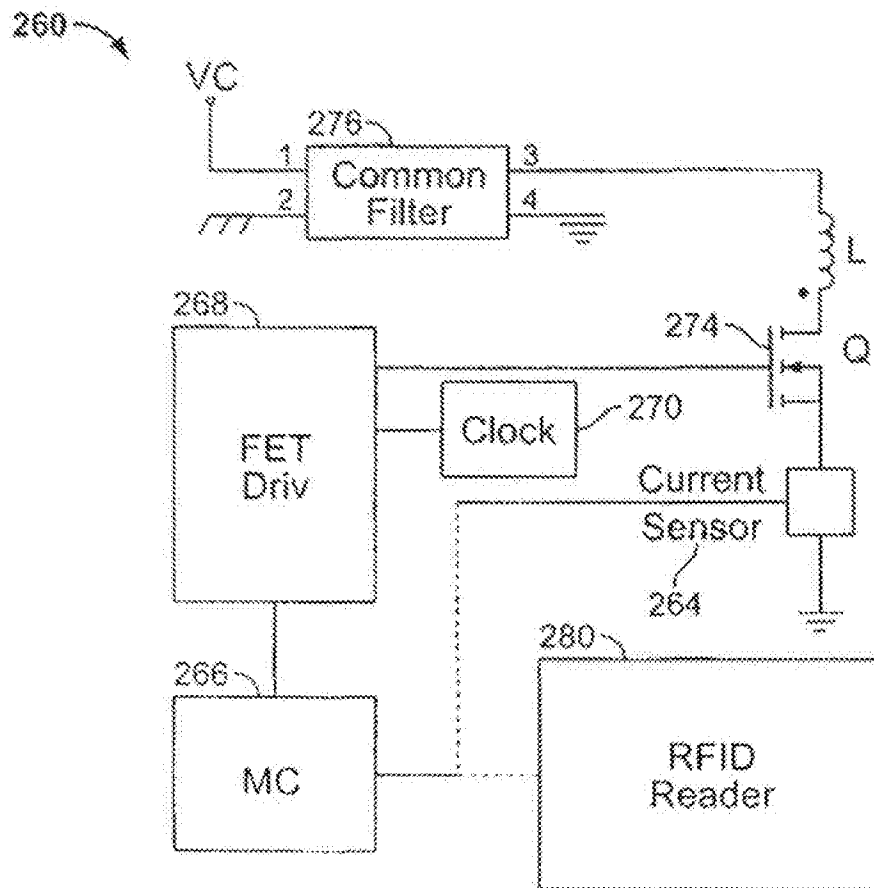


FIG. 10

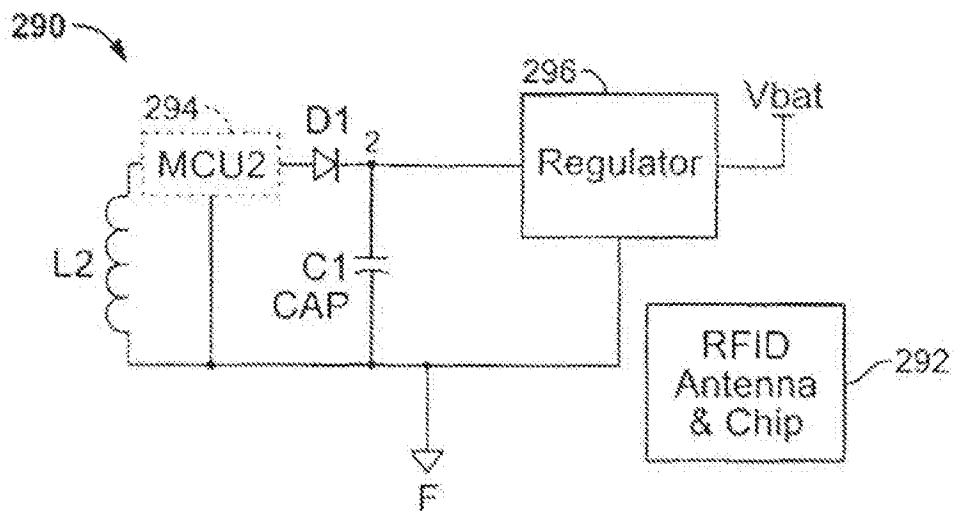


FIG. 11

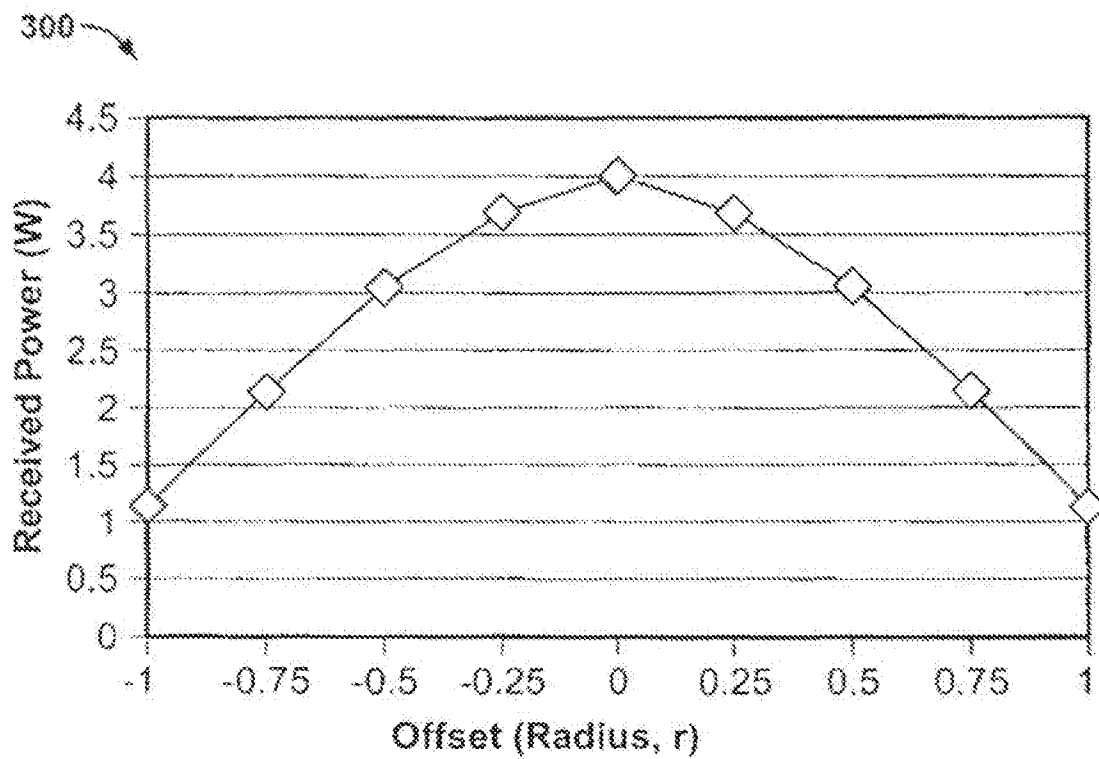


FIG. 12

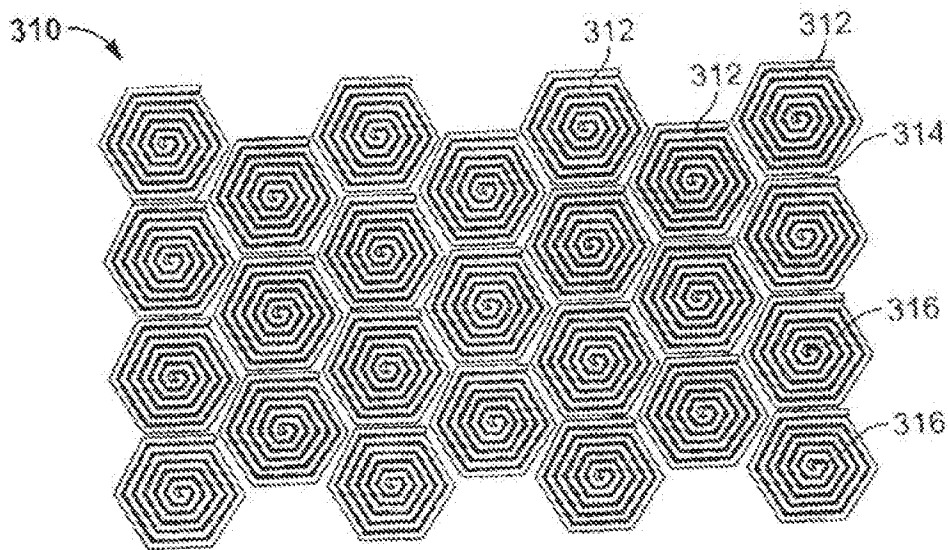


FIG. 13

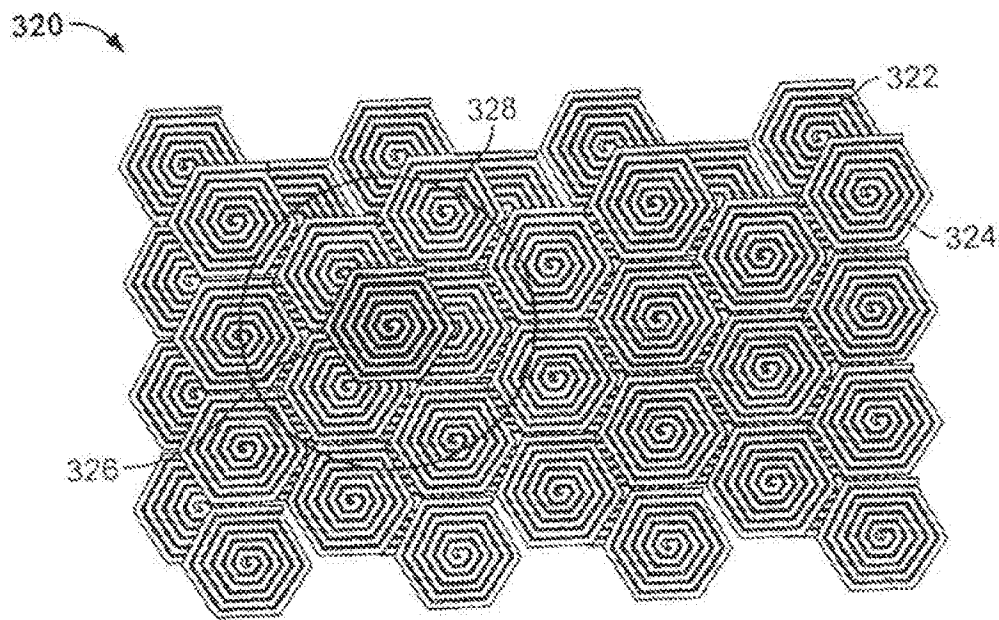


FIG. 14

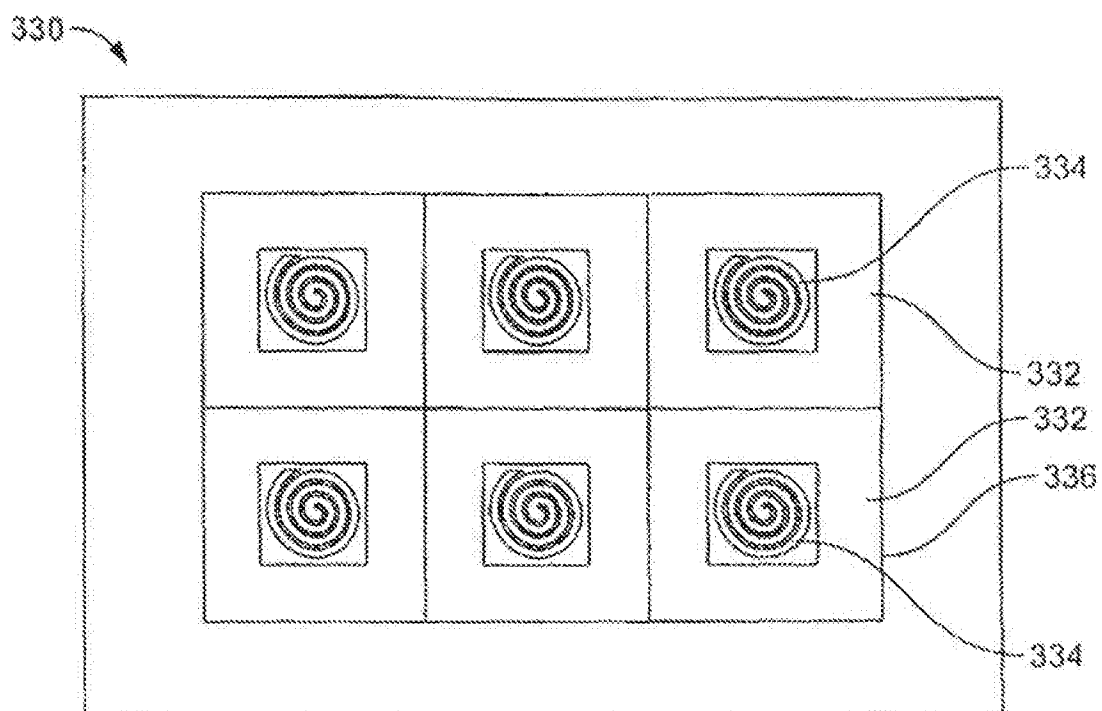


FIG. 15

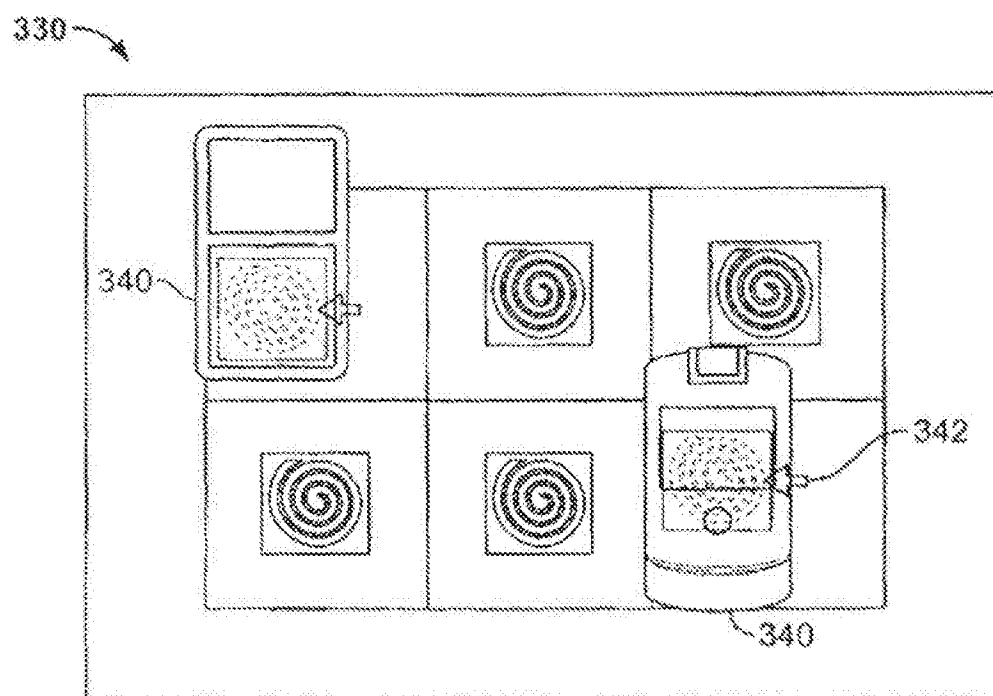


FIG. 16

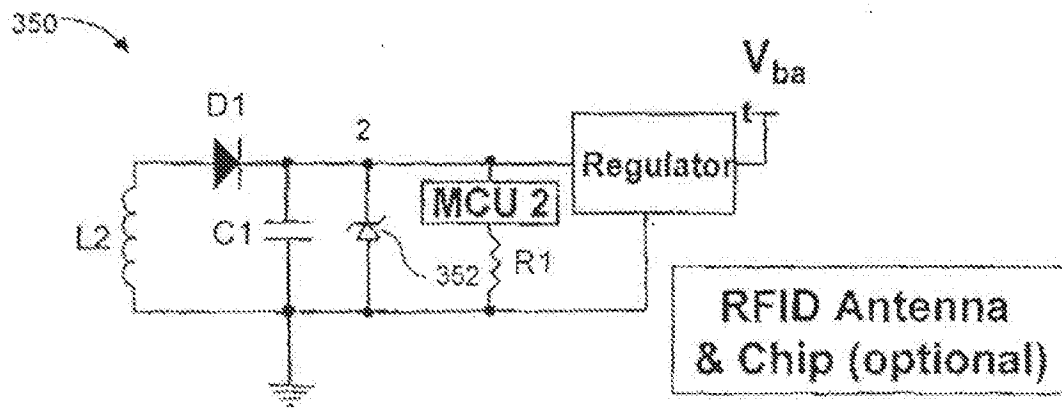


FIG. 17

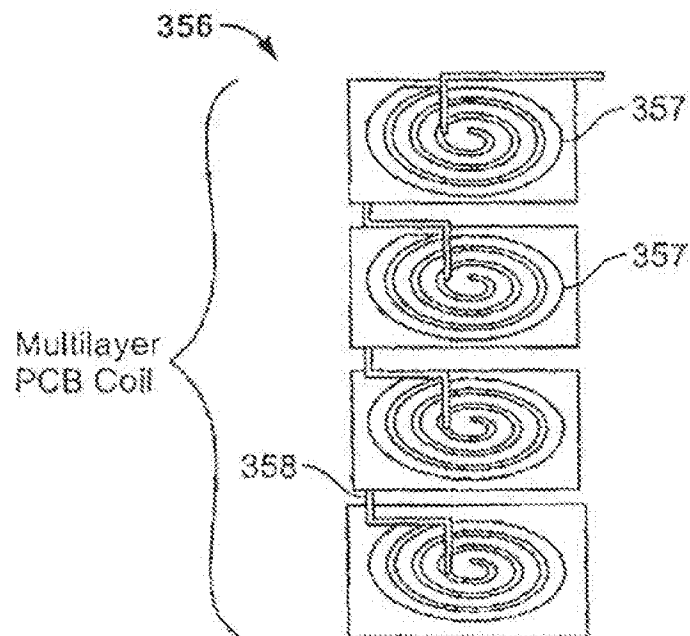


FIG. 18

420

