AO 120 (Rev. 08/10)

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

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.	DATE FILED	U.S. DISTRICT COURT
1:22-cv-00433	10/7/2022	Eastern District of Texas

PLAINTIFF	DEFENDANT
Mojo Mobility Inc.	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

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	119301

Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 08/21/2020 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant asserting small entity status. See 37 CFR 1.27.

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.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Louis Wu/
Name:	Louis Wu
Registration Number:	44413

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	02/21/2017	9577440	AFPA-01007US1	4181

133328 7590 02/01/2017

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 109 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):

Afshin Partovi, Sunnyvale, CA;
Michael Sears, Ben Lomond, 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.

Notice of References Cited	Application/Control No. 13/115,811	Applicant(s)/Patent Under Reexamination PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

Change(s) applied to document, /R.L./ 10/13/2016

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	WO 2006115368	11/2006			
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	WO 2006115368: JUNG et. al. Method for Transmitting/Receiving Data In A communication System; November 2, 2006
	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.

Receipt date: 10/29/2013	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	9	6586909		2003-07-01	Trepka	
	10	6462509		2002-10-08	Abe	
Change(s) applied to document, /J.E./ 10/21/2016	11	7042196		2006-05-09	~~Cheng~~ Ka-Lai et al.	
	12	6184651		2001-02-06	Fernandez	
	13	6016046		2000-01-18	Kaite	
	14	7164255		2007-01-16	Hui	
	15	6756765		2004-06-29	Bruning	
	16	6917182		2005-07-12	Burton	
	17	6741064		2004-05-25	Liu	
	18	6650088		2003-11-18	Webb	
	19	6697272		2004-02-24	Nanbu	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Ets Web-1.0

Receipt date: 09/29/2015	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25	
	First Named Inventor	Afshin PARTOVI	
	Art Unit	2859	
	Examiner Name	Berhanu	
	Attorney Docket Number	AFPA-01007US1	

	5	20120112552	A1	2012-05-10	Baarman et al.	
	6	20120041843	A1	2012-02-16	Taylor et al.	
Change(s) applied to document, /J.E./ 10/21/2016	7	20100171369	A1	2010-07-08	Baarman et al. ~~Taylor et al.~~	
	8	20090212637	A1	2009-08-27	Baarman et al.	
	9	20090174263	A1	2009-07-09	Baarman et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 02/27/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Afshin Partovi	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	1	20070178945		2007-08-02	Cook	
Change(s) applied to document, /J.E./ 10/21/2016	2	20050007067		01/2005 ~~2007-02-08~~	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	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 06/17/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	11	20070178945		2007-08-02	Cook		
Change(s) applied to document, /J.E./ 10/21/2016	12	20050007067		01/2005 ~~2007-02-08~~	Baarman		
	13	20100007307		2010-01-14	Baarman		
	14	20080272889		2008-11-06	Symons		
	15	20100277121		2010-11-04	Hall		
	16	20100127660		2010-05-27	Cook		
	17	20110012556		2011-01-20	Lai		
	18	20100081473		2010-04-01	Chatterjee		
	19	20090284227		2009-11-19	Mohammadian		

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 10/29/2013	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25	
	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	2	20100207771		2010-08-19	Trigiani, Antonio		
Change(s) applied to document, /JE/ 10/21/2016	3	20060202665		~~2011-03-10~~ 09/2006	Hsu Feng-Hsiung		
	4	20060108977		2006-05-25	Kagermeier et al.		
	5	20100081473		2010-04-01	Chatterjee et al.		

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	European Search Report and Search Opinion in connection with Europe Application 08747863.2 (European National Stage application of PCT/US2008/063084) dated April 2, 2013, 7 pages.	☐
	2	Office Action in connection with Chinese Application 200880023854.4 (Chinese National Stage application of PCT/ US2008/063084) dated August 28, 2012, 18 pages.	☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

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

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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
Change(s) applied to document, /J.E./ 10/21/2016	1	7804054		2010-09-28	~~Shalom~~ Ben-Shalom et al.	
	2	4873677		1989-10-10	Sakamoto	
	3	6301128		2001-10-09	Jang	
	4	5600225		1997-02-04	Goto	
	5	5963012		1999-10-05	Garcia	
	6	6870089		2005-03-02	Gray	
	7	3938018		1976-02-10	Dahl	
	8	5991170		1999-11-23	Nagai	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