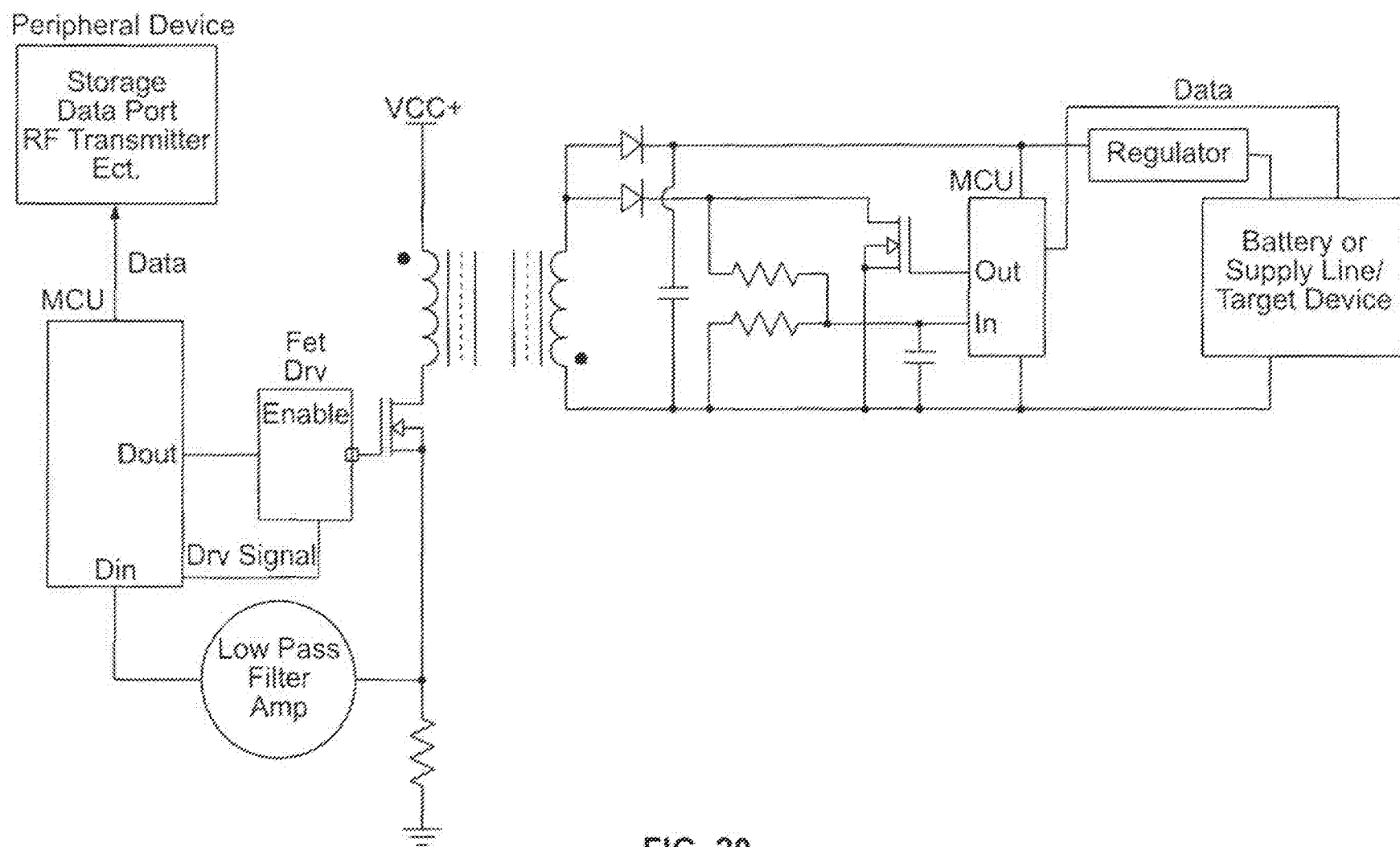


FIG. 20

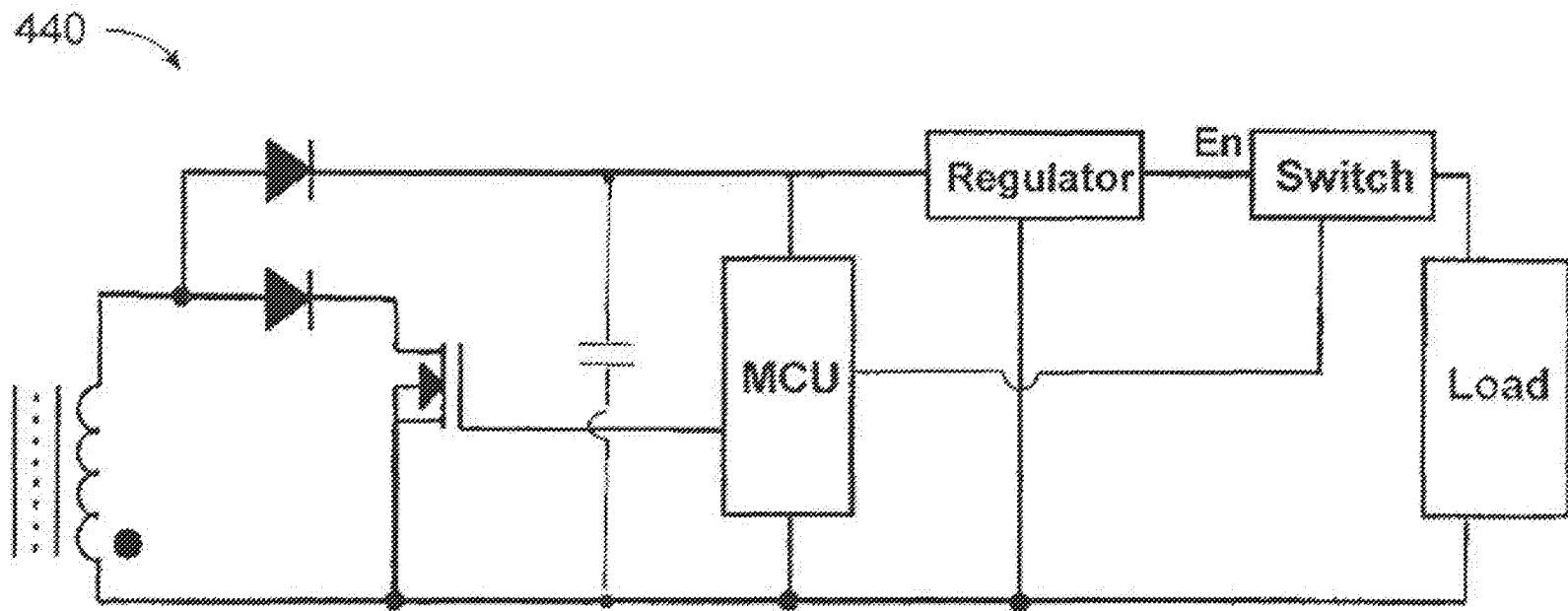


Figure 21

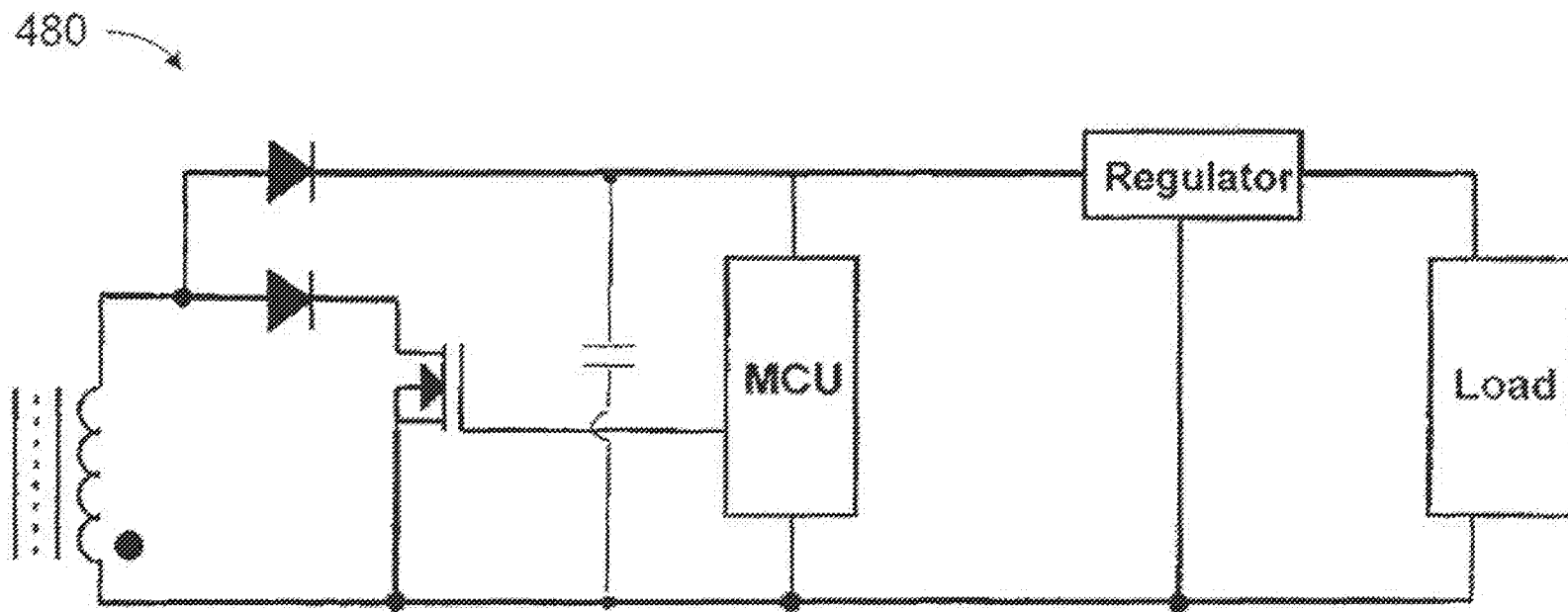


Figure 22

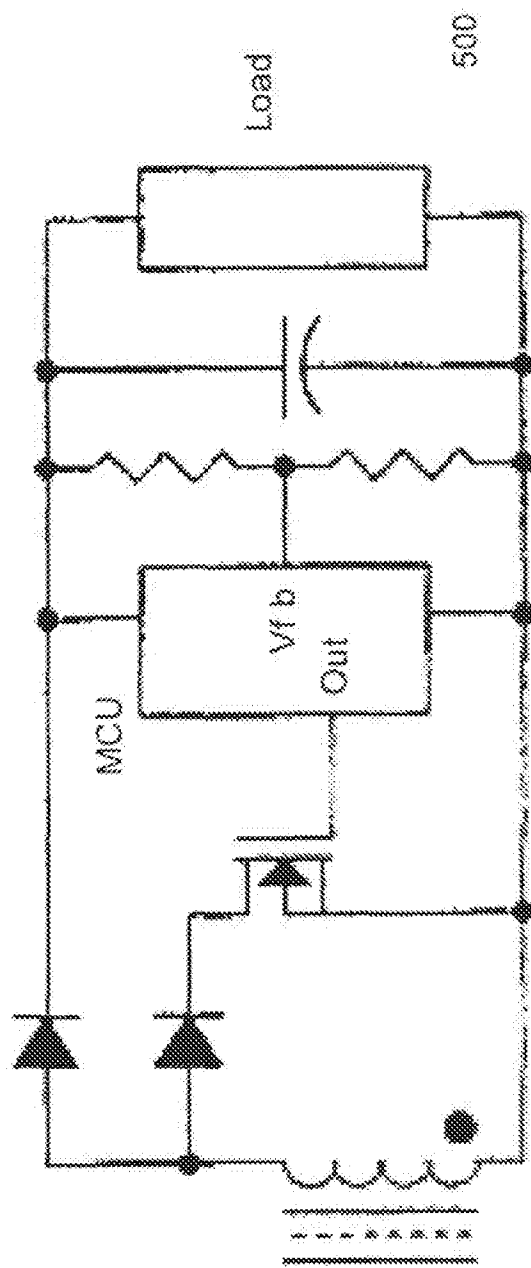


FIG. 23

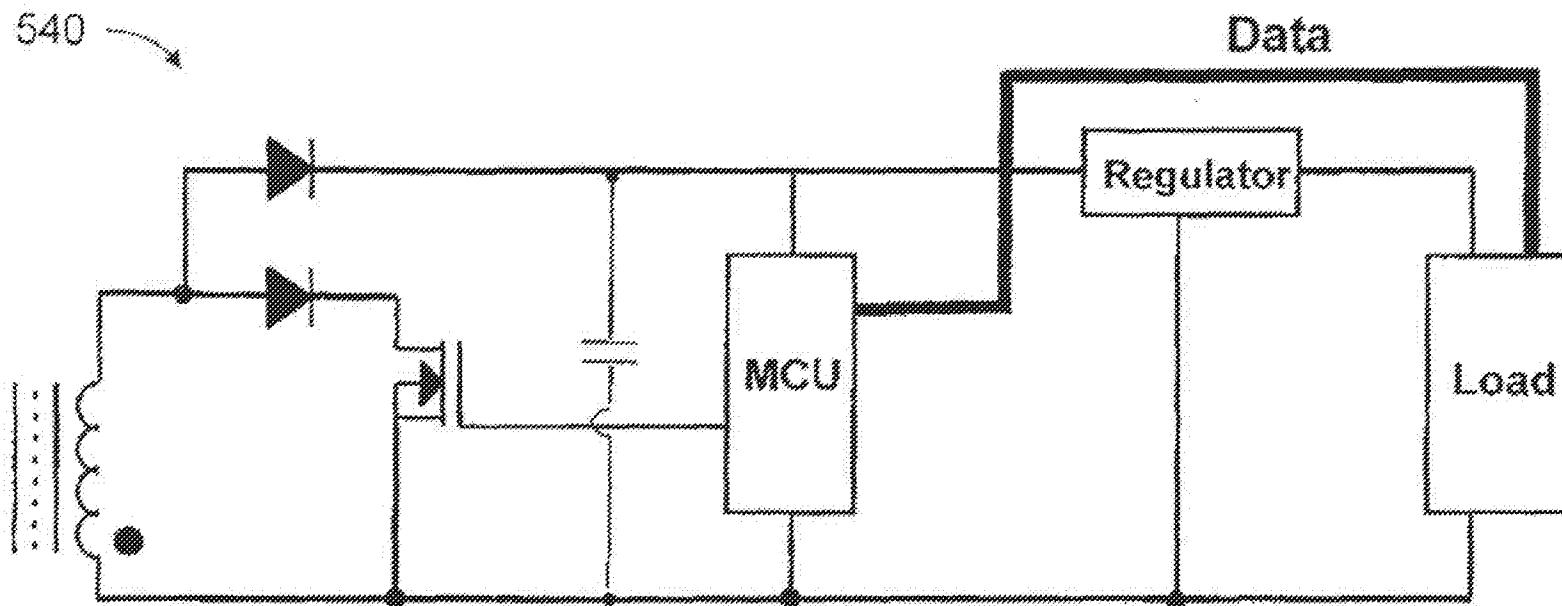


Figure 24

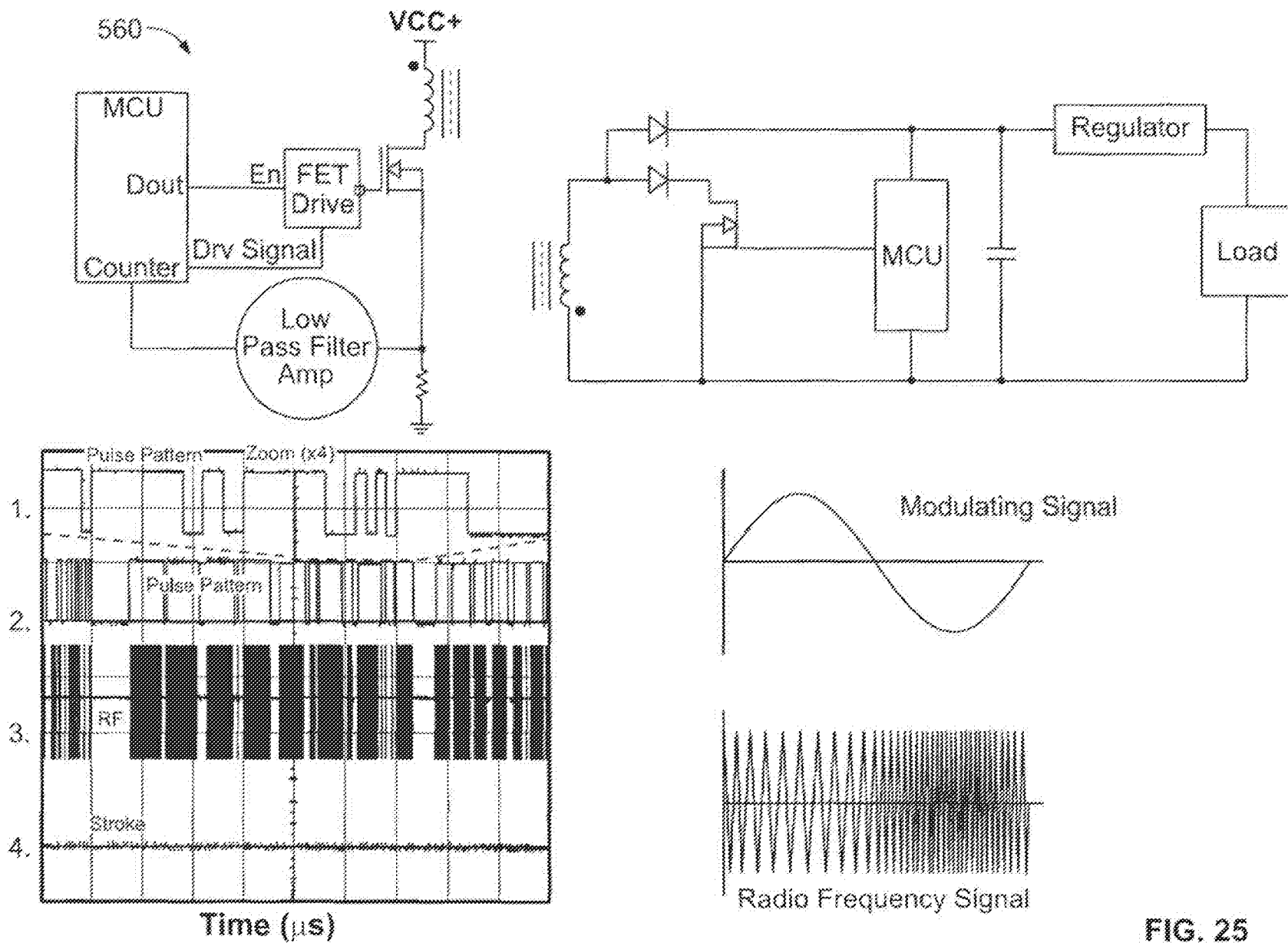


FIG. 25

580

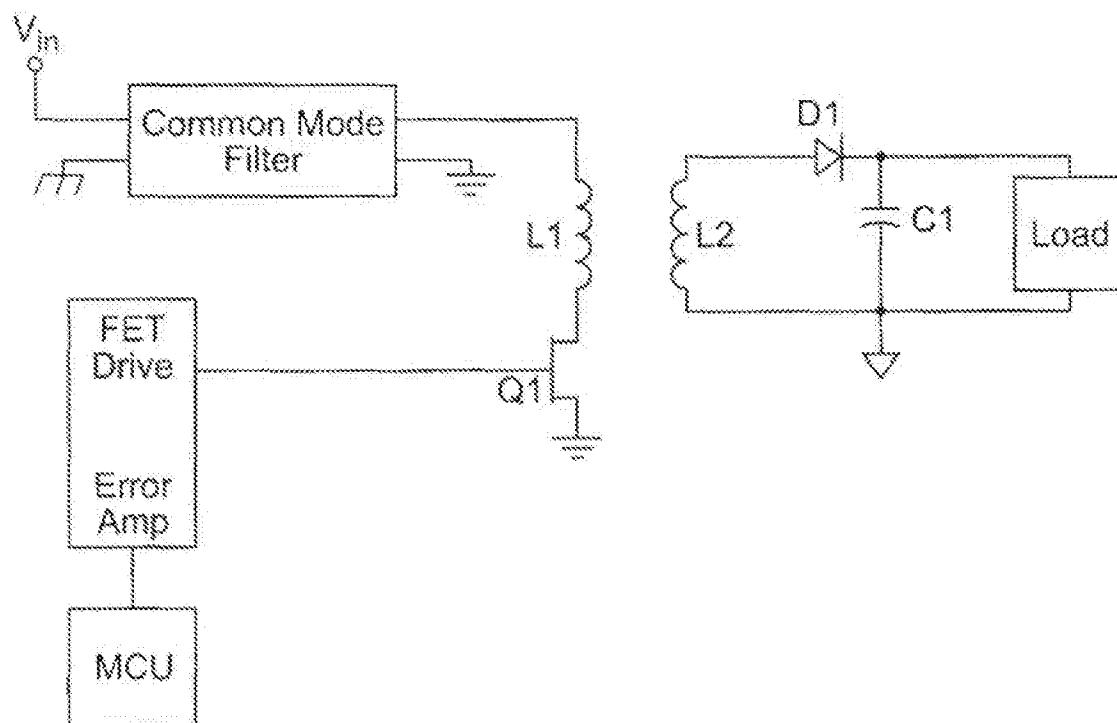


FIG. 26

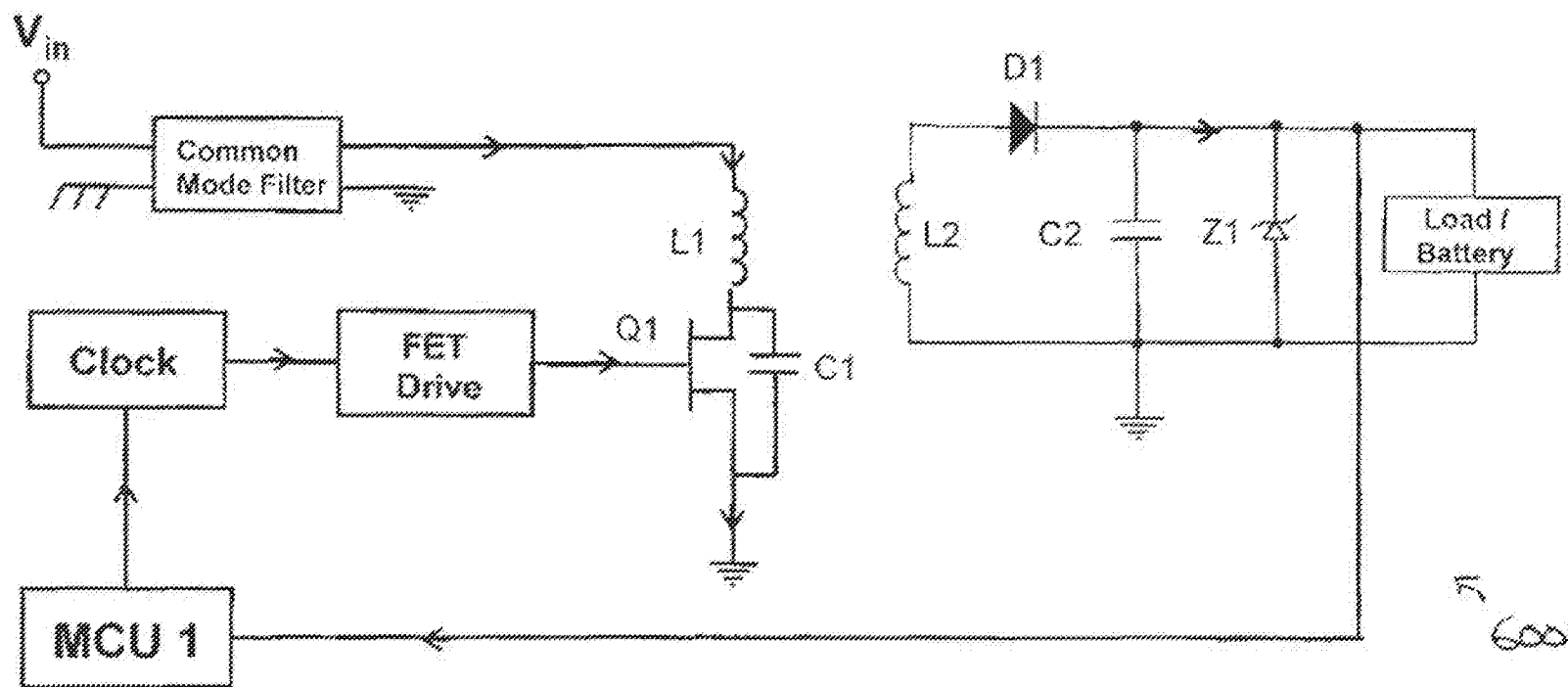
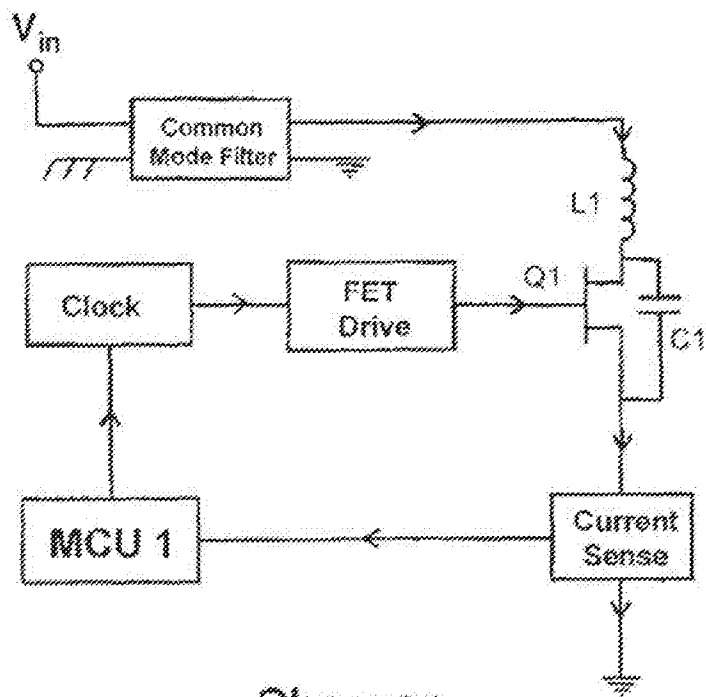
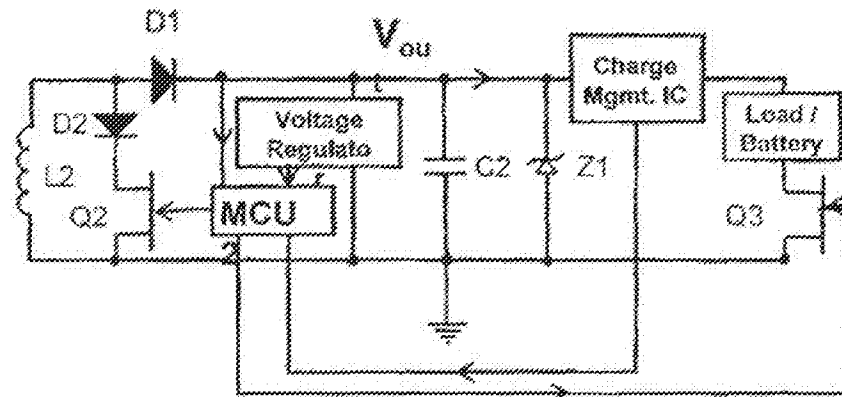