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

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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	6803774		2004-10-12	Park	
	2	8169185		2012-05-01	Partovi et al.	
	3	5744933		1998-04-28	Inoue et al.	
	4	4800328		1989-01-24	Bolger et al.	
	5	7151357		2006-12-19	Xian et al.	
Change(s) applied to document, /J.E./ 10/21/2016	6	5889384		03/1999 ~~1999-05-30~~	Hayes et al.	
	7	5434493		1995-07-18	Woody et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 10/29/2013	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100007307		2010-01-14	Barrman et al.	
	2	20080272889		2008-11-06	Symons et al.	
	3	20100277121		2010-11-04	Hall et al.	
	4	20110012556		2011-01-20	Lai	
Change(s) applied to document, /J.E./ 10/21/2016	5	20020089305		07/2002 ~~2002-11-07~~	Park et al.	
	6	20020093309		2002-07-18	Peele et al.	
	7	20070279002		2007-12-07	Partovi et al.	
	8	20090096413		2009-04-16	Partovi et al.	
	9	20110187318		2011-08-04	Hui et al.	
	10	20110221387		2011-09-15	Steigerwald et al.	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 10/29/2013	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	31	6975198		2005-12-13	Baarman	
	32	7031662		2006-04-18	Suzuki	
	33	7116200		2006-10-03	Baarman	
	34	7118240		2006-10-10	Baarman	
	35	7126450		10/2006 ~~2013-10-29~~	Baarman	
	36	7132918		2006-11-07	Baarman	
	37	7162264		2007-01-09	Vance	
	38	7183870		2007-02-27	Takagi	
	39	7184706		2007-02-27	Someya	
	40	7209084		2007-04-24	Lindell	
	41	7221919		2007-05-22	Takagi	

Change(s) applied to document, /J.E./ 10/24/2016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Examiner Initials*

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (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)

133328 2800 08/05/2016
Mojo Mobility (c/o Louis Wu)
PO Box 10074
Oakland, CA 94610

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.

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01003US1	4181

TITLE OF INVENTION: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/05/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
BERHANU, SAMUEL	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 03-02 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 Louis Wu
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 has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Mojo Mobility, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Santa Clara, CA

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

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☒ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — 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.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — 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.
- ☒ Applicant changing to regular undiscounted fee 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 /Louis L. Wu/ Date January 5, 2017
Typed or printed name Louis L. Wu Registration No. 44413

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Louis L. Wu
Attorney Docket Number:	AFPA-01007US1
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:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**960**

Electronic Acknowledgement Receipt	
EFS ID:	27973977
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	05-JAN-2017
Filing Date:	25-MAY-2011
Time Stamp:	04:16:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$960
RAM confirmation Number	010517INTEFSW04184000
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	Issue Fee Payment (PTO-85B)	2017-01-05IssueFeePaymentForm.pdf	263360 b18aa815ff6d2a3800659befe8f73e17d2f8c3c5	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30510 8afbea6c14bd4b10b1428e8bbcd6600cee0d6ea7	no	2
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

133328 7590 10/19/2016

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

EXAMINER	
BERHANU, SAMUEL	

ART UNIT	PAPER NUMBER
2859	

MAIL DATE	DELIVERY MODE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25	
	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	Attorney Docket Number	AFPA-01007US1	

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	Examiner Name	Berhanu, Samuel	
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	1	20030210106		2003-11-13	Cheng	
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	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	1	WO2005109597	WO		2005-11-17	Splashpower Limited		☐
	2	WO2005024865	WO		2005-03-17	Splashpower Limited		☐
	3	WO2004055654	WO		2004-07-01	Splashpower Limited		☐

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	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

	4	WO2004038887	WO		2004-05-06	Splashpower Limited		☐
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(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	SAKAMOTO, et al., "A Novel Circuit for Non-Contact Charging Through Electro-Magnetic Coupling", 1992, IEEE, pp. 165-174.	☐
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	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

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EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	10/14/2016

*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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NOTICE OF ALLOWANCE AND FEE(S) DUE

133328 7590 10/05/2016

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

EXAMINER
BERHANU, SAMUEL

ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 10/05/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

TITLE OF INVENTION: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/05/2017

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: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

TITLE OF INVENTION: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/05/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
BERHANU, SAMUEL	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.
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Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

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4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
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5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — 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.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — 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.
- ❑ Applicant changing to regular undiscounted fee 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 _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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PO Box 10074
Oakland, CA 94610

EXAMINER	
BERHANU, SAMUEL	
ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 10/05/2016

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 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, 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.