Figure 27



Charger

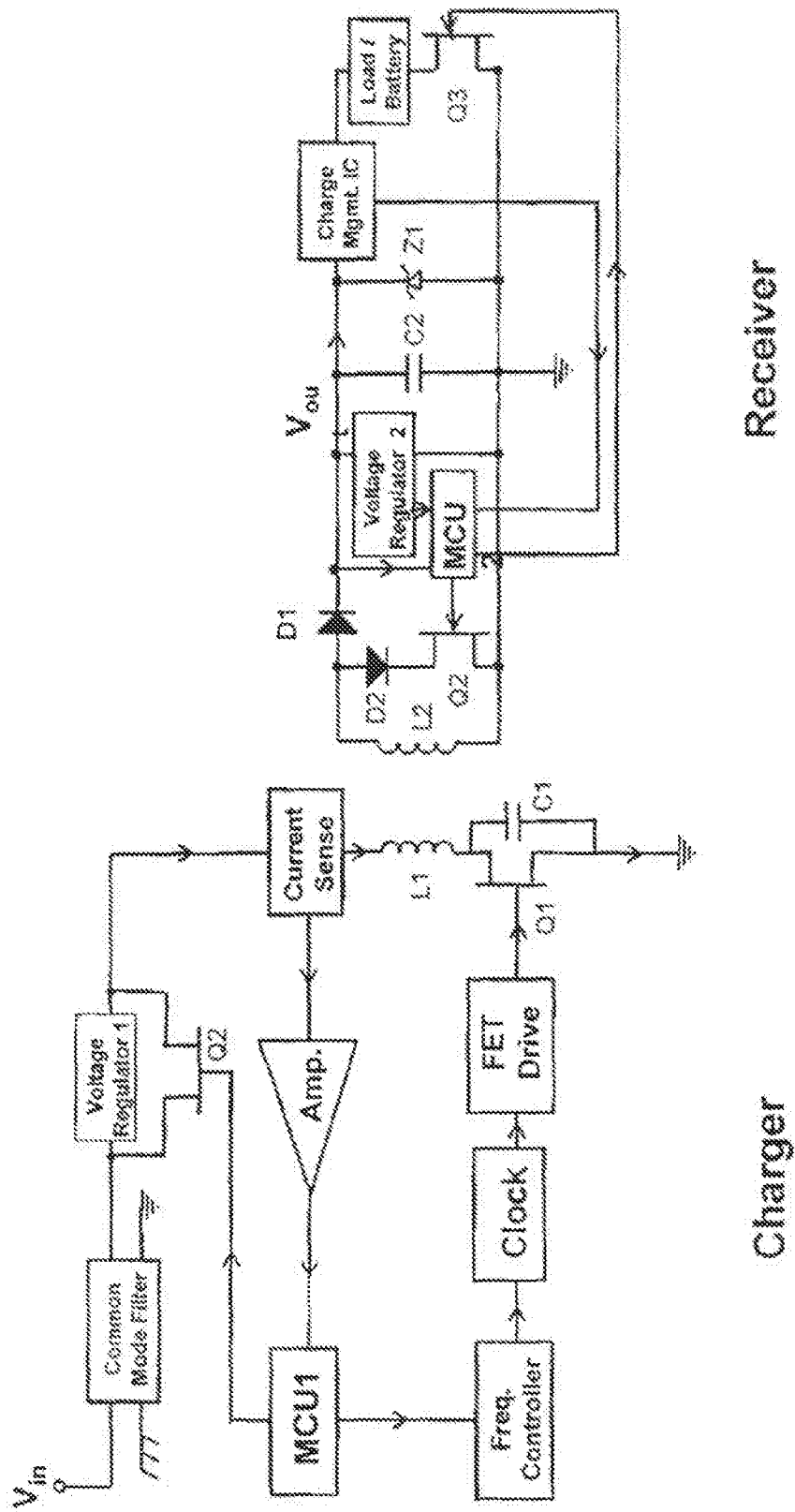
620



Receiver

630

Figure 28



640

Figure 29

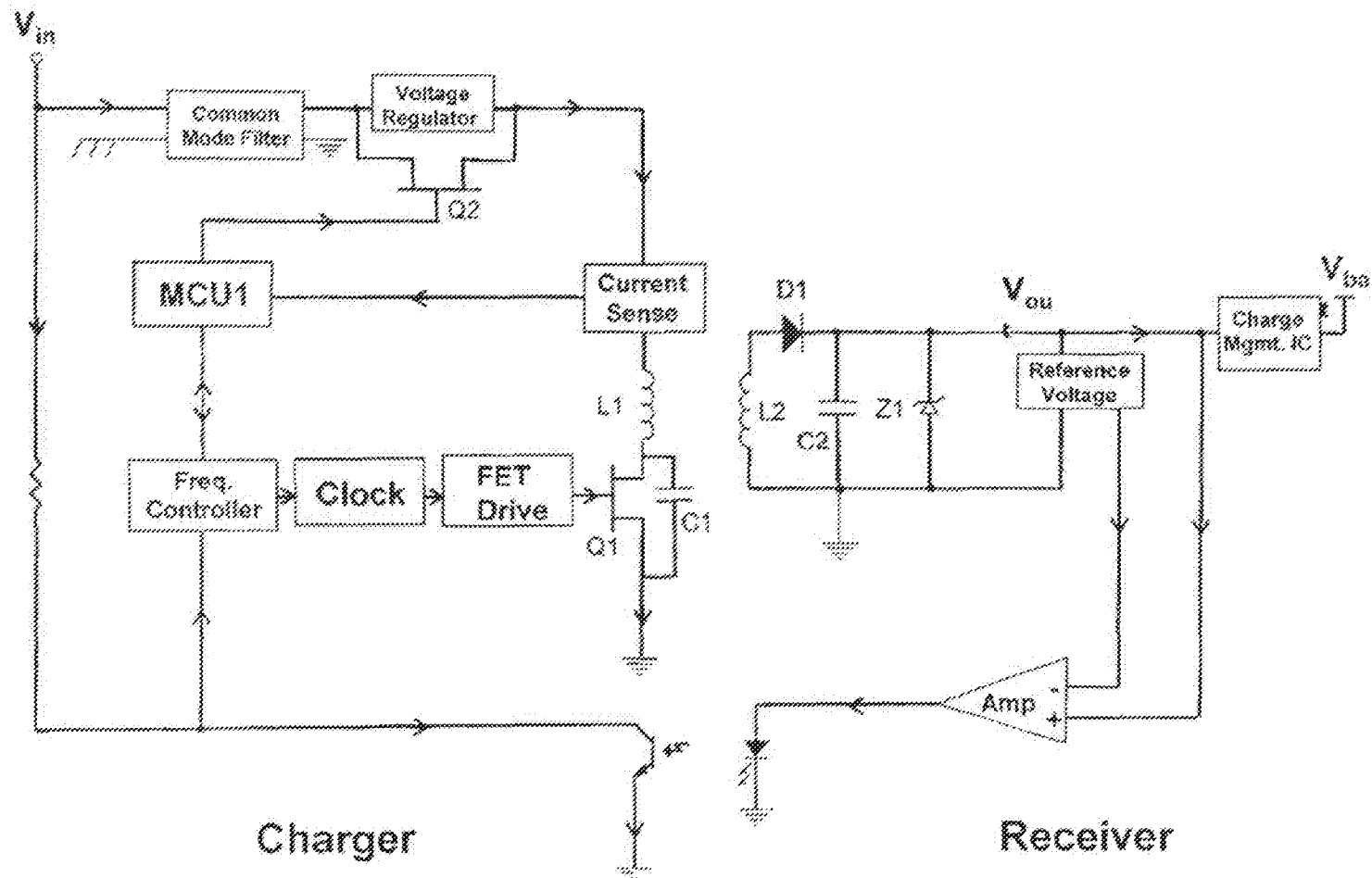
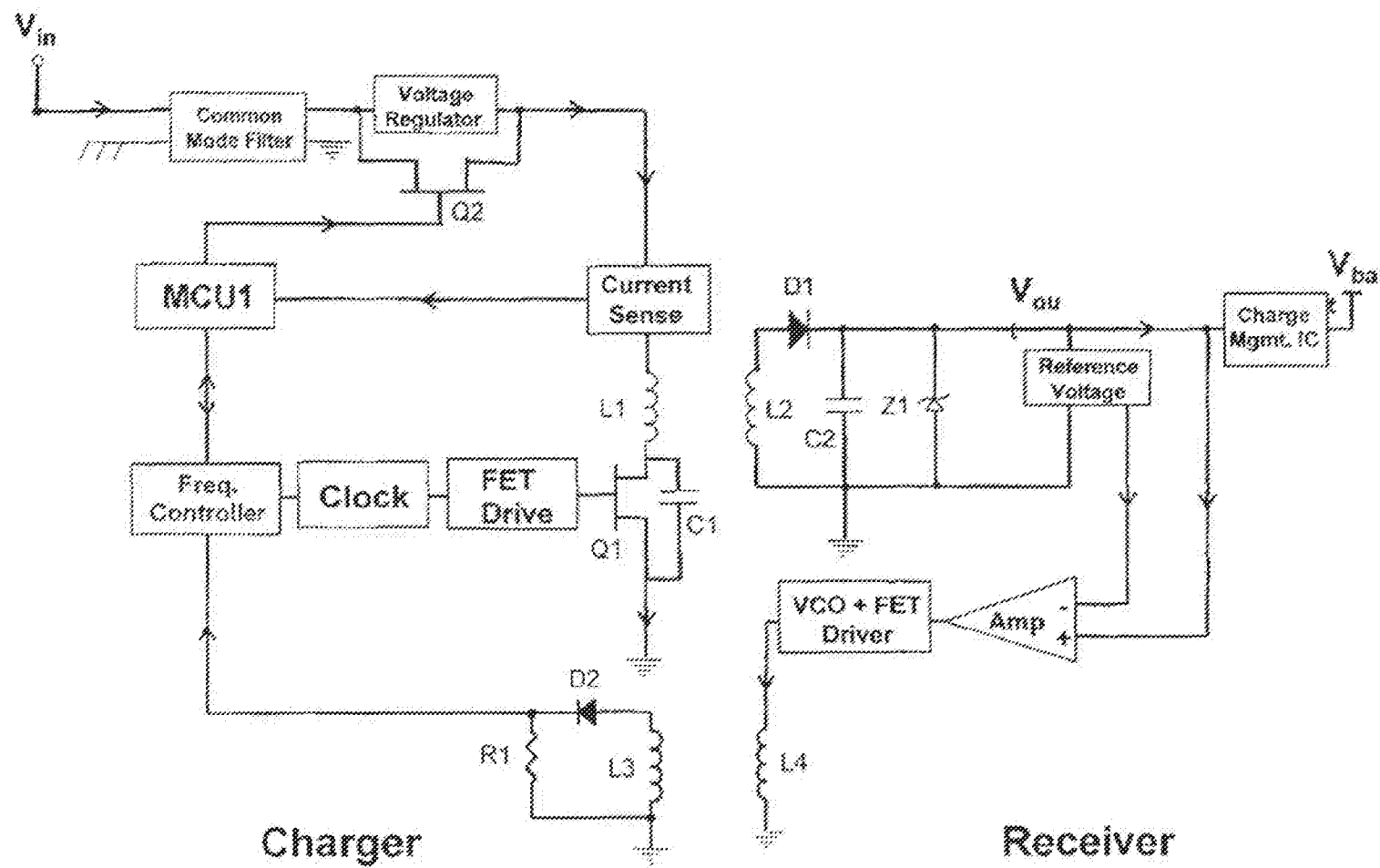