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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:

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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.
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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.

Notice of Allowability	Application No. 13/115,811	Applicant(s) PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	AIA (First Inventor to File) 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 *Remarks filled on 09/13/2016*.
   ☐ 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 *1-2,11-20, 22-34 and 36-38*. 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 10/29/2013
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 _____.

/SAMUEL BERHANU/
Primary Examiner, Art Unit 2859

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

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	2	5959433		1999-09-28	Rohde	
	3	6208115		2001-03-27	Binder	
	4	5952814		1999-09-14	Van Lerbergne	
	5	6489745		2002-12-03	Koreis	
	6	6040680		2000-03-21	Toya	
	7	5734254		1998-03-31	Stephens	
	8	6636017		2003-10-21	Zink et al.	

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	11	7042196		2006-05-09	Cheng	
	12	6184651		2001-02-06	Fernandez	
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	21	6625477		2003-09-23	Wakefield	
	22	6436299		2002-08-20	Baarman	
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	Attorney Docket Number	AFPA-01007US1	

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	1	WO2005109597	WO		2005-11-17	Splashpower Limited		☐
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
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	13	Gizmo Watch, "Pitstop: A Table Top Recharging Solution by Belkin", http://www.gizmowatch.com/entry/pitstop-a-table-top-recharging-solution-by-belkin, December 2006, 5 pages.	☐
	14	UNKNOWN AUTHOR, "Cutting the Cord", April 2007, The Economist, 1 page.	☐
	15	BISHOP, "Microsoft Surface Brings Computing to the Table", May 2007, http://seattlepi.nwsource.com/business/317737_msftdevic30.html, 7 pages.	☐
	16	WILDCHARGE, "The Wire-Free Power Revolution is Only Days Away, and WildCharge, Inc. Is Leading the Charge", September 2007, 3 pages.	☐
	17	Economist.com Science Technology Quarterly, "Wireless Charging", http://www.economist.com/science/tq/PrinterFriendly.cfm?story_id=13174387, 4/15/2009, 4 pages.	☐

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

EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	09/29/2016

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 10/29/2013	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

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.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

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	/Karl F. Kenna/	Date (YYYY-MM-DD)	2013-10-29
Name/Print	Karl F. Kenna	Registration Number	45445

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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

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 record s.

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	**Art Unit**
	SAMUEL BERHANU	2859

CPC						
Symbol					**Type**	**Version**
H02J		7	/	00	F	2013-01-01
H01F		5	/	003	I	2013-01-01
H01F		38	/	14	I	2013-01-01
H02J		7	/	025	I	2013-01-01
H02J		17	/	00	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	28	
/SAMUEL BERHANU/ Primary Examiner.Art Unit 2859	09/29/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4,17

U.S. Patent and Trademark Office — Part of Paper No. 20160929

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	**Art Unit**
	SAMUEL BERHANU	2859

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
320	108	H	0	2	J	7 / 00 (2006.01.01)					

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	28	
/SAMUEL BERHANU/ Primary Examiner.Art Unit 2859	09/29/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4,17

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	**Art Unit**
	SAMUEL BERHANU	2859

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	9	17	24	33										
2	2	10	18	25	34										
-	3	11	19	-	35										
-	4	12	20	26	36										
-	5	-	21	27	37										
-	6	13	22	28	38										
-	7	14	23												
-	8	15	24												
-	9	16	25												
-	10	17	26												
3	11	18	27												
4	12	19	28												
5	13	20	29												
6	14	21	30												
7	15	22	31												
8	16	23	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 28	
/SAMUEL BERHANU/ Primary Examiner.Art Unit 2859 (Primary Examiner)	09/29/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4,17

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	0	(battery receiver coil over$1charg$3 induct$4 identification).clm.	US-PGPUB; USPAT	AND	OFF	2016/09/29 16:00
L3	0	(battery receiver coil over$1charg$3 induct$4 identif$7).clm.	US-PGPUB; USPAT	AND	OFF	2016/09/29 16:01
L4	6	(battery receiver coil over$1charg$3 induct$4).clm.	US-PGPUB; USPAT	AND	OFF	2016/09/29 16:01
L5	0	(battery receiver coil over$1charg$3 induct$4).clm.	US-PGPUB; USPAT	SAME	OFF	2016/09/29 16:01
L6	0	(battery receiver coil over$1charg$3 induct$4 regulator).clm.	US-PGPUB; USPAT	AND	ON	2016/09/29 16:01
L7	29	(battery receiver coil induct$4 regulator).clm.	US-PGPUB; USPAT	AND	ON	2016/09/29 16:02

9/29/2016 4:14:04 PM
C:\Users\sberhanu\Documents\EAST\Workspaces\13831642.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	Art Unit
	SAMUEL BERHANU	2859

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
320	108	3/22/2013	SB
320	150	3/22/2013	SB
	Updated	2/24/2014	SB
	Updated	8/8/2014	SB
	Updated	6/22/2015	SB
	Updated	11/3/2015	SB
	Updated	9/28/2016	SB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor and PLUS search conducted----------see printout	3/22/2013	SB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	PGPUB Claim text search conducted----see printout	9/29/2016	SB

Electronic Acknowledgement Receipt	
EFS ID:	26915897
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	13-SEP-2016
Filing Date:	25-MAY-2011
Time Stamp:	19:35:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1900
RAM confirmation Number	091416INTEFSW19364400
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		2016-09-13ResponseToFinalOAandRCE.pdf	138270 fd1054c99731916c31566cc39af3b74c767cbd77	yes	11

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	8
Applicant Arguments/Remarks Made in an Amendment	9	11

Warnings:

Information:

2	Request for Continued Examination (RCE)	2016-09-13RCE.pdf	1363790 7035d9b3993e4af7837e20f602d5e7c25583884f	no	3

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	32468 e631cdc8fac6dbf3439e4f641c274f7c3112949b	no	2

Warnings:

Information:

Total Files Size (in bytes):	1534528

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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.

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. 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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/115,811	Filing Date	2011-05-11	Docket Number (if applicable)	AFPA-1007US1	Art Unit	2859
First Named Inventor	Afshin Partovi			Examiner Name	BERHANU, Daniel R.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, to any international application that does not comply with the requirements of 35 U.S.C. 371, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV.

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 506896

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. 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.

Signature of Registered U.S. Patent Practitioner			
Signature	/Louis Wu/	Date (YYYY-MM-DD)	2016-09-13
Name	Louis Wu	Registration Number	44413

This collection of information is required by 37 CFR 1.114. 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 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.

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 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.

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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.

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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 Patent Application Fee Transmittal	
Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Louis L. Wu
Attorney Docket Number:	AFPA-01007US1
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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
RCE- 2nd and Subsequent Request	1820	1	1700	1700
		Total in USD ($)		**1900**

Electronic Acknowledgement Receipt	
EFS ID:	26915897
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	13-SEP-2016
Filing Date:	25-MAY-2011
Time Stamp:	19:35:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1900
RAM confirmation Number	091416INTEFSW19364400
Deposit Account	9443
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		2016-09-13ResponseToFinalOAandRCE.pdf	138270 fd1054c99731916c31566cc39af3b74c767cbd77	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	11

Warnings:					
Information:					
2	Request for Continued Examination (RCE)	2016-09-13RCE.pdf	1363790 7035d9b3993e4af7837e20f602d5e7c25583884f	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32468 e631cdc8fac6dbf3439e4f641c274f7c3112949b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1534528		

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New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI et al. Examiner: BERHANU, Daniel R.
Serial No.: 13/115,811 Group Art Unit: 2859
Filing Date: May 25, 2011 Confirmation No: 4181
Title: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

AMENDMENT PURSUANT TO 37 CFR 1.111,
PROVISIONAL REQUEST FOR CONTINUED EXAMINATION (RCE)

Submitted via EFS

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

Sir:

In response to the Office Action dated May 13, 2016, Applicant hereby amends the pending claims for this case.