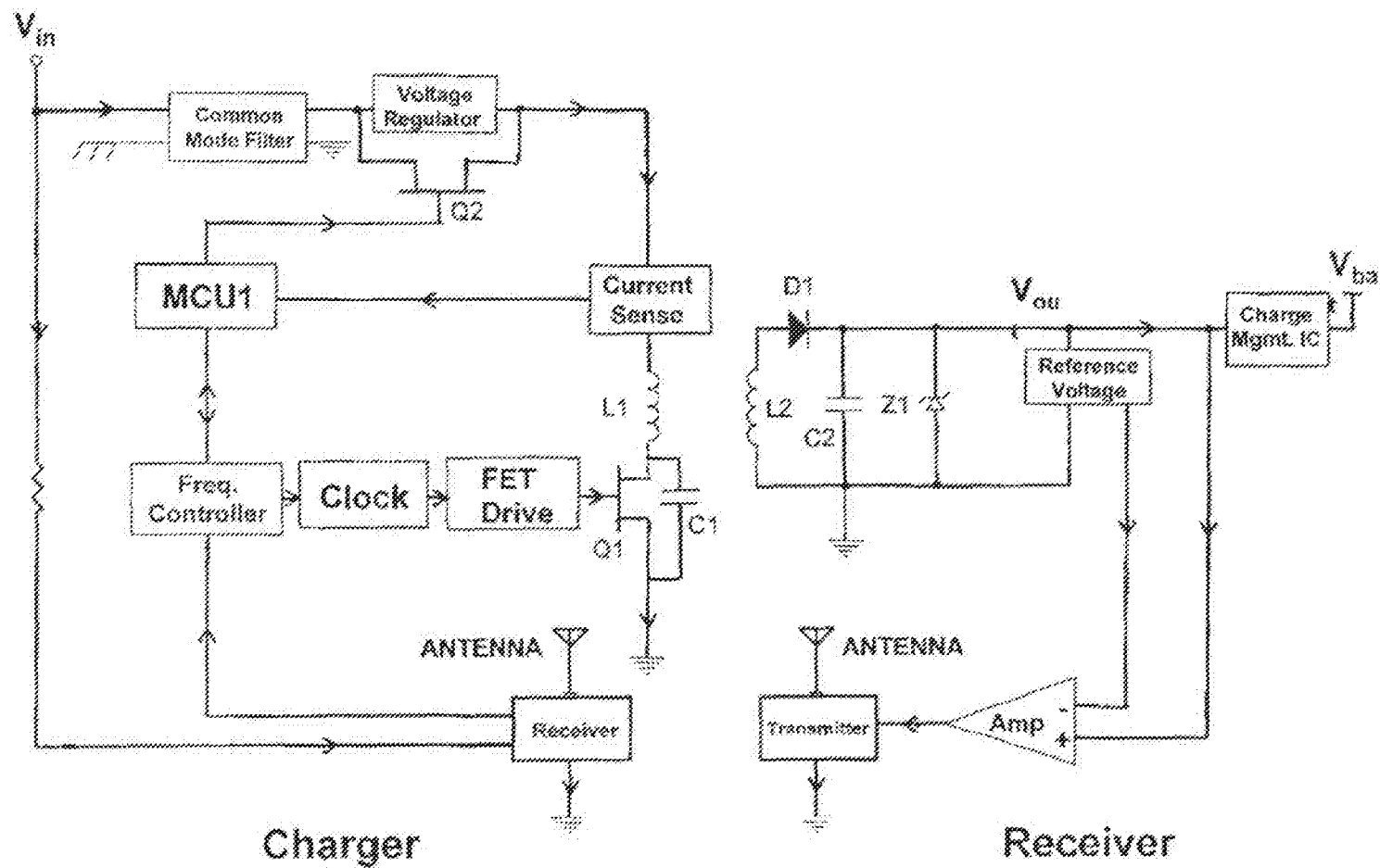
Figure 30

650



660

Figure 31



670

Figure 32

680

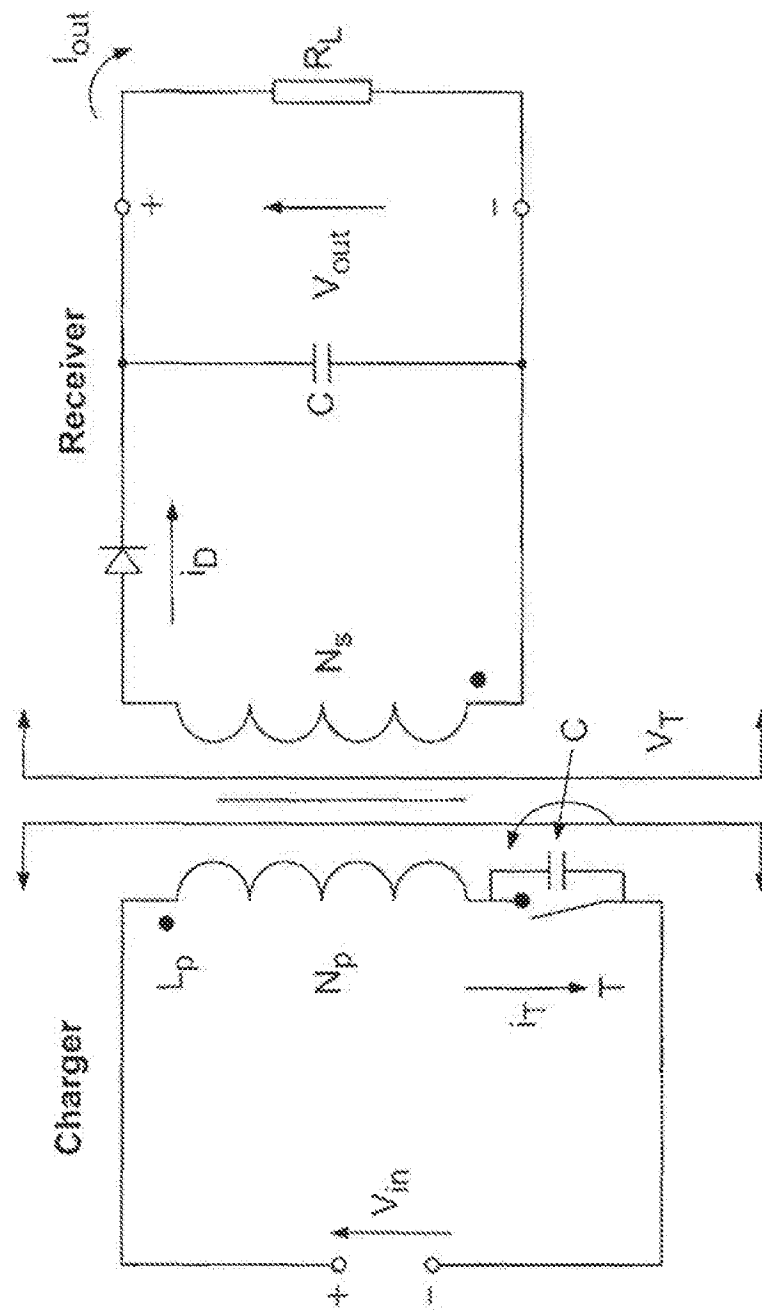


FIG. 33

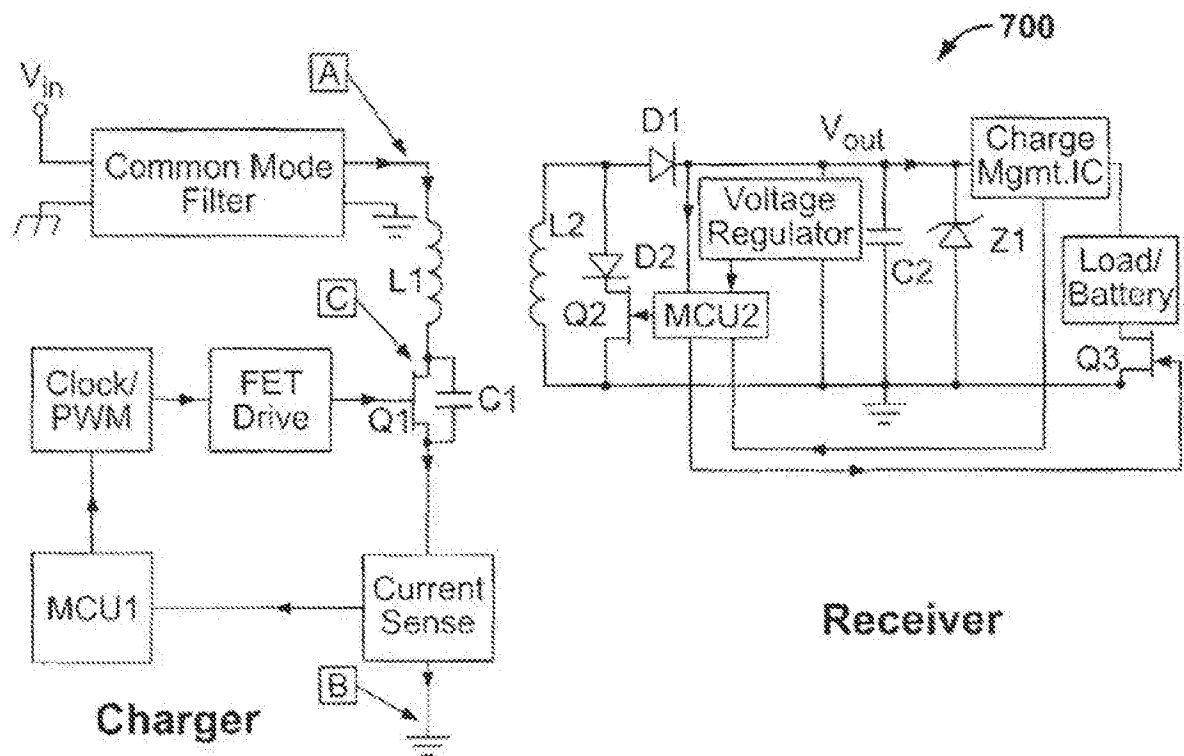


FIG. 34

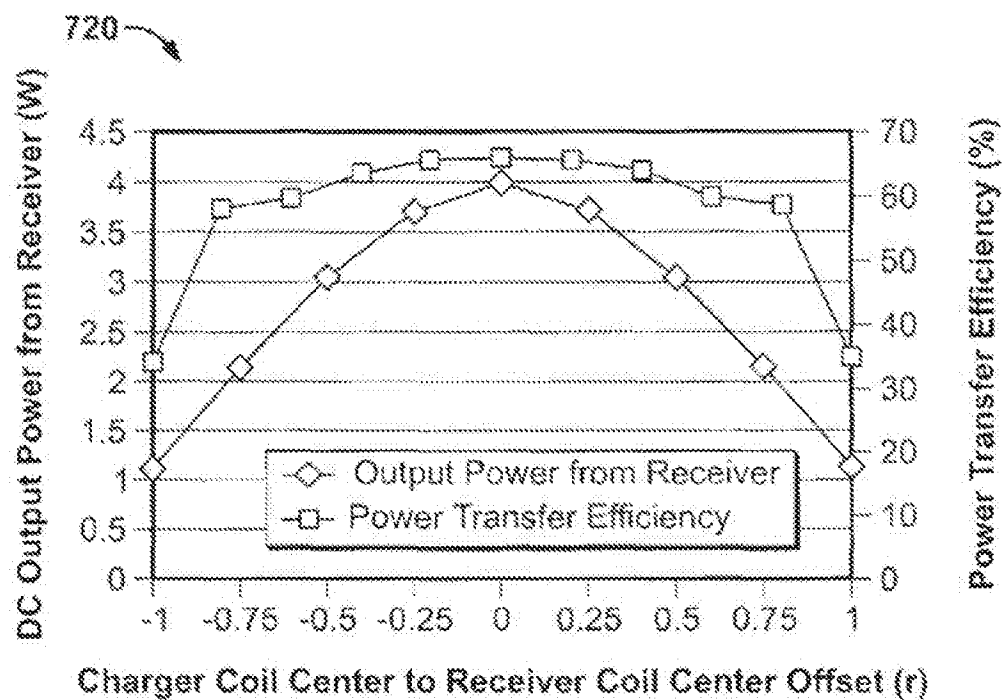


FIG. 35

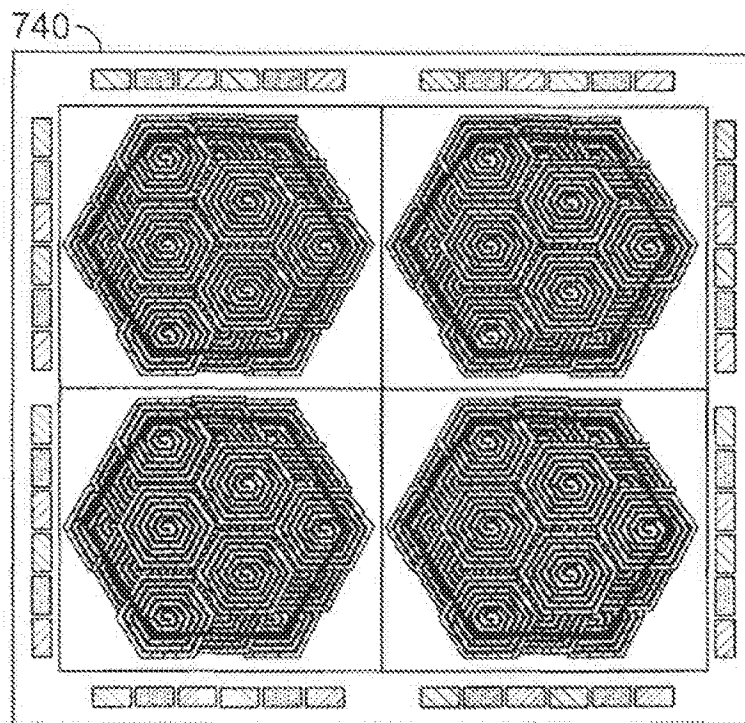


FIG. 36

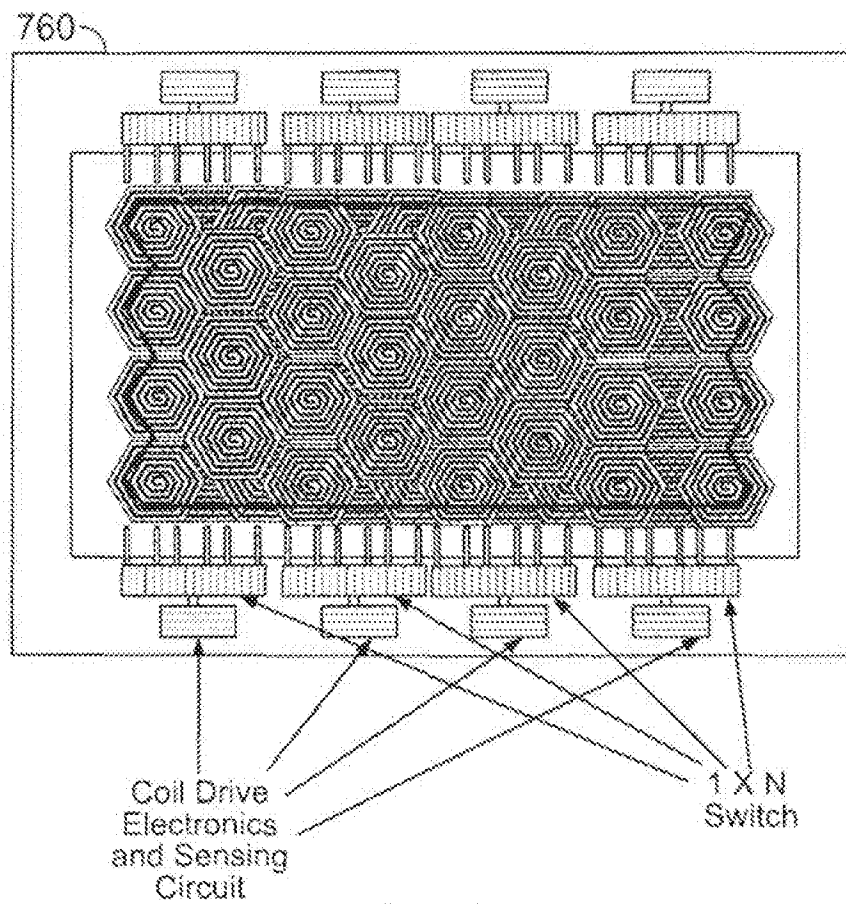
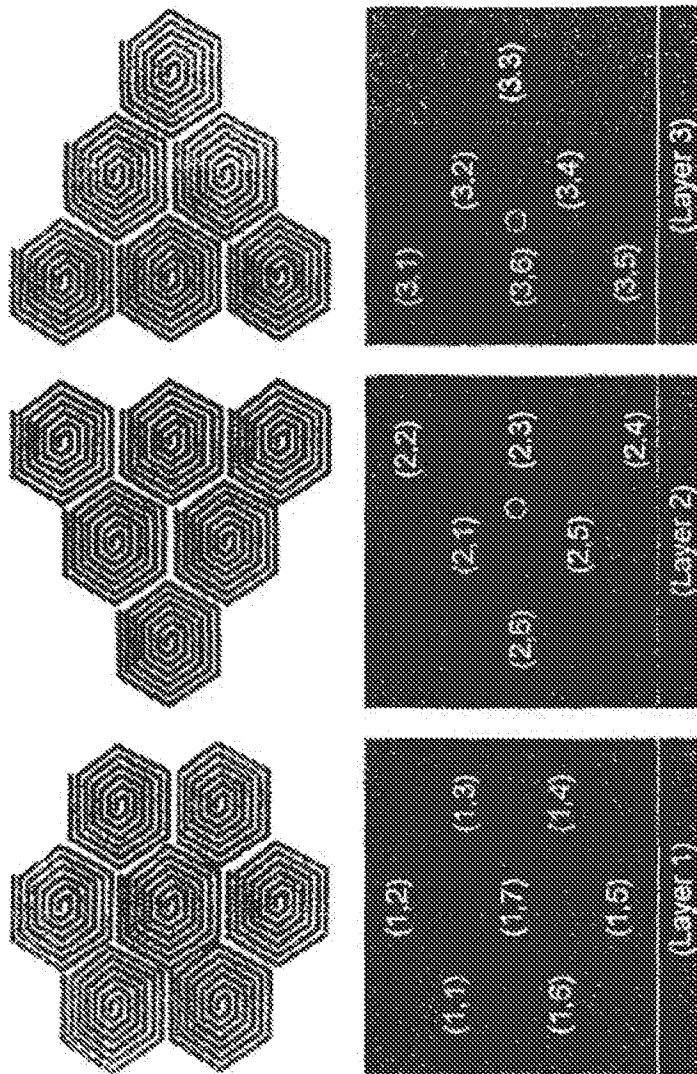