Claims begin on page 2 of this document.

Remarks begin on page 9 of this document.

Appropriate fees for a **provisional** RCE along with appropriate fees for a one-month extension of time accompany these papers. The provisional RCE is submitted in response to an apparent error on the part of the Examiner, as discussed below. Applicant requests refund of the RCE fee if appropriate in view of MPEP 706.07(a).

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A mobile device capable of inductive powering or charging by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith, comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to ~~a~~ the universal base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

2. (Original) The mobile device of claim 1 further comprising a shell, wherein the receiver is attached to the shell.

3-10. (Canceled)

11. (Previously Presented) A system for use with a mobile device for charging or powering the mobile device inductively by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith, comprising:

a universal base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;

wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;

wherein one or both of the mobile device and a battery have

a receiver and particular charging characteristics associated therewith,

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit,

a means for avoiding overcharging one or both of the mobile device and battery inductively, and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

12. (Original) The system of claim 11 wherein one or more of the coils are manufactured on printed circuit boards and are manufactured to have a low resistance.

13. (Original) The system of claim 11 wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device is placed close to the primary coil of the base unit or the presence of the mobile device is to be detected.

14. (Original) The system of claim 11 wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices.

15. (Original) The system of claim 14 wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device placed close to or aligned with the primary coil of the base unit.

16. (Original) The system of claim 15 wherein the presence of the mobile device placed close to or aligned with the primary coil of the base unit is detected by monitoring the current passing through the primary coil or the switching means.

17. (Original) The system of claim 11 wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

18. (Original) The system of claim 17 wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device.

19. (Original) The system of claim 11 wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a device is placed directly on top of a coil in the base.

20. (Previously Presented) The system of claim 11 further comprising a battery coupled to and powering the base unit, and wherein the battery can be occasionally charged by an external power supply or solar cell to maintain a charge sufficient to power the inductive device for a period of time.

21. (Canceled)

22. (Original) The system of claim 11, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

23. (Original) The system of claim 11 wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

24. (Original) The system of claim 11 wherein the base unit can be integrated into any of briefcases, bags, or clothing.

25. (Original) The system of claim 11 wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

26. (Original) The system of claim 11 wherein one or more of the primary coils are stacked to improve transfer efficiency.

27. (Original) The system of claim 11, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and activates a coil or wire near the mobile device to charge or provide power the mobile device.

28. (Original) The system of claim 27, wherein the charger or power supply senses the location of the mobile device by sensing a change in a resonant circuit in the charger or power supply when the mobile device is nearby.

29. (Original) The system of claim 11, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

30. (Original) The system of claim 11, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices placed inside would be charged or powered inductively.

31. (Original) The system of claim 11, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

32. (Original) The system of claim 11, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

33. (Original) The system of claim 11, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

34. (Original) The system of claim 11, wherein the mobile device to be charged or powered includes a charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

35. (Canceled)

36. (Original) The system of claim 11, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

37. (Previously Presented) A system capable of inductive powering or charging by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith, comprising:

a battery, wherein one or both of a device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the device, wherein the receiver is one of attached to or incorporated into the battery or the device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the device or battery, which is configured to provide wireless identification of the receiver to ~~a~~ the universal base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the device or battery, to be within a range of parameters for the device or the battery;

wherein different devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the device or the battery, for use by the base unit to provide power transfer to the receiver and to the device and the battery according to their particular charging characteristics.

38. (Previously Presented) The system of claim 37 wherein the system is included within an automobile.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, claims 1, 2, 11-20, 22-34 and 36-38 stand rejected, as follows:

Claims 1-2, 11-12, 14-18, 22-31 and 36-37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et al. (WO 2006/001557) (hereinafter Jung), in view of Lyon (US 2004/0145342), Hui (US 2005/0189910), in view of Erikson (US 2009/0072784).

Claims 13 and 34 are **newly** rejected under 35 USC 103(a) as being unpatentable over Jung in view of Lyon, Hui, Erikson and Van Lerberghe (US 5,925,814) (hereinafter Van).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Chen et al. (US 6,331,744) (hereinafter Chen);

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Hui, Lyon, Erikson, and Fukuda et al. (US 4,311,953) (hereinafter Fukuda);

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Sudo (JP408000838);

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Charych (US 6,798,716);

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung and Baarman et al. (US 2005/0007067) (hereinafter Baarman).

Applicant thanks the Examiner for clarifying that the two Hui references previously cited are one in the same. However, since Applicant did not amend the claims in response to the office action immediately preceding the Office Action under reply, **a holding of finality with respect to the office action is improper here due to Examiner error**.

In the previous office action, the Examiner cited Hui twice without proper indication that both Hui references are one in the same. In addition, Applicant has not amended the claims in the office action immediately preceding the Office Action under reply. Because the Examiner now cites Van, which was clearly **not** necessitated by Applicant's amendment of the claims nor does the Examiner identify an IDS disclosing Van, a holding of finality appears improper under MPEP 706.07(a).

Thus, Applicant requests a refund of the RCE fee. Alternatively, Applicant requests an

explanation why Van had not been brought to the attention of Applicant before the Examiner's use of Van to reject finally claims 13 and 34 in the Office Action under reply.

Also, Applicant has noticed the previously overlooked fact that the Examiner, on page 2 of the Office Action under reply, states "This is in response to an amendment/response filed on 4/19/2009." According to Applicant's records, the office action immediately preceding the Office Action under reply is dated November 5, 2015. Further according to Applicant's records, Applicant submitted a response to the November 5th office action on February 5, 2016.

In fact, the subject application has a filing date of May 25, 2011, which postdates "4/9/2009" by over two years. Thus, **a telephonic interview is requested to make sure that the Examiner and Applicant are looking at the same set of papers for the same case.**

AMENDMENTS TO THE CLAIMS:

All independent claims have been amended to recite a **universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith.** Support for this amendment can be found in paragraph [0042], [0050], [0062], etc. Thus, no new matter has been added.

35 USC 103 REJECTIONS:

All claims stand again rejected as obvious under pre-AIA 35 U.S.C. 103(a). In response, Applicant has amended all independent claims so that they recite elements neither taught nor suggested in any of the cited art. That is, the independent claims have now been amended to recite the term "universal." In combination with all other claim elements, the term "universal" clearly demonstrates that all claims are nonobvious for numerous reasons. To illustrate, Applicant submits that not all charging systems are "universal" in nature. For example, Samsung smartphone chargers do not charge Apple iPhones, and Apple iPad chargers do not charge Samsung Galaxy smartphones. Thus, such universality renders all pending claims nonobvious.

Ironically, the fact that the Examiner has repeatedly chosen to rely on four or more references in his attempt to reject all indepenendant claims, in its own backhanded manner, also supports the nonobviousness of all pending claims. The Examiner's stance is analogous to citing four different pieces of art, each piece individually describing a knife, scissors, bottle opener, and

nail file, respectively. In combination, the four pieces of art are used to reject a claim directed to a universal "Swiss Army" pocket knife having tools that individually serve the functionality of a knife blade, scissors, bottle opener, and nail file. Clearly, the rejection would be considered wrongly issued because Swiss Army knives embody an inventive (nonobvious) step over their individual tools. This is because before the invention of such a universal tool, no one of ordinary skill in the art would have thought to include four different tools with disparate functions in a single universal item. In addition, such a singular universal item would convenient to take traveling in place of four different.

Thus, all claims should be allowable, and a prompt indication thereof is requested.

Respectfully Submitted,

By: /Louis L. Wu/

Customer No. 133328 Louis L. Wu, Registration No. 44413

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/115,811	Filing Date 05/25/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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))	36 minus 20 =	* 16	x $26 =	**416**
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	* 0	x $110 =	**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	**416**

APPLICATION AS AMENDED – PART II

AMENDMENT	09/13/2016	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 28	Minus	** 36	= 0	x $40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x $210 =	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) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x $ =	
	☐ 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.
** 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 number found in the appropriate box in column 1.

LIE
GERALDINE STANLEY

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

133328 7590 05/13/2016

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

EXAMINER	
BERHANU, SAMUEL	

ART UNIT	PAPER NUMBER
2859	

MAIL DATE	DELIVERY MODE
05/13/2016	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. 13/115,811	Applicant(s) PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	AIA (First Inventor to File) 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 *02/05/2016*.