FIG. 37



2/30

FIG. 38

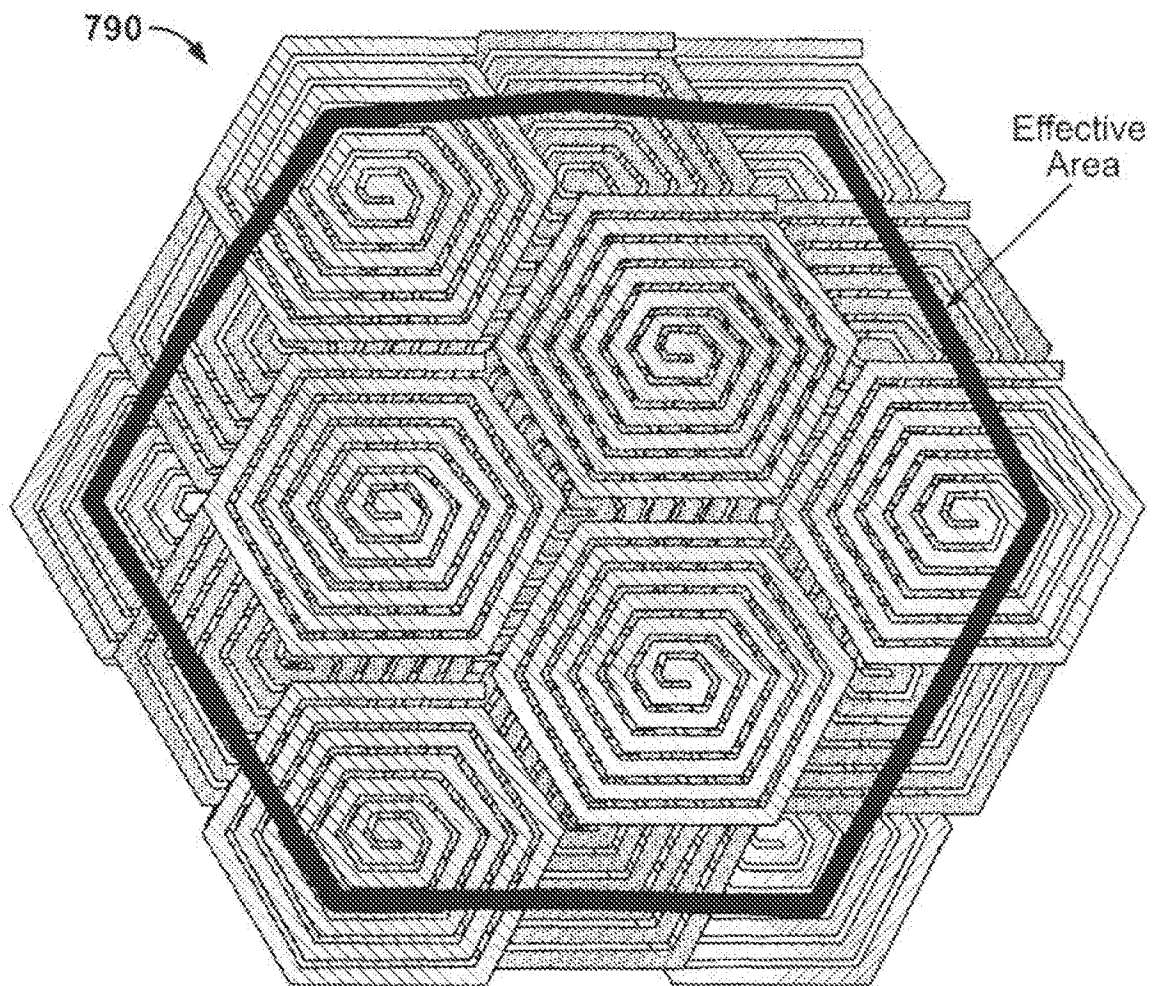


FIG. 39

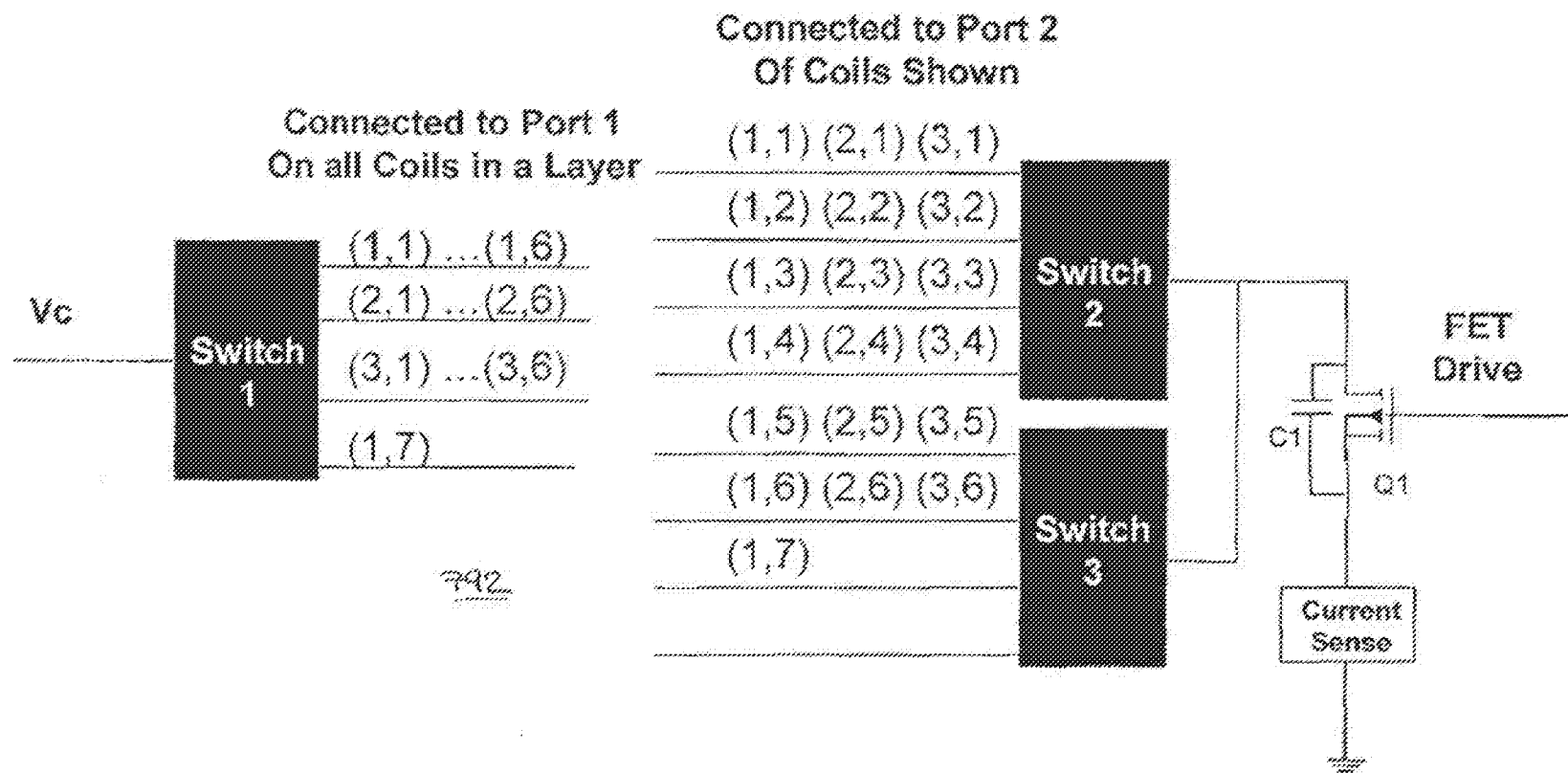


Figure 40

796

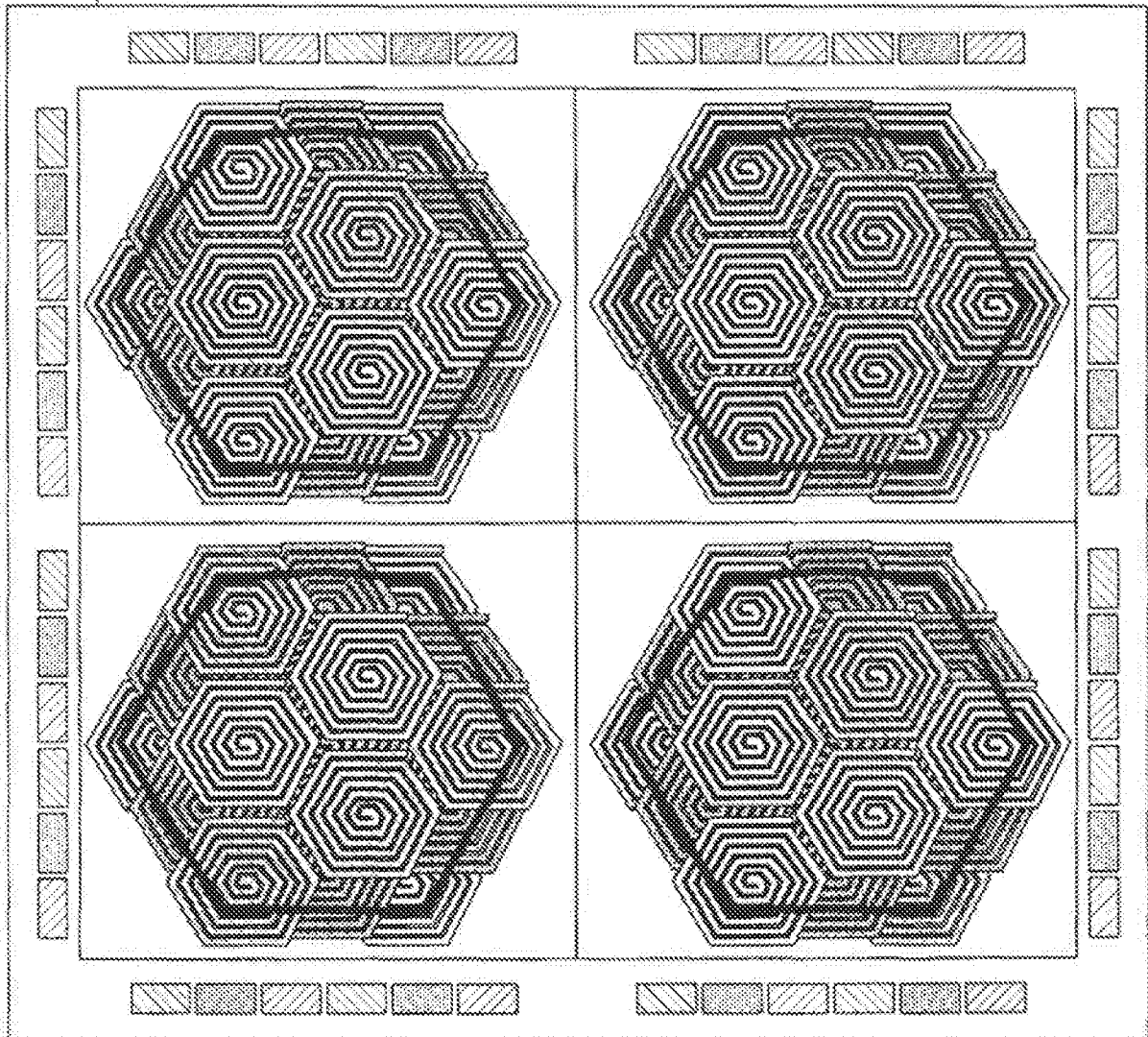


FIG. 41

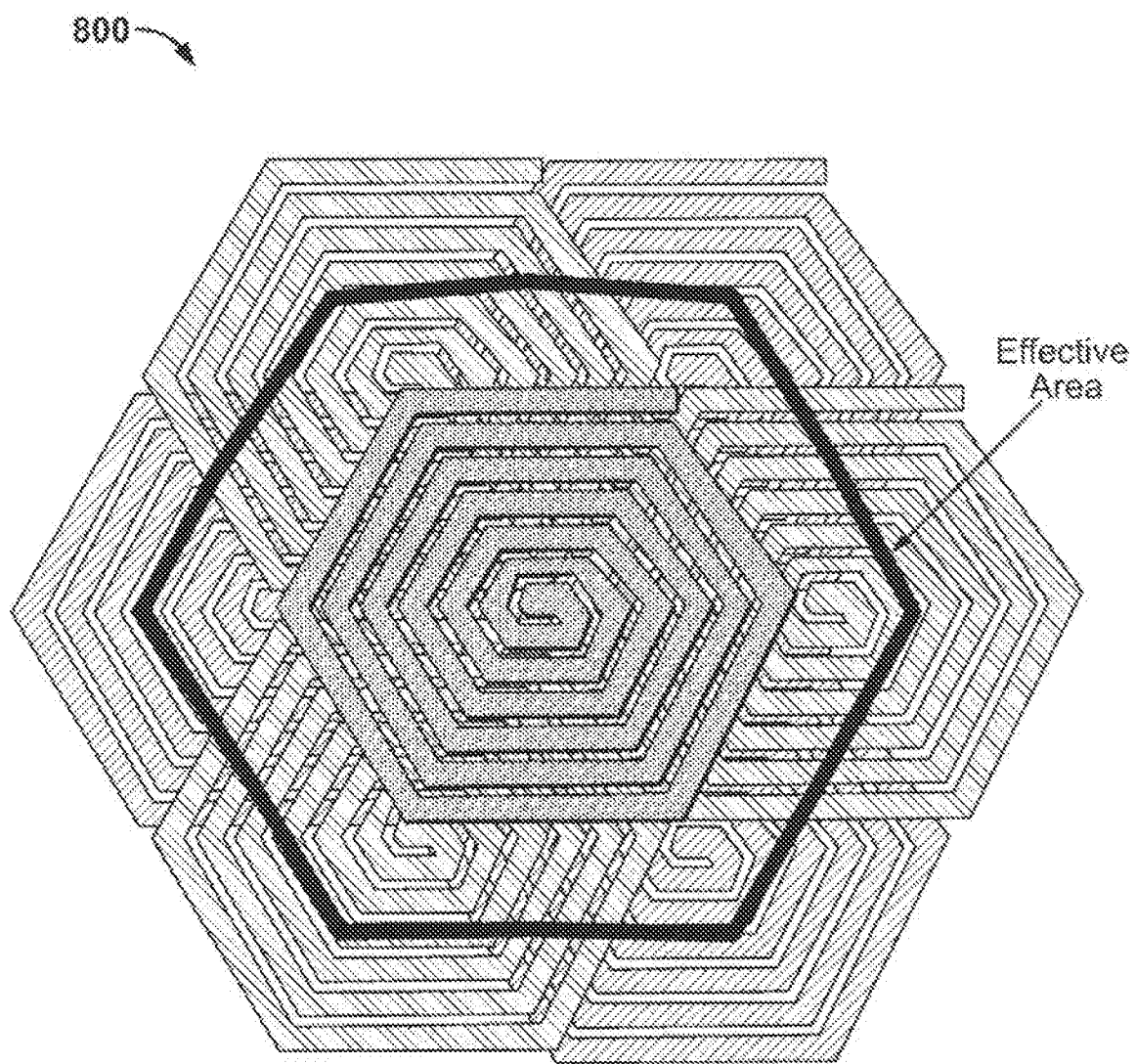


FIG. 42

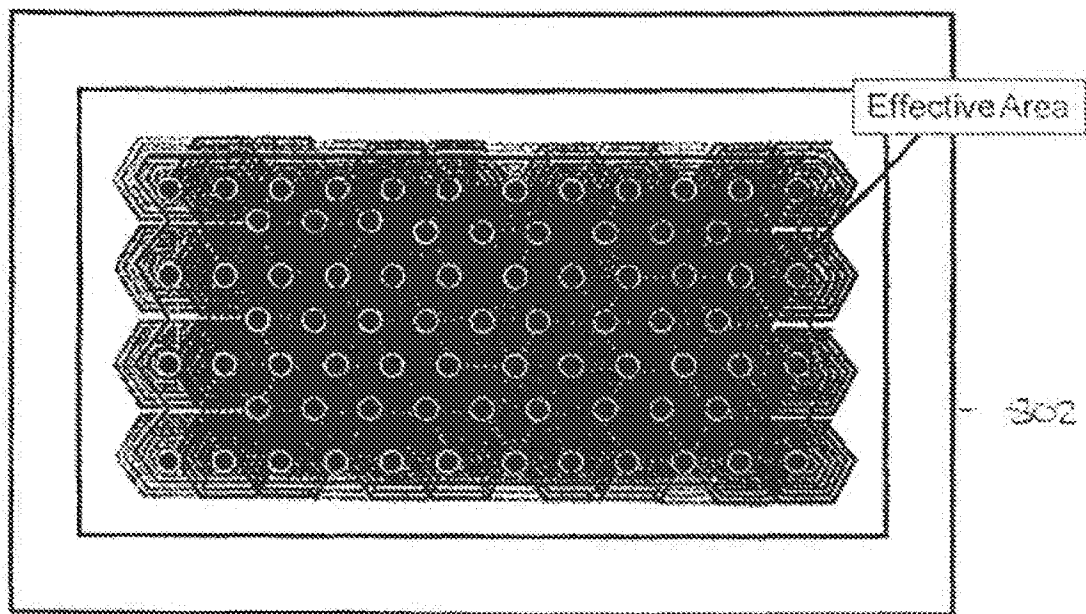


FIG. 43

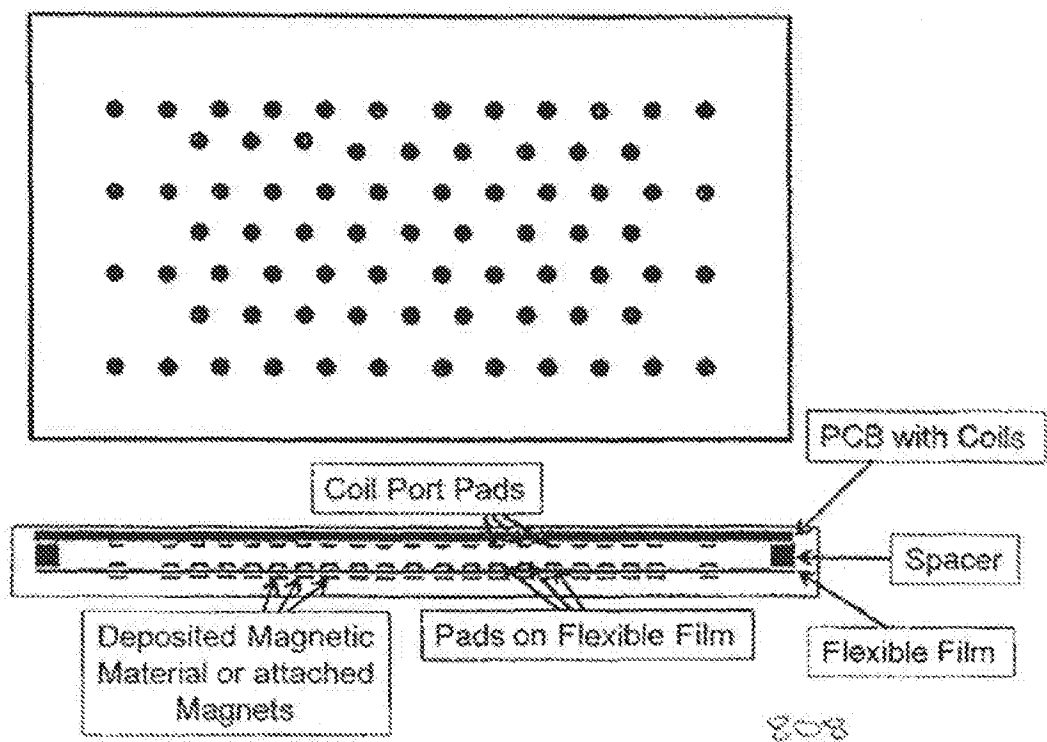


FIG. 44

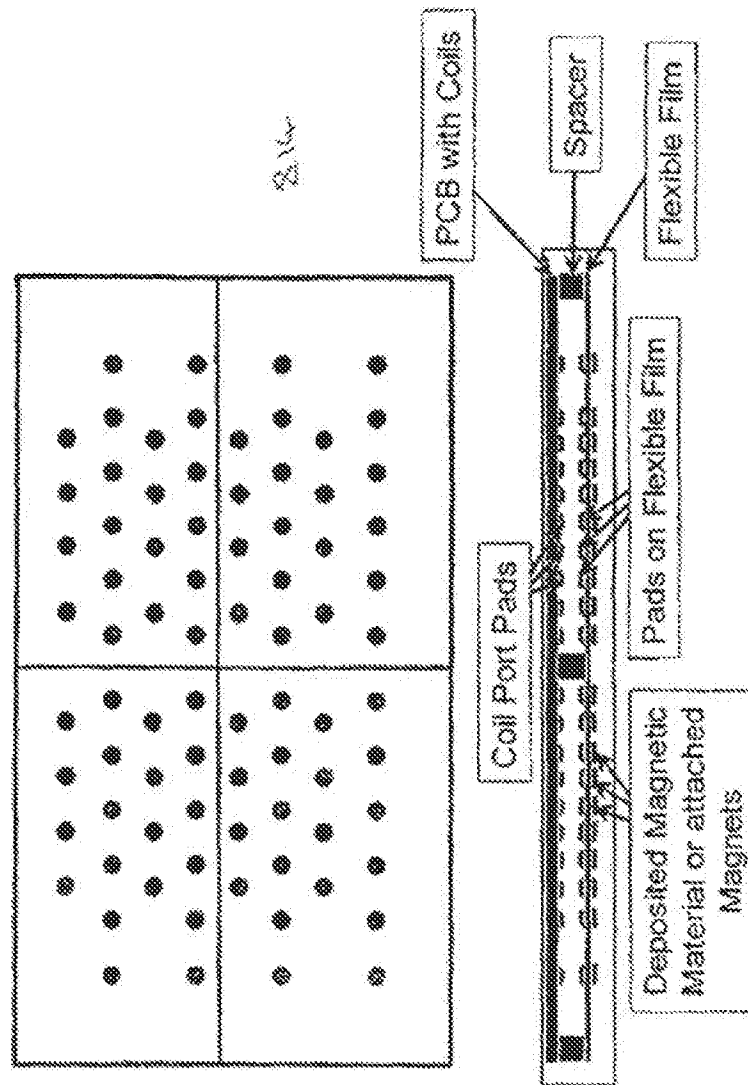


FIG. 45

820

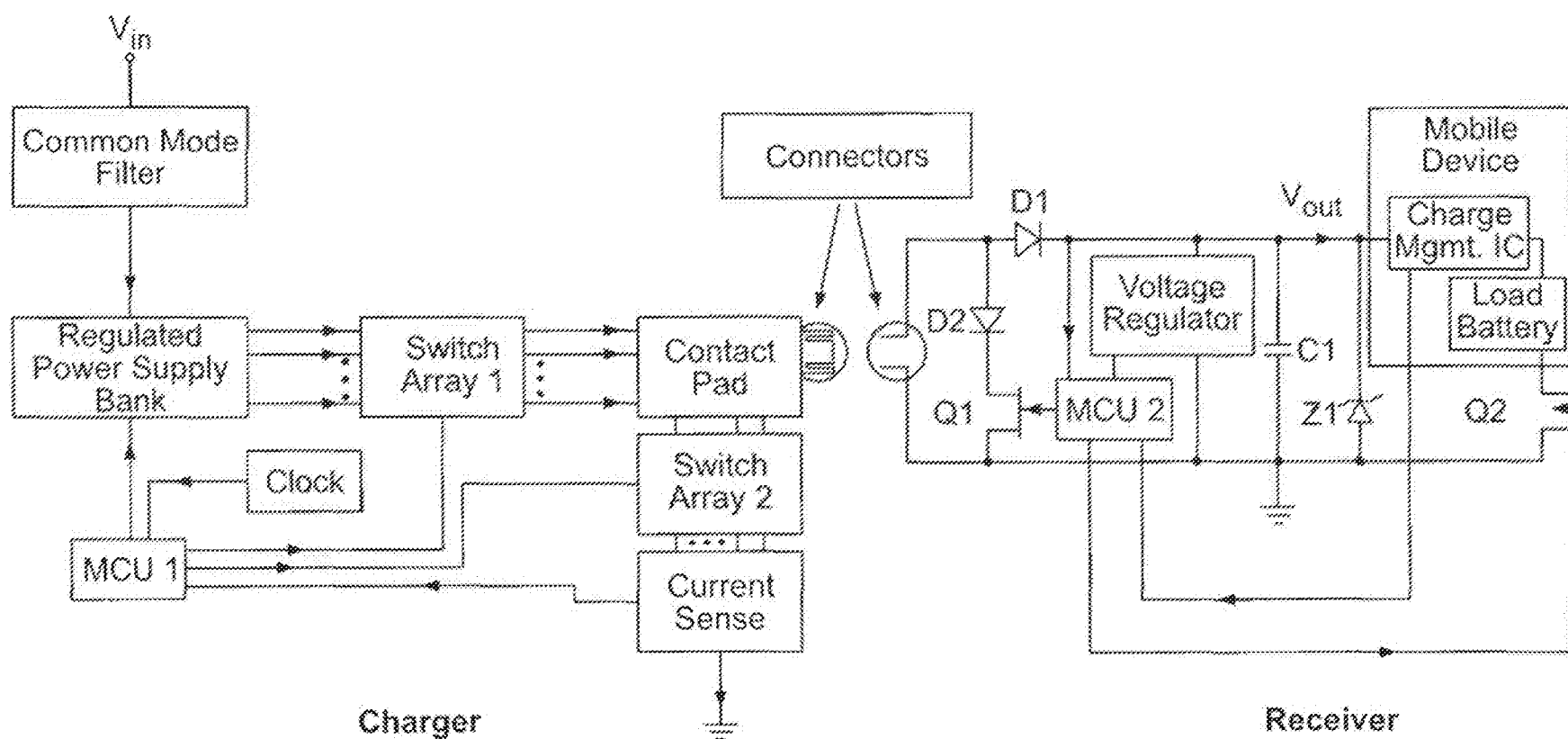


FIG. 46

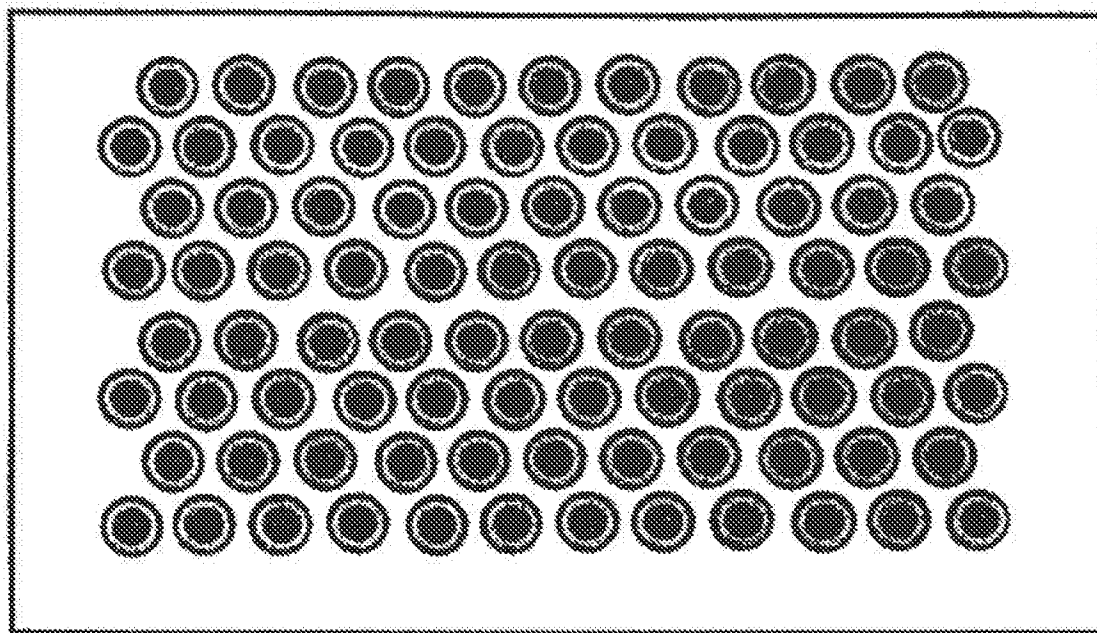


FIG. 47

824

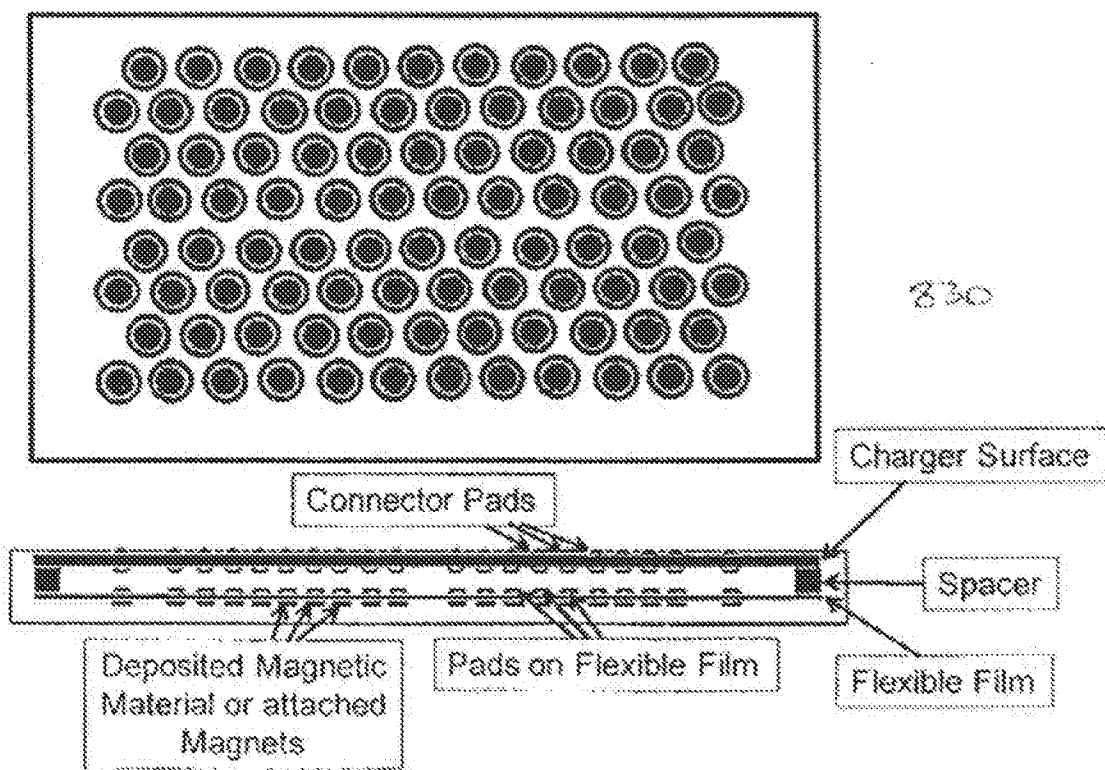


FIG. 48

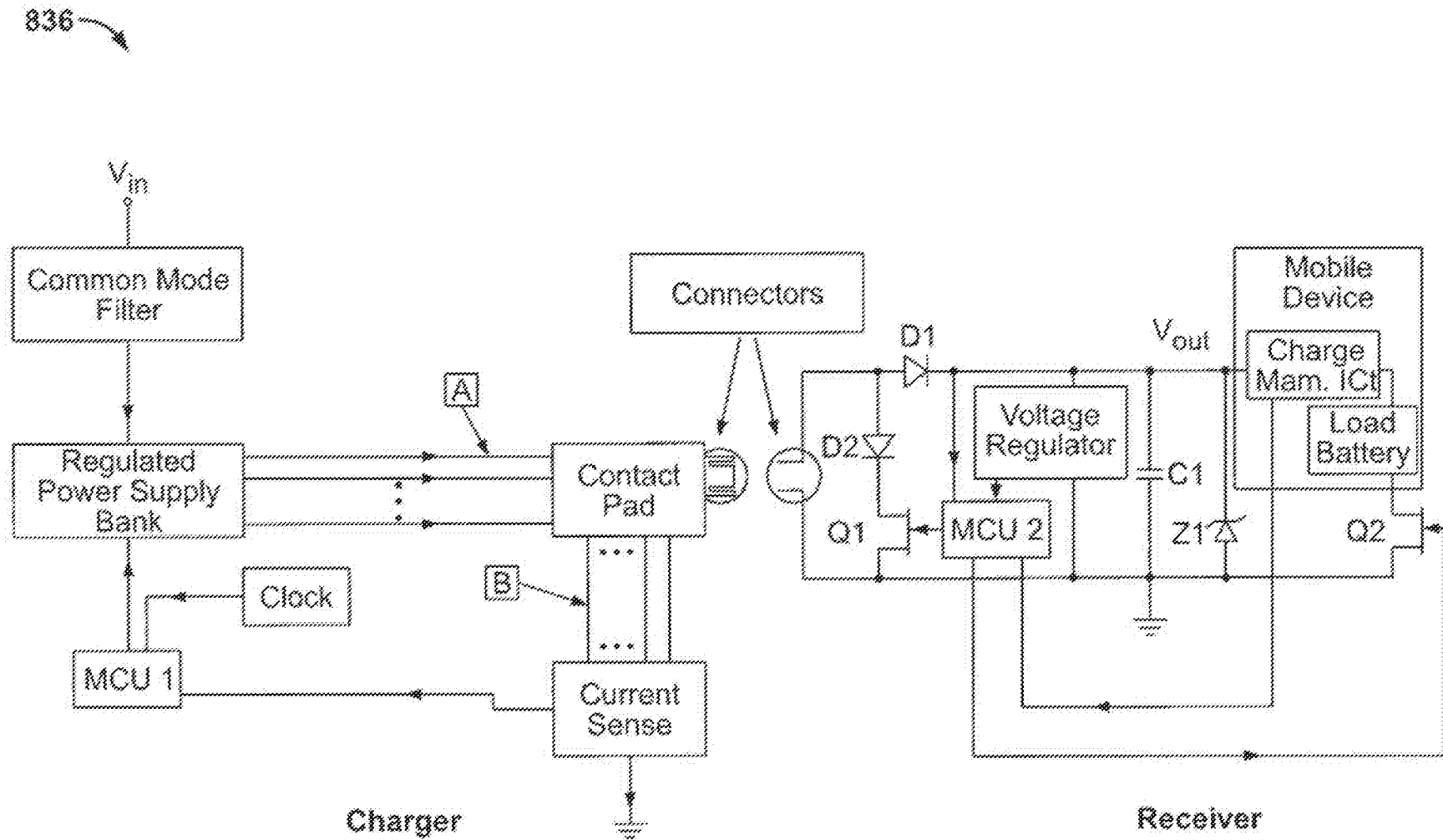


FIG. 49

Should read Charge Mgmt. IC

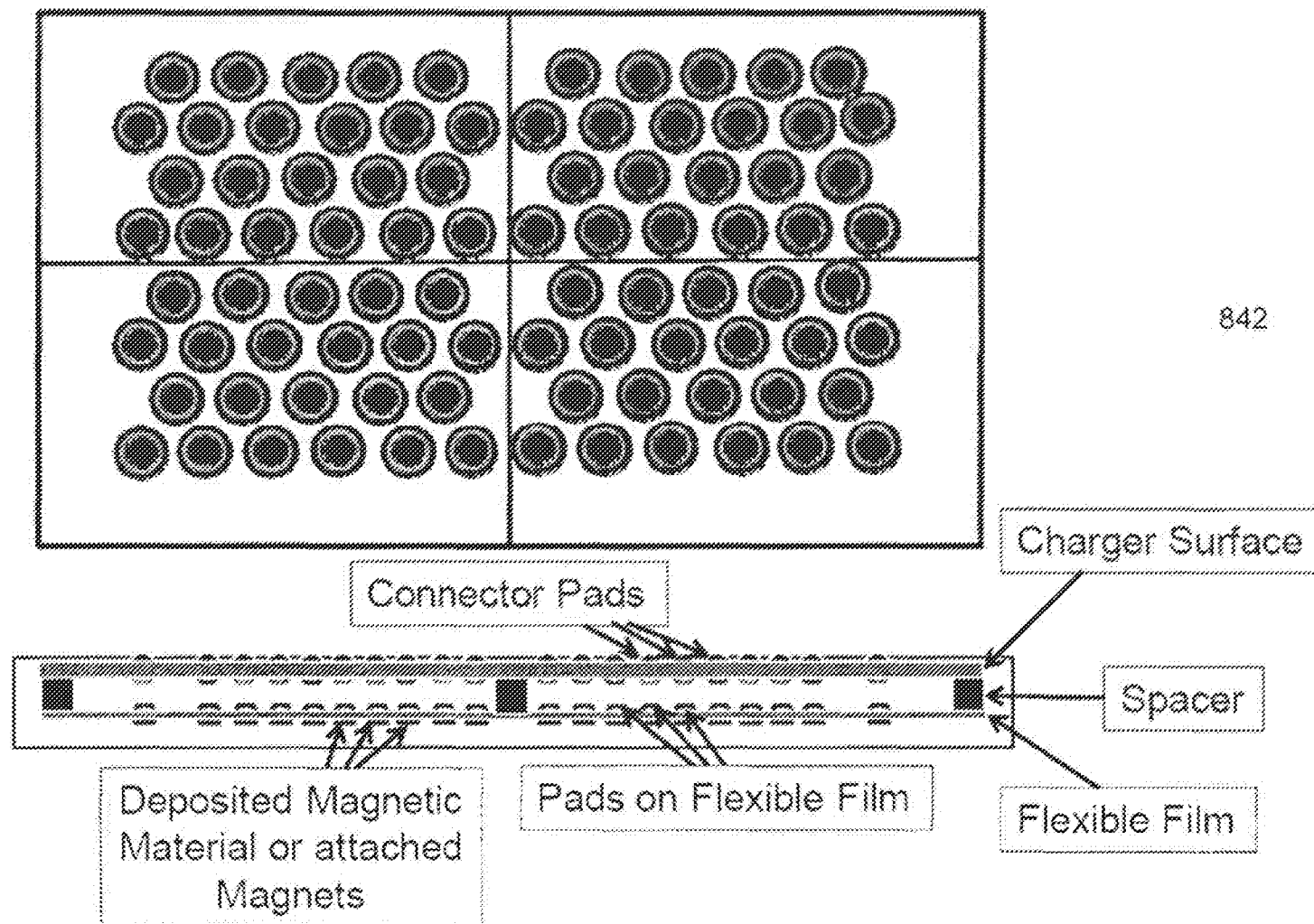


FIG. 50

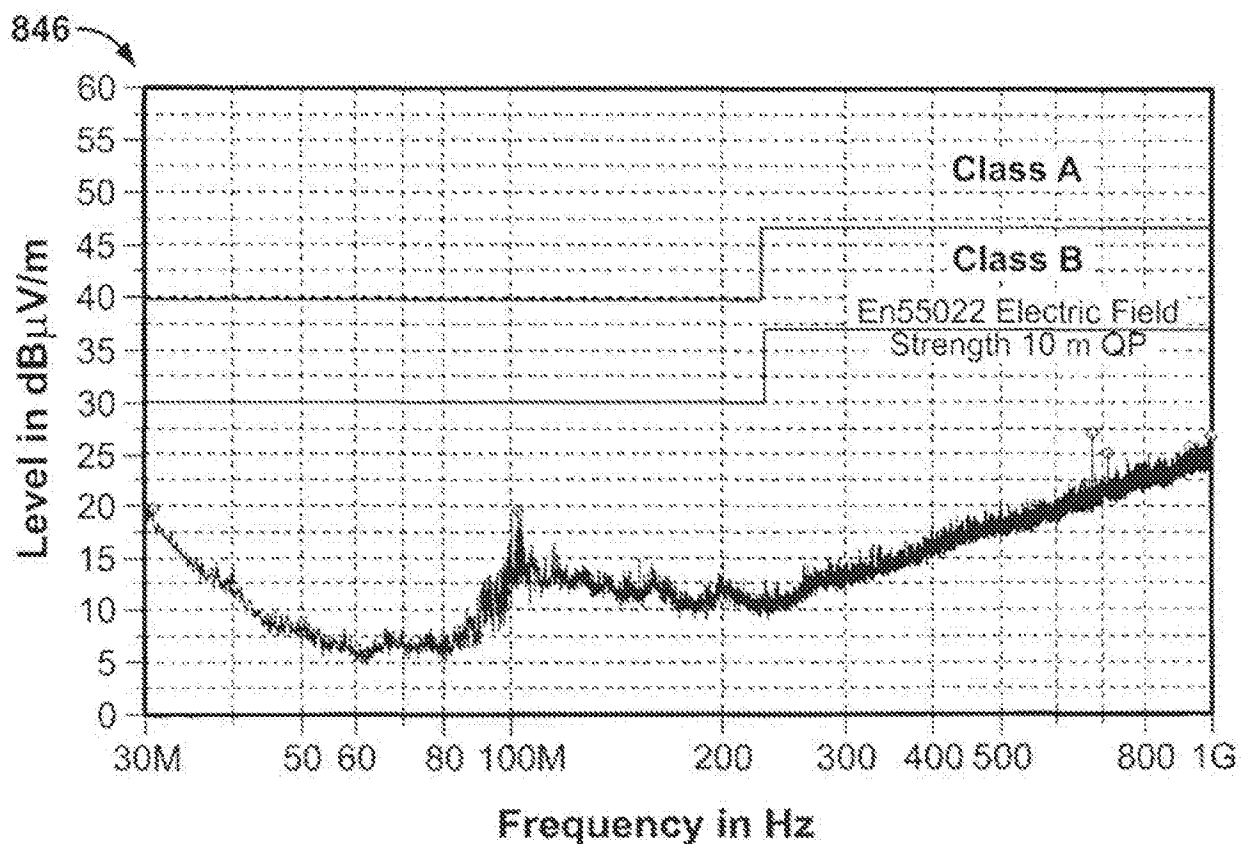


FIG. 51

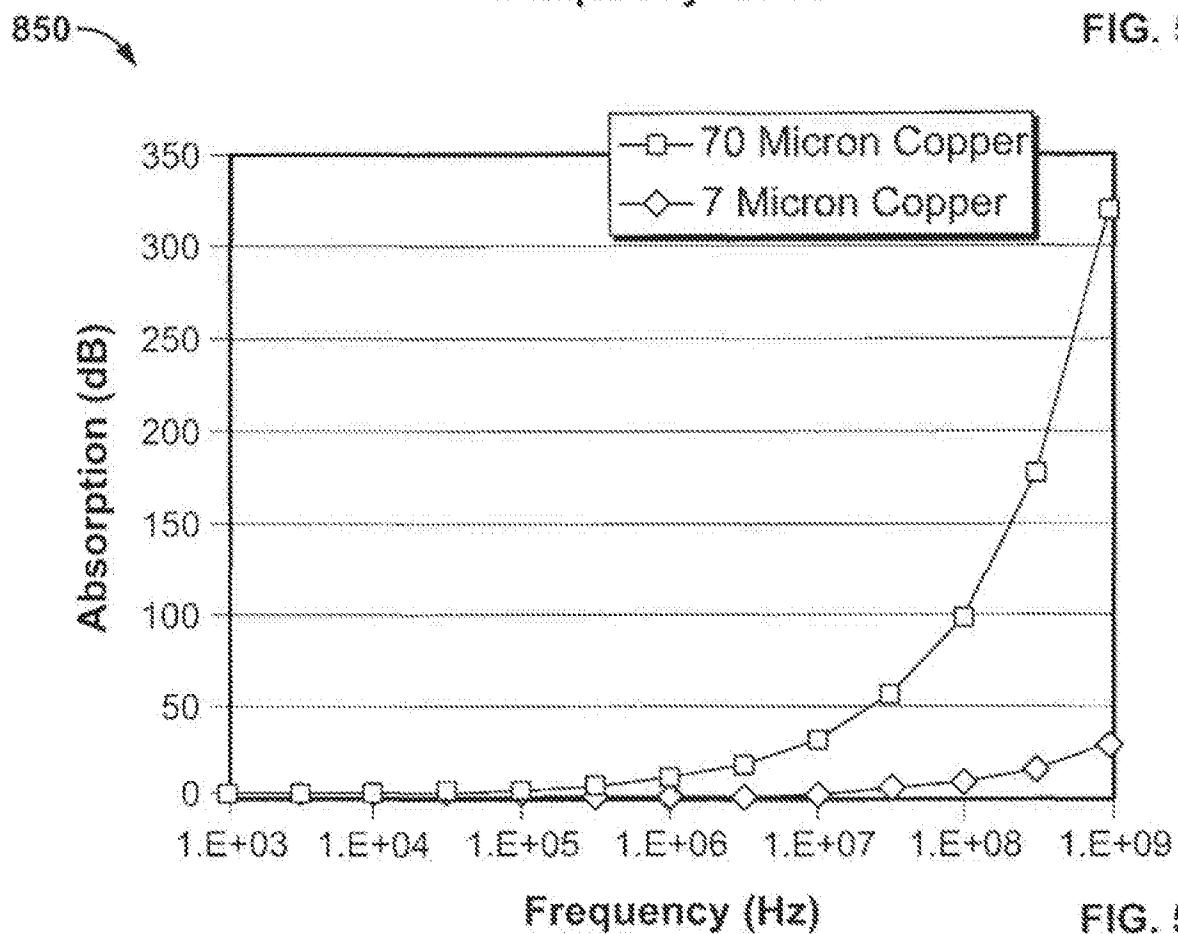


FIG. 52

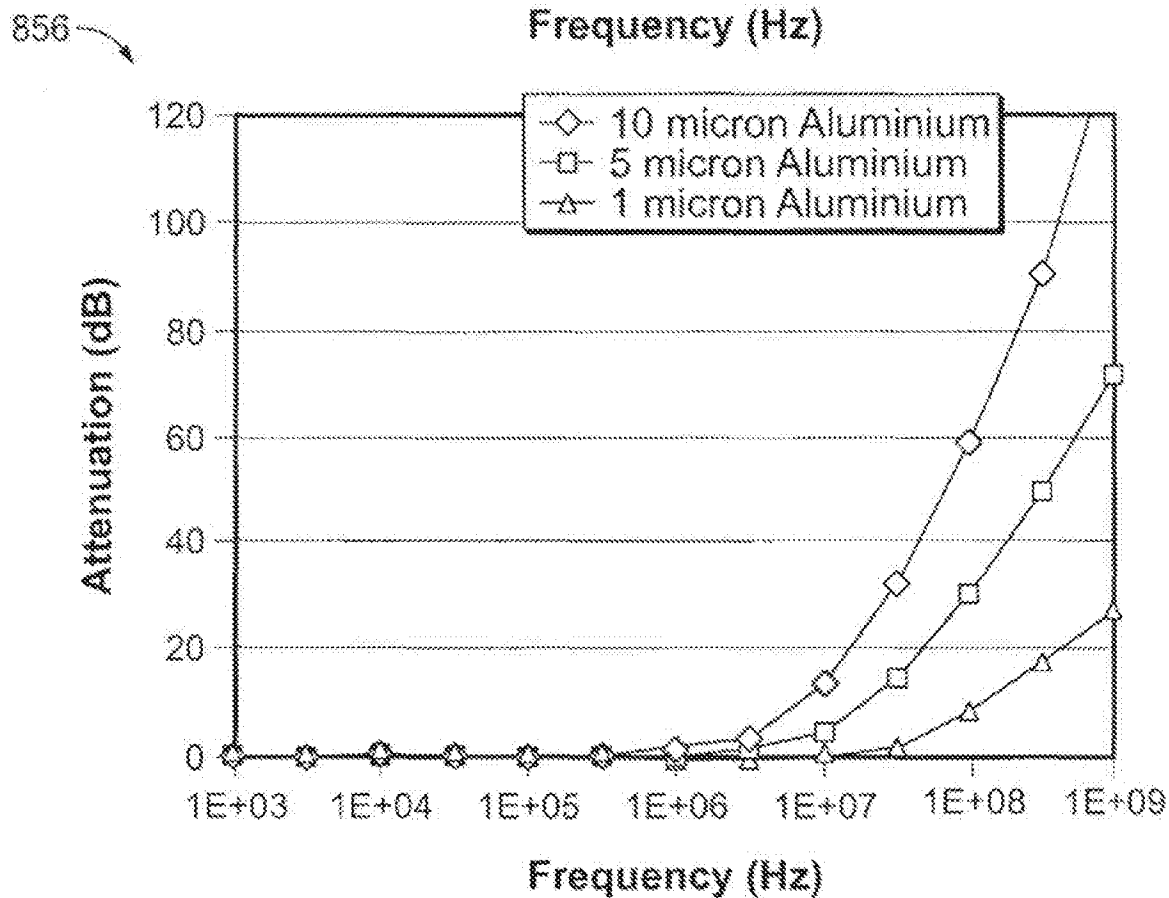
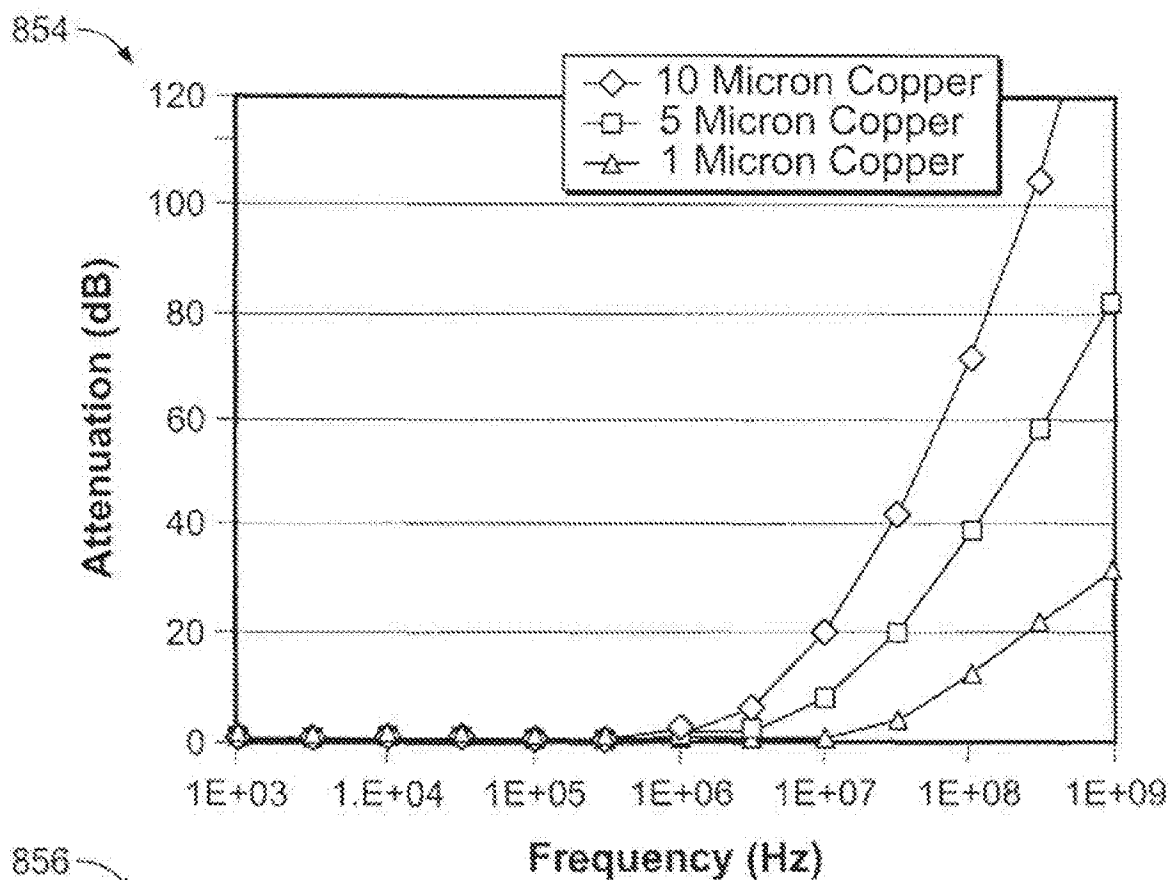