☐ 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) *1,2,11-20,22-34 and 36-38* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2,11-20,22-34 and 36-38* is/are rejected.

8)☐ Claim(s) _____ 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 *05/05/2011* 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)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

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

Response to Amendment

This is in response to an amendment/response filed on 02/19/2009

Claims 1-2, 11-20, 22-34 and 36-38 are currently pending.

Claim Rejections - 35 USC § 103

2. 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.

3. 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 of this title, 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 negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-

AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

5. Claims 1-2, 11-12, 14-18, 22-31 and 36 -37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et. al. (WO 2006/001557) (hereinafter Jung) in view of Lyon (US 2004/0145342), and Hui (US 2005/0189910), further in view of Erikson (US 2009/0072784).

As to Claims 1, 11 and 37, Jung discloses in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising:

a battery; [see figure 1, element 100 $ page 9, lines 1-2], wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver [charging receiver module, 110; see page 9 lines 14]] for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device:

a regulator [the controller 240; controls and regulates charging], that

wherein different mobile devices and batteries can have different charging characteristics associated therewith [see page 9, lines 14-17]; and

wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit [see page 9, lines 14-17] verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics [page 18, lines 2-15; see also figure 7, steps S100-S140].

Jung also discloses in figure 1, an identification component [RFID Reader for the electronic device and battery, it is located in the body of the device; see page 18, lines 10-15; see associated with the mobile device or the replacement shell skin, door or other device, which is configured to provide wireless identification of the receiver to a based unit [see page 10, lines 12-16].

Jung does not disclose explicitly, regulator senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery.

Lyon discloses in figures 1-2, regulator [controller 214] senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery [see paragraphs 019-0020].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

Neither Jung nor Lyon explicitly discloses, wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil; an identification component associated with the mobile device or battery which is configure d to provide wireless identification of the receiver to a base unit;

Hui discloses in figure 1, wherein the receiver coil [fig 6 shows that the coil is planner] coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil [see also paragraph 005; 0075];

Hui discloses in figure 45, wherein different mobile devices [figure 45, device 3] can have different charging characteristics associated therewith [3V to 24 V, see paragraphs 0016 & 0108] ; and wherein the base unit operates to one or more detect [see paragraph 103], identify and/or authenticate the mobile device with the base unit, determine a selection of the one or more primary coils in alignment with the secondary coil or receiver associated with the mobile device, and communicate information to provide power transfer to the mobile device, via the selection of the one or more primary coils in alignment, according to its particular charging characteristics [see paragraph [0103] and Fig. 45, and paragraphs [0070]-[0072]].

Hui also discloses in figure 13(b) the secondary coil [figure 13(b) element 24] removably attachable as part of a replacement shell, skin, door or other device which includes the secondary coil and receiver and which couples to one or more of a battery electrodes or a power port of the mobile device [noted that the secondary coil is removably attached to the battery (21)].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to activate only primary coil of Jung's that is aligned with the secondary coil apparatus as taught by Hui in order to charge rechargeable battery in a more efficient and reliable manner, and prevent power waste.

However, Jung, Lyon and Hui don't disclose explicitly, a means for avoiding overcharging one or both of the mobile device and battery inductively.

Erikson discloses in figure 1, a means for avoiding overcharging one or both of the mobile device and battery inductively [see ¶007; charger protection to protect overcharging].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use overcharging protection means in Jung's apparatus at taught by Erikson in order to avoid battery damage due to overcharging.

As to Claim 2, Jung discloses in Figure 2, wherein the receiver [110] is attached to the shell of the mobile device or battery.

As to Claim12, Jung discloses in figure 3, wherein one or more of the coils are manufactured by one of printed circuit boards or by etching or stamping or forming copper or other material and are manufactured to have a low resistance.

As to Claim 22, Lyon discloses in Figures 1-6, a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

As to Claim 30, Lyon discloses in Figures 1-6, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices and/or batteries placed inside would be are charged or powered inductively.

As to Claim 31, Lyon discloses in Figures 1-6, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

As to Claim 36, Lyon discloses in Figures