FIG. 53

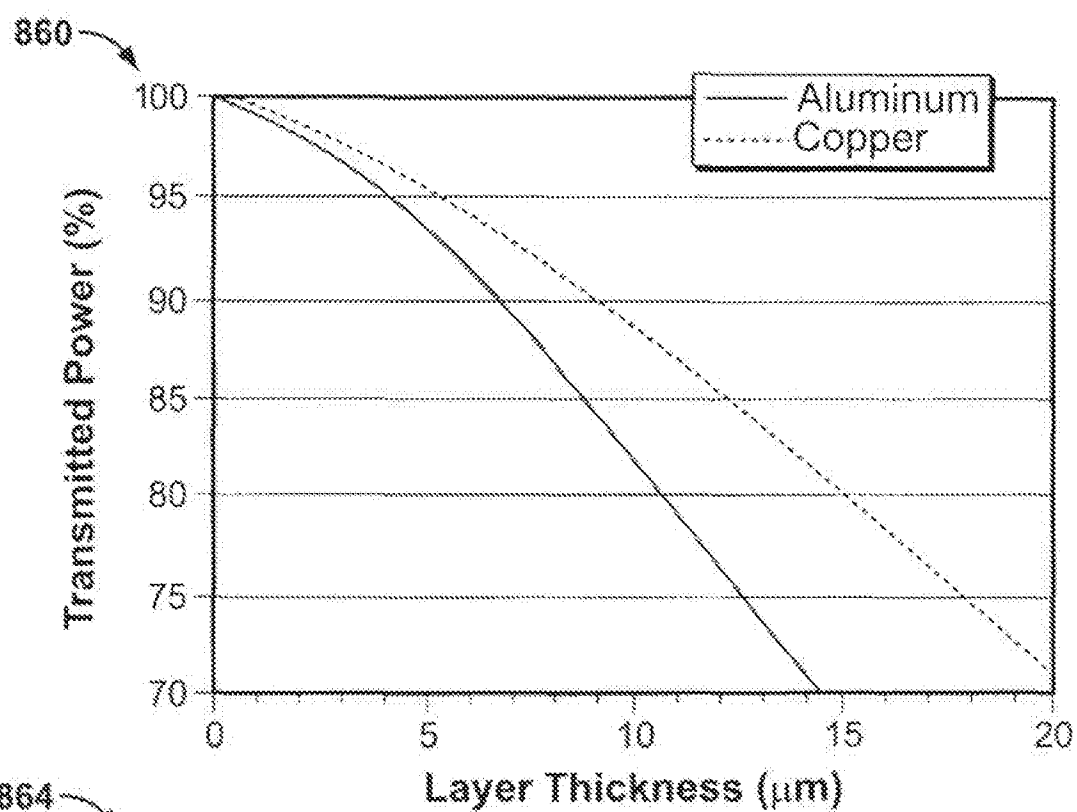


FIG. 54

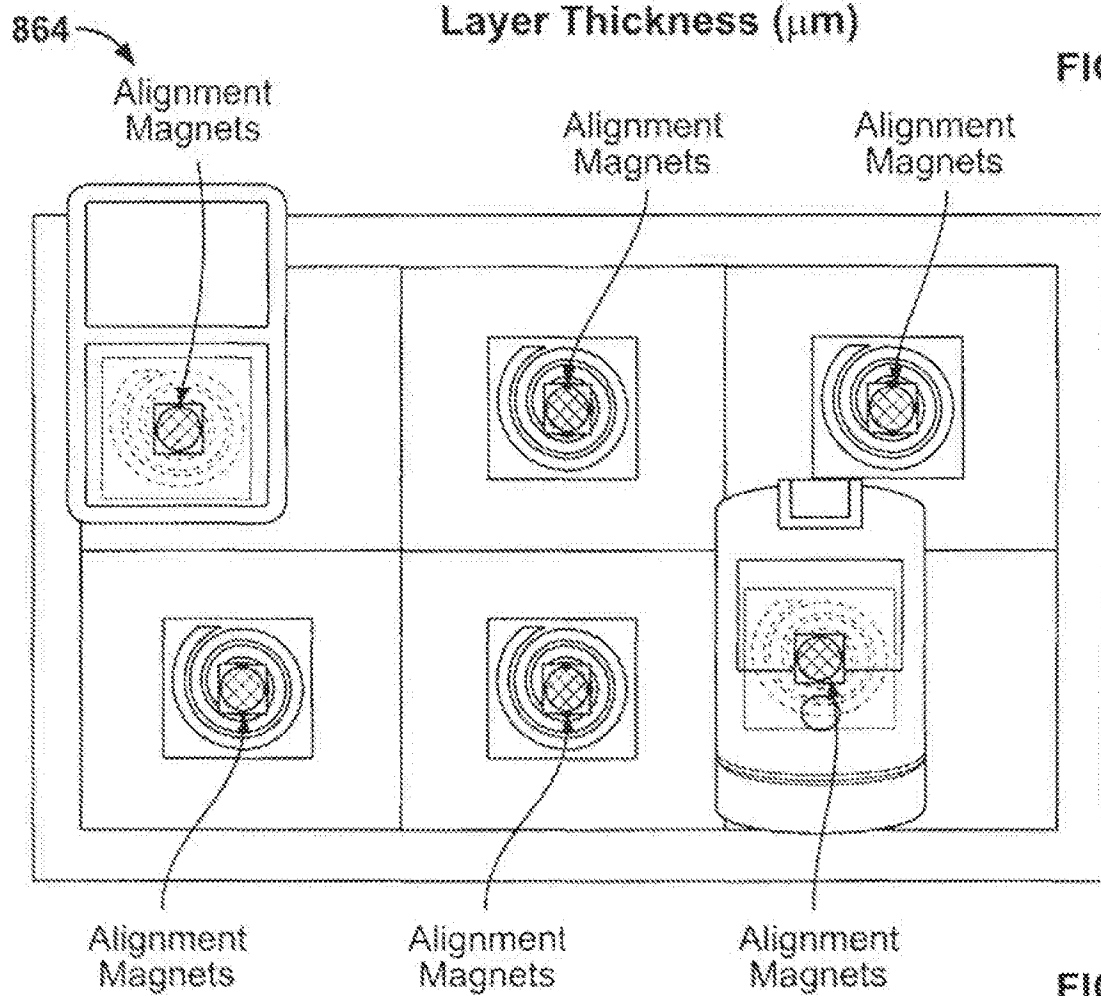


FIG. 55

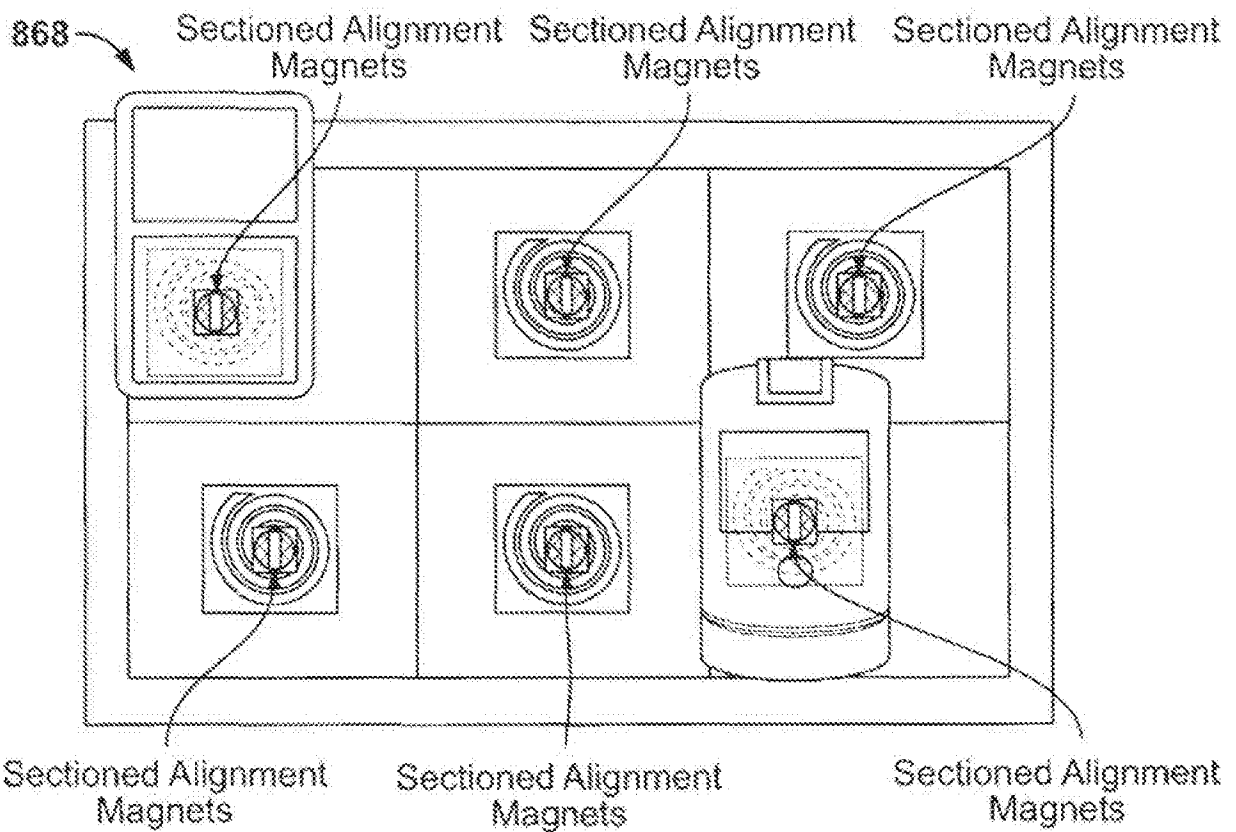


FIG. 56

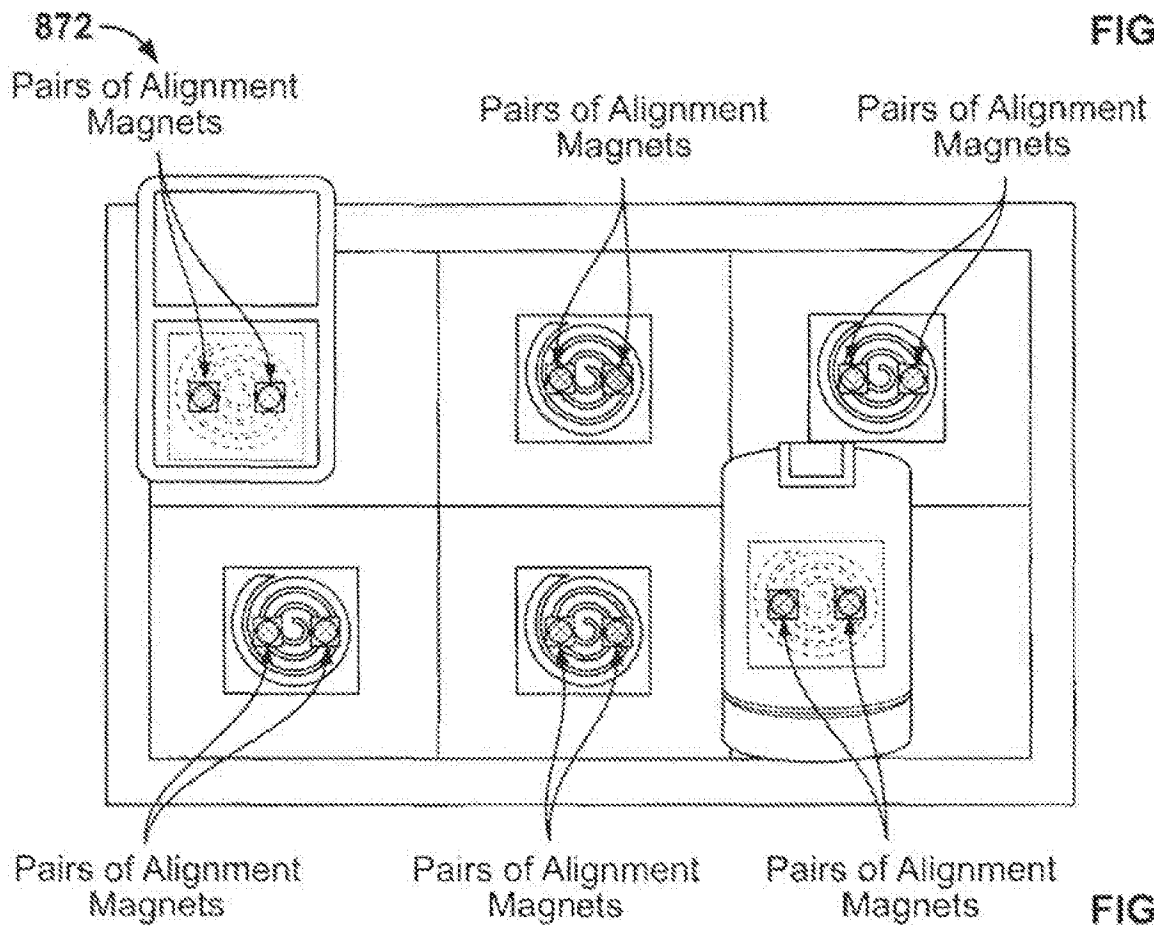


FIG. 57

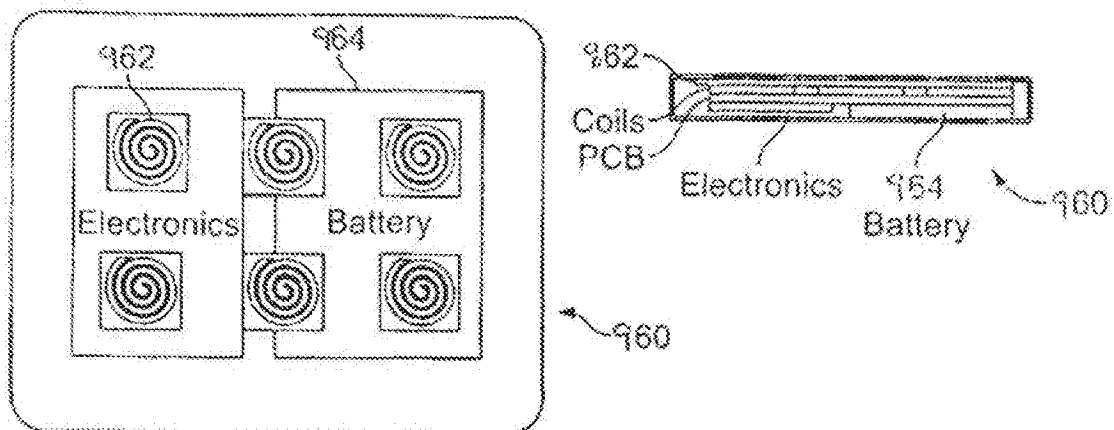


FIG. 58

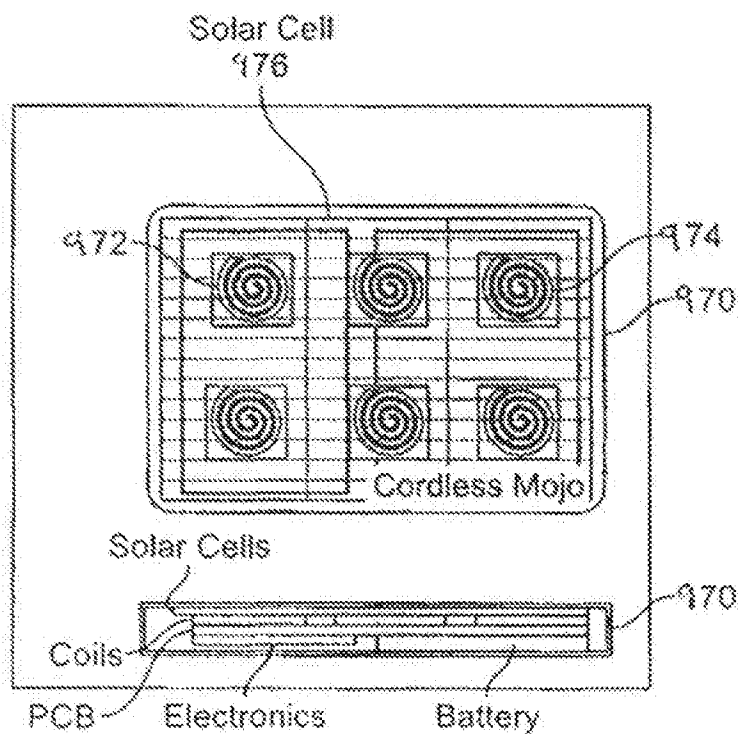


FIG. 59

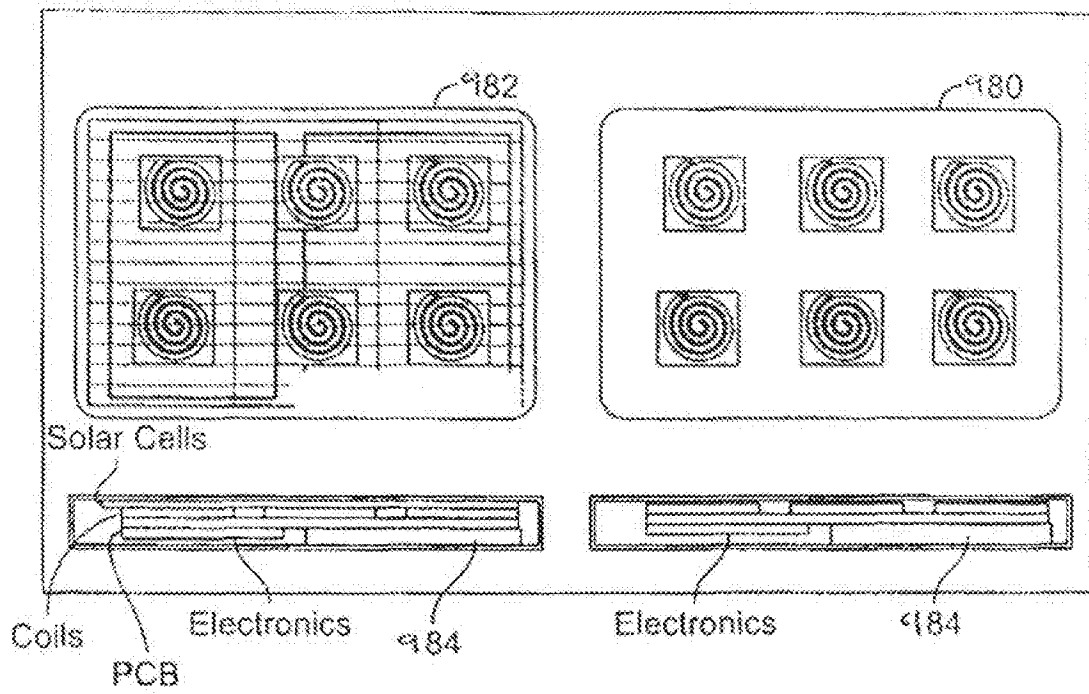


FIG. 60

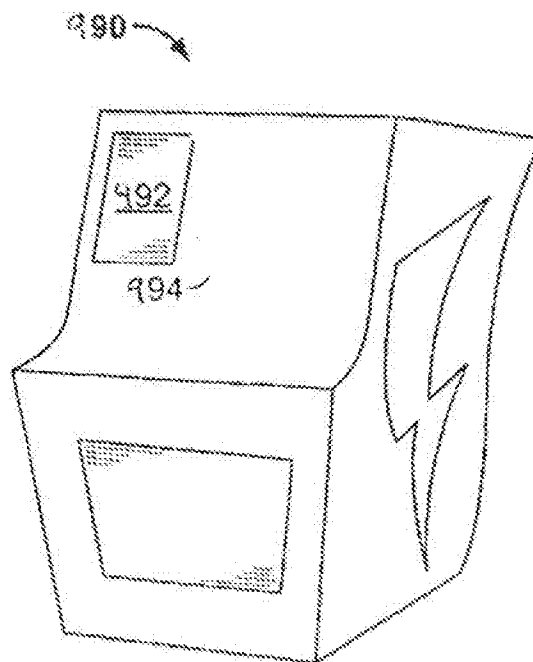


FIG. 61

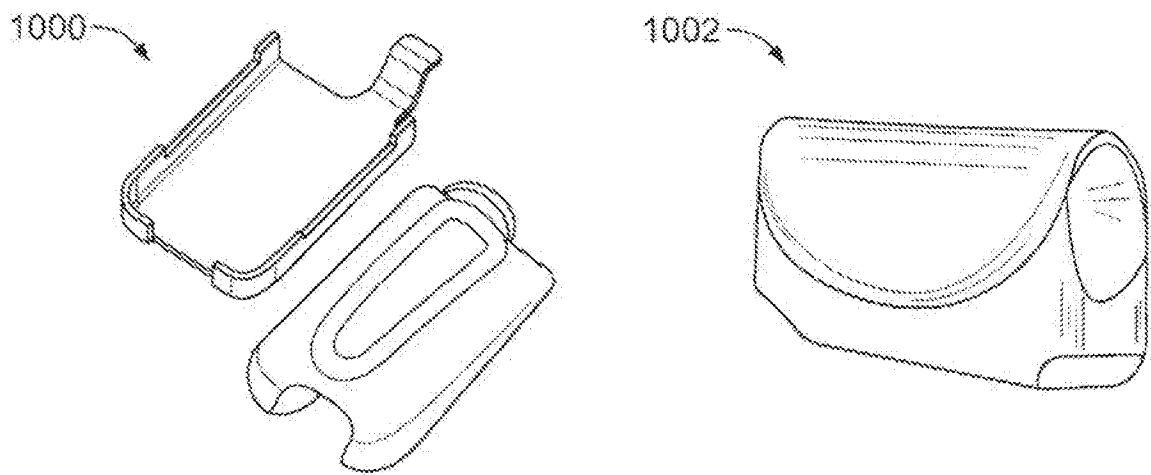


FIG. 62

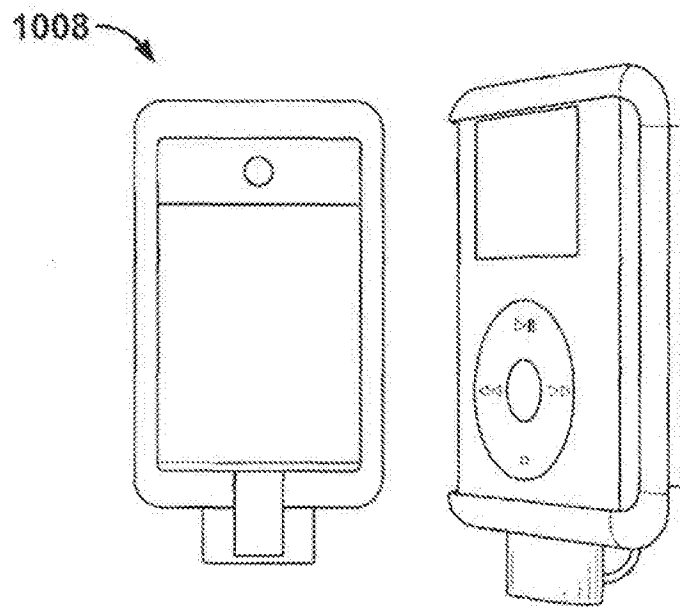


FIG. 63

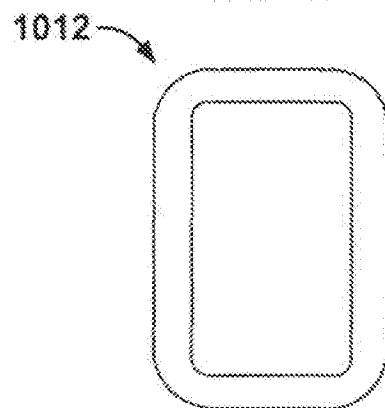


FIG. 64

1020

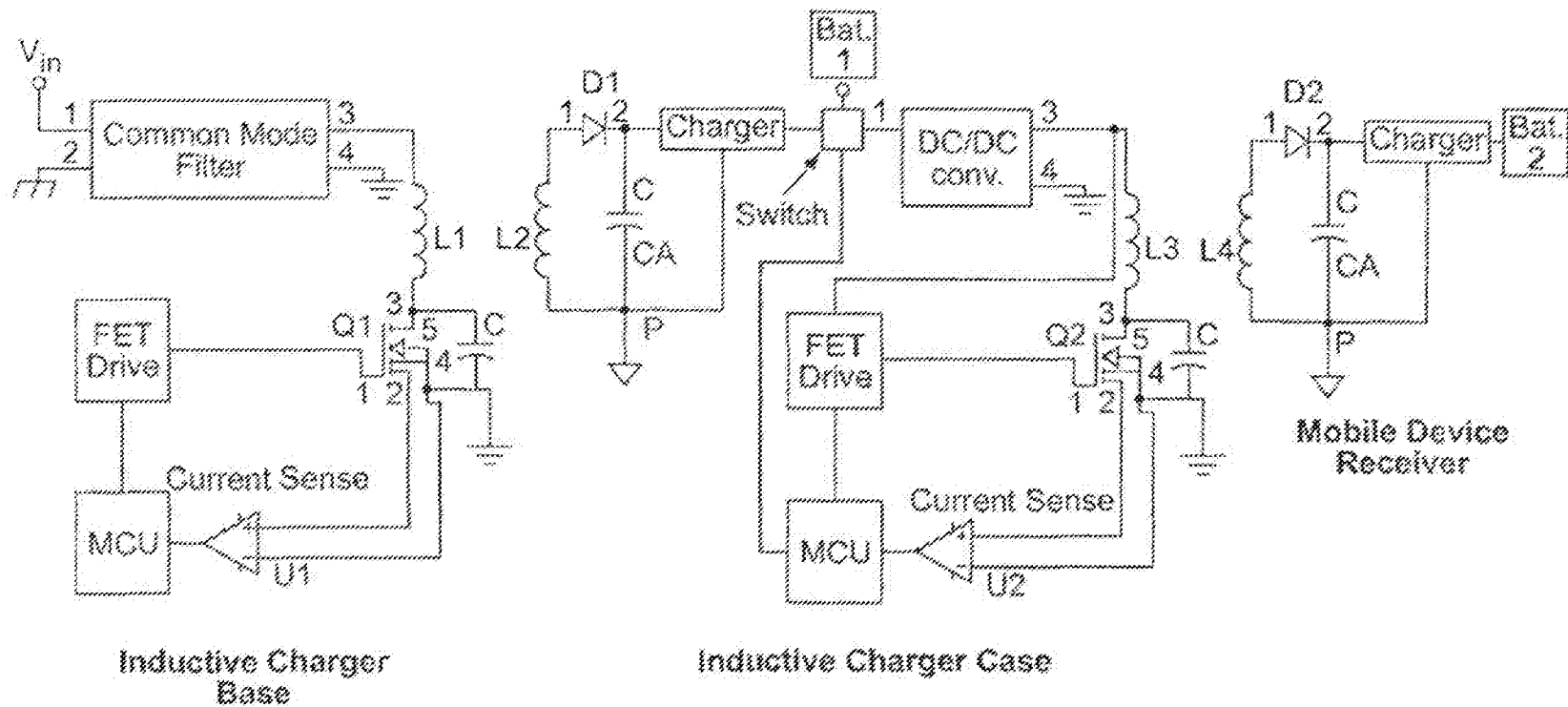


FIG. 65

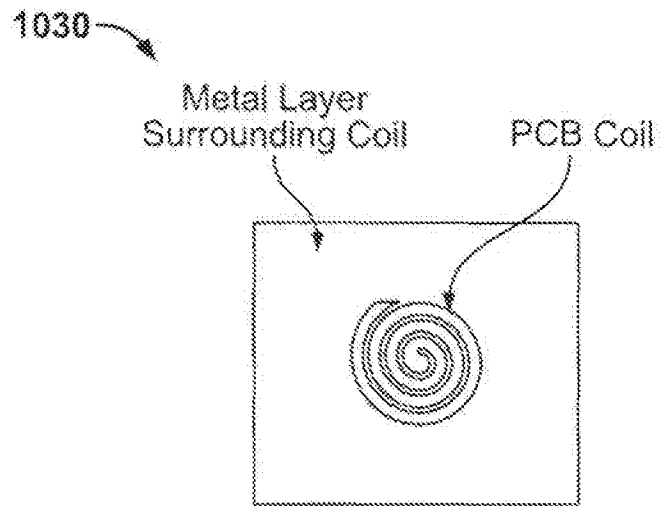


FIG. 66

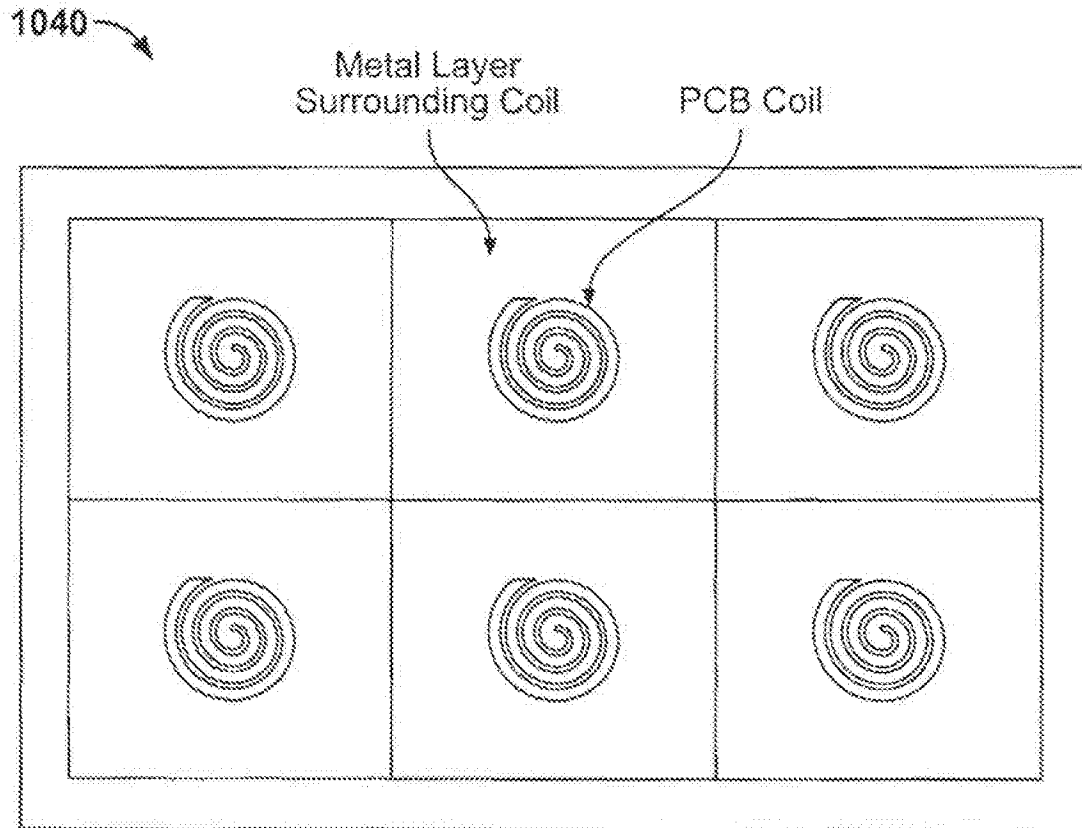


FIG. 67

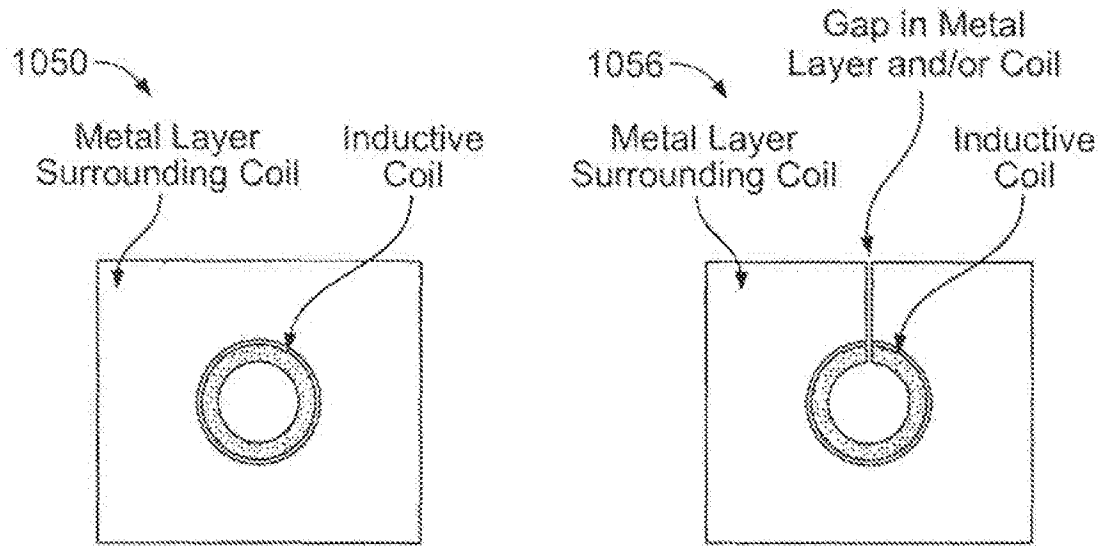


FIG. 68

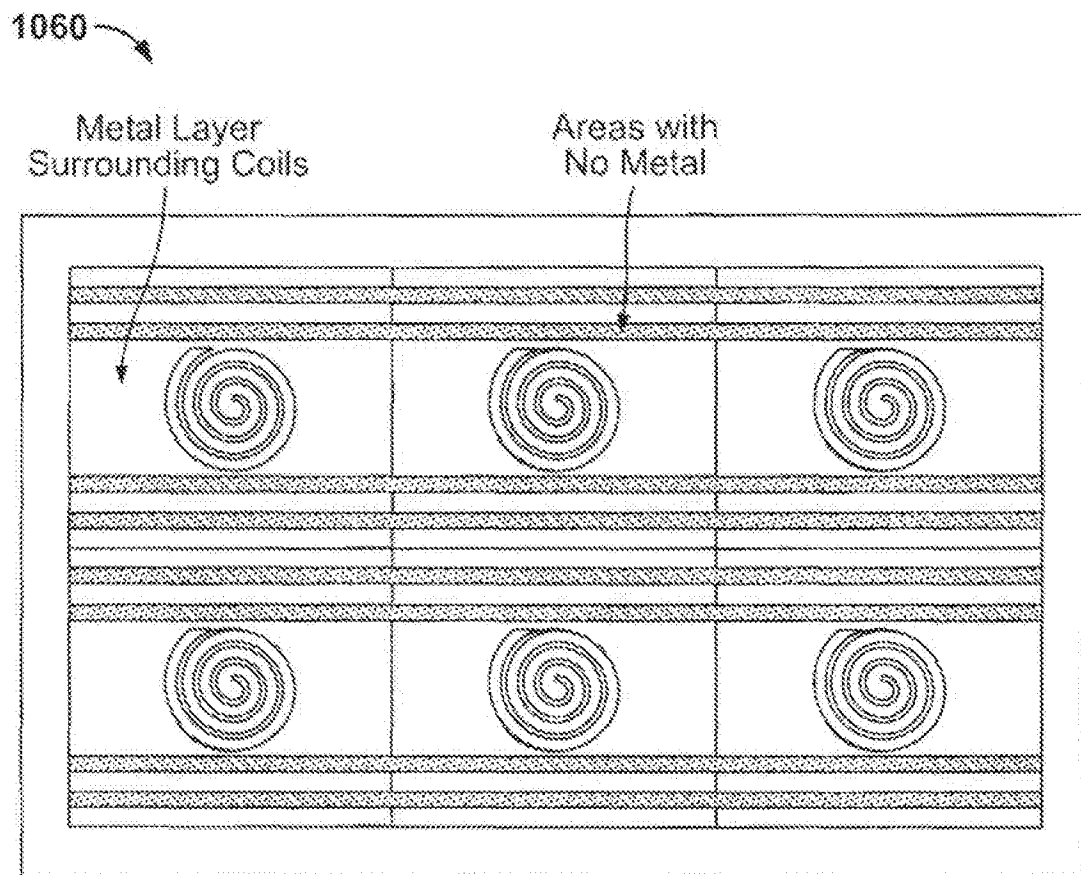


FIG. 69

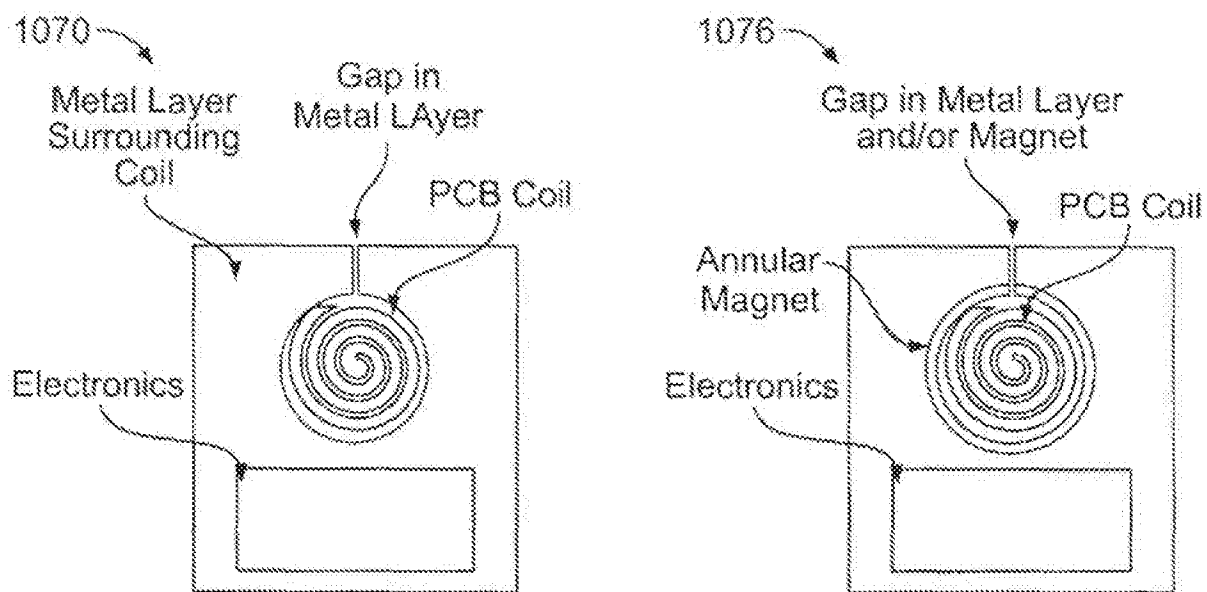


FIG. 70

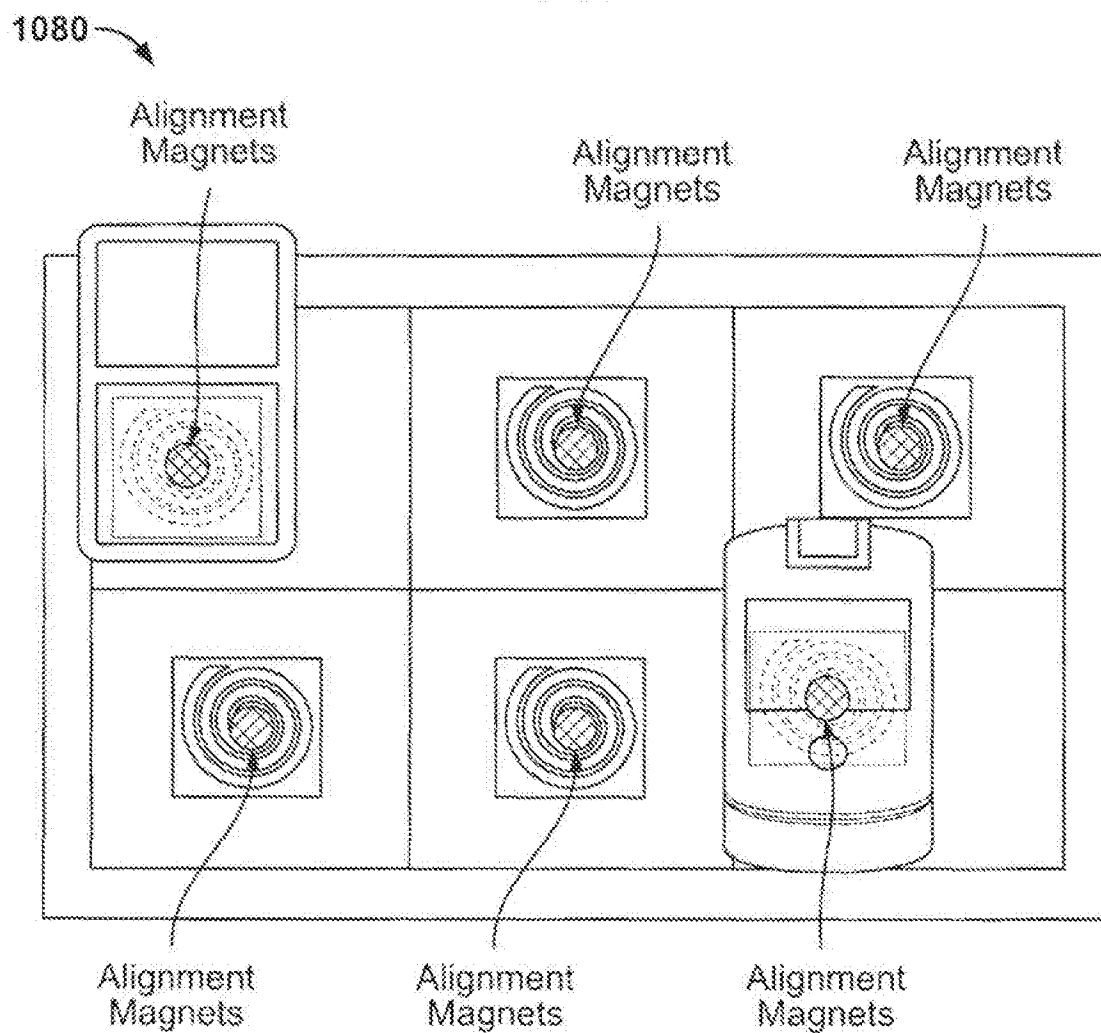


FIG. 71

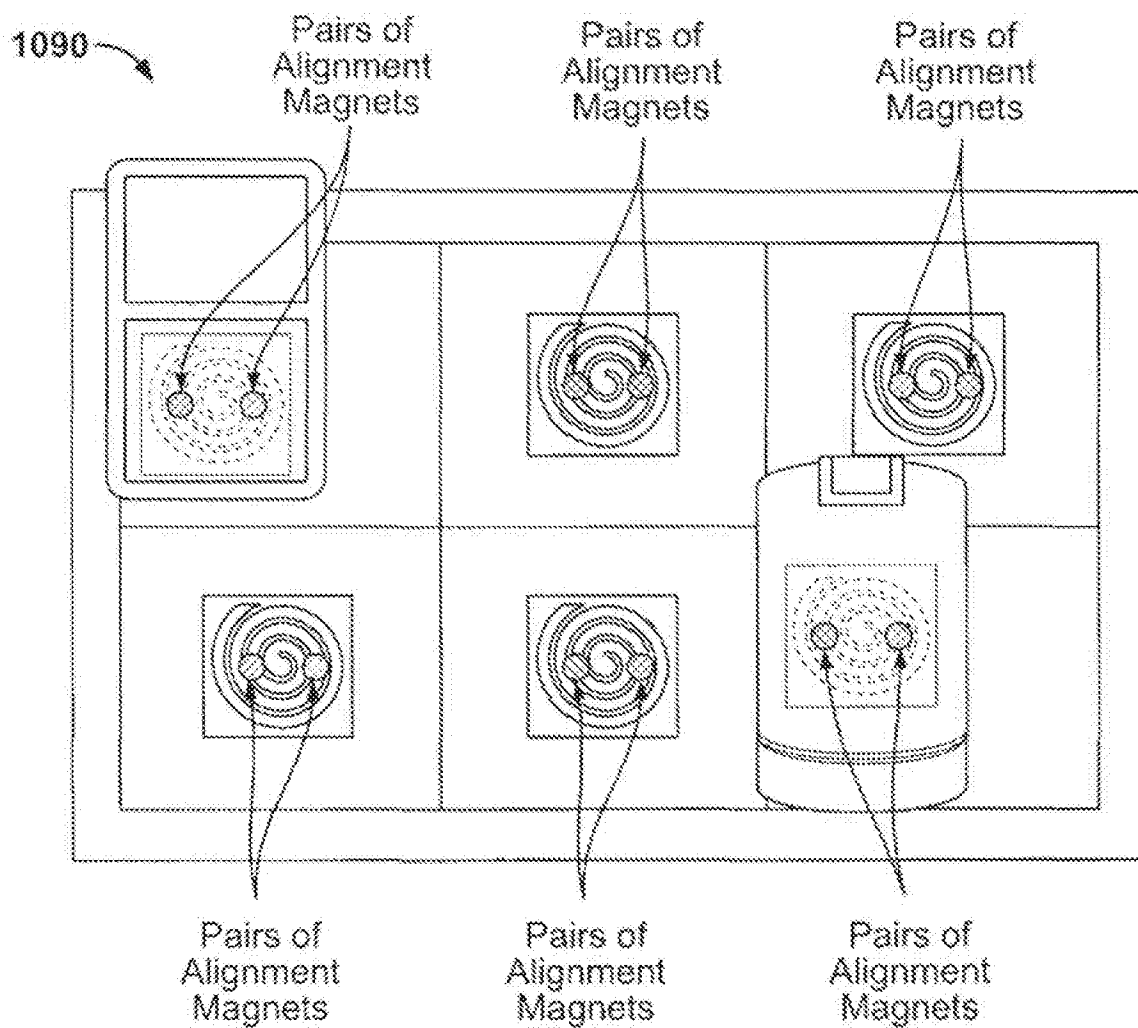


FIG. 72

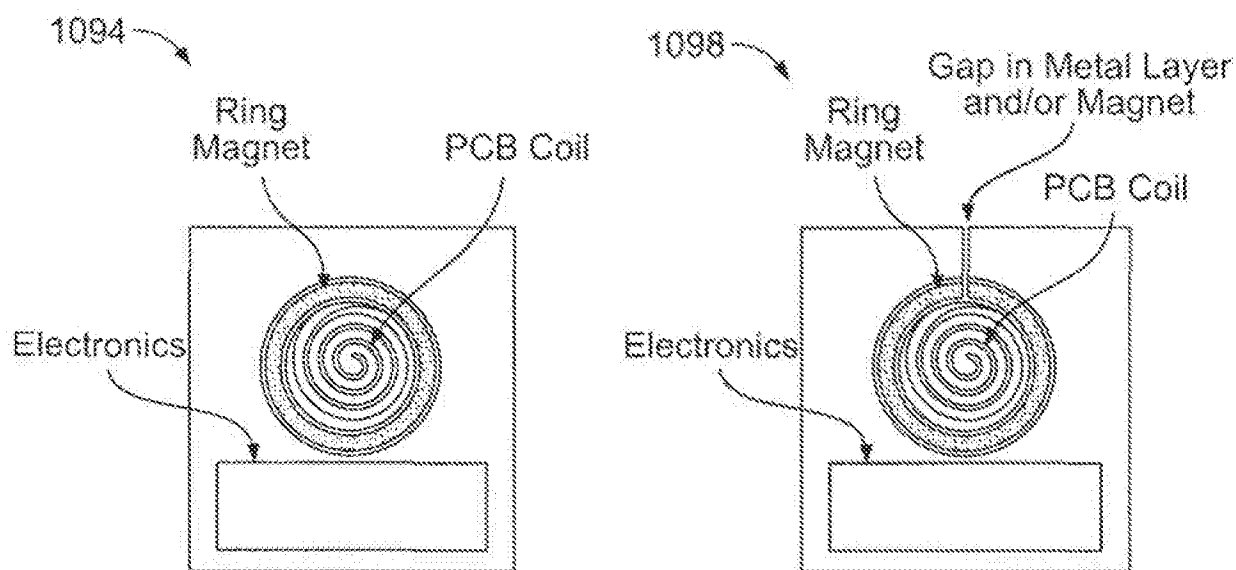


FIG. 73

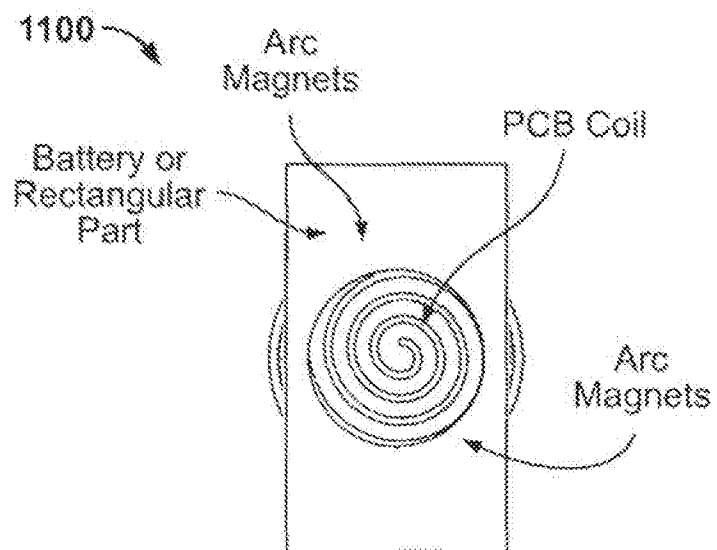


FIG. 74

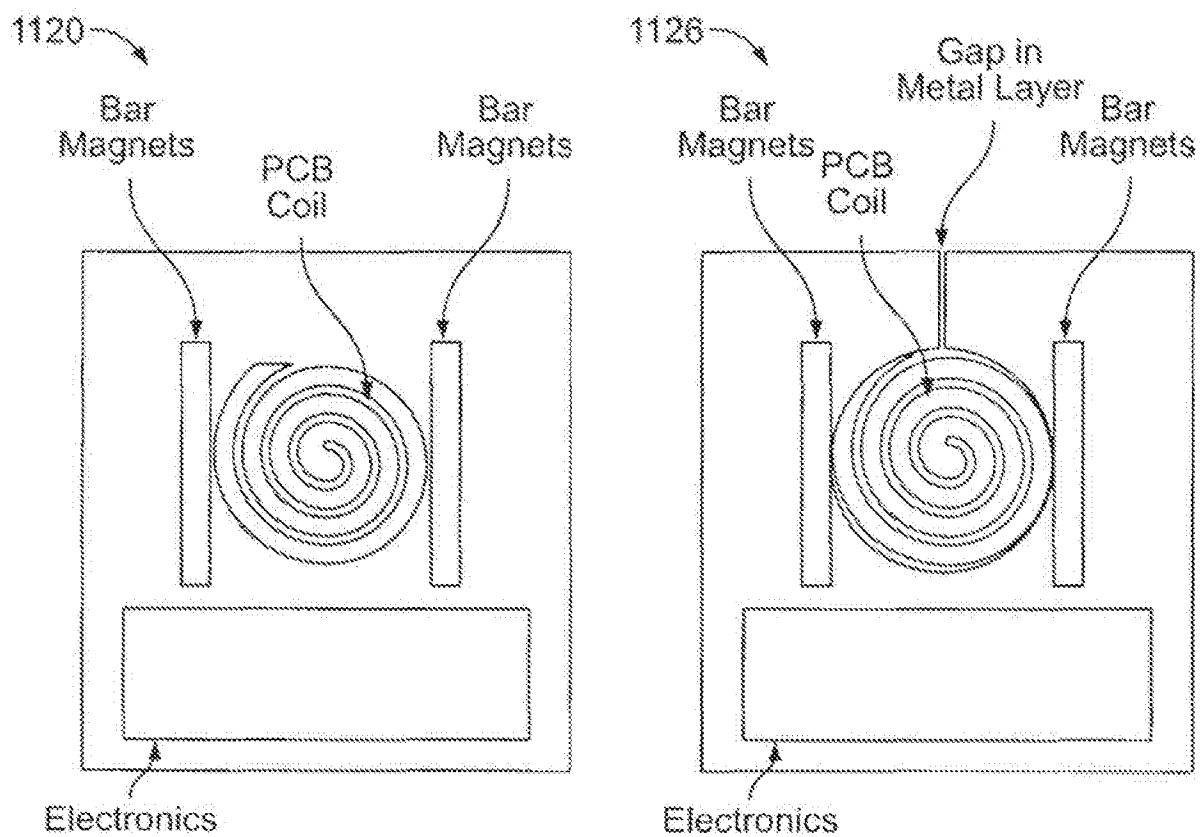


FIG. 75

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Afshin		Partovi		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Palo Alto	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	3350 Scott Blvd				
Address 2	Bldg. 37A				
City	Santa Clara	State/Province	CA		
Postal Code	95054	Country	US		

Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Michael		Sears		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Ben Lomond	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	140 Middle Road				
Address 2					
City	Ben Lomond	State/Province	CA		
Postal Code	95005	Country	US		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	133328		
Email Address	info@wuiplaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		
Attorney Docket Number	AFPA-01013US6	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	50	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	133328		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove			
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
15463252	Continuation of	15056689	2017-03-20		
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15056689	Continuation of	14608052	2015-01-28	9601943	2017-03-21
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14608052	Continuation of	13708548	2012-12-07	8947047	2015-02-03
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13708548	Continuation of	13442698	2012-04-09	8629654	2014-01-14
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13442698	Continuation of	12116876	2008-05-07	8169185	2012-05-01
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12116876	Continuation in part of	11669113	2007-01-30	7952322	2011-05-31
Prior Application Status	Expired	Remove			
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11669113	Claims benefit of provisional	60763816	2006-01-31		
Prior Application Status		Remove			
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11669113	Claims benefit of provisional	60810262	2006-06-01		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15056689	Continuation in part of	15056689	2017-03-20
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
11669113	Claims benefit of provisional	60810298	2006-06-01
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
11669113	Claims benefit of provisional	60868674	2006-12-05
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	60916748	2007-05-08
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	60952835	2007-07-30
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61012922	2007-12-12
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61012924	2007-12-12
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61015606	2007-12-20
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12116876	Claims benefit of provisional	61043027	2008-04-07

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number AFPA-01013US6	
	Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here. ☒		
Organization Name	Mojo Mobility, Inc.	
Mailing Address Information For Applicant:		
Address 1	3350 Scott Blvd.	
Address 2	Bldg. 37A	
City	Santa Clara	State/Province CA
Country	US	Postal Code 95054
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
Remove				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add				

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Louis Wu/		Date (YYYY-MM-DD)	2017-03-20
First Name	Louis	Last Name	Wu	Registration Number
				44413
Additional Signature may be generated within this form by selecting the Add button. Add				

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AFPA-01013US6
		Application Number	
Title of Invention	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

**Title of
Invention**

IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or

☐ United States application or PCT international application number _____
filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Afshin Partovi Date (Optional) : _____

Signature: /Afshin Partovi/

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)****Title of
Invention****IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS)
CHARGING**

As the below named inventor, I hereby declare that:

This declaration ☒ The attached application, or
is directed to:☐ United States application or PCT international application number _____
filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001
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LEGAL NAME OF INVENTORInventor: Michael Sears Date (Optional) : _____Signature: /Michael Sears/

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING			
First Named Inventor/Applicant Name:	AFSHIN PARTOVI			
Filer:	Louis L. Wu			
Attorney Docket Number:	AFPA-01013US6			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				785

Electronic Acknowledgement Receipt

EFS ID:	33376780
Application Number:	16055109
International Application Number:	
Confirmation Number:	7571
Title of Invention:	IMPROVED EFFICIENCIES AND FLEXIBILITIES IN INDUCTIVE (WIRELESS) CHARGING
First Named Inventor/Applicant Name:	AFSHIN PARTOVI
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01013US6
Receipt Date:	05-AUG-2018
Filing Date:	
Time Stamp:	09:30:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 785
RAM confirmation Number	080618INTEFSW09402600
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		App.pdf	467618	yes	103
			f4ca3174f81b5a956b0d26a99fc55a2a3f5cd ec5		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	99	
	Claims		100	102	
	Abstract		103	103	
Warnings:					
Information:					
2	Drawings-only black and white line drawings	FIGS.pdf	5539653	no	50
			08ebc308df9db50312df0da5ff3d1fcb6b0 7577		
Warnings:					
Information:					
3	Application Data Sheet	ADS.pdf	1824029	no	10
			6b3e911a6f65ac65a8f5958aad97eab2327 3482		
Warnings:					
Information:					
4	Oath or Declaration filed	Declaration-Partovi.pdf	150546	no	2
			830f8b3dc16a91ba9aeb2f0b091de8abb19 df7f9		
Warnings:					
Information:					
5	Oath or Declaration filed	Declaration-Sears.pdf	150561	no	2
			16456cac738bbf59a29f92279a507ea93977 0ab9		

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	34924	no	2
			3e58ab059b7587b84ad312c6f0fc2b62ad9d333f		
Warnings:					
Information:					
Total Files Size (in bytes):				8167331	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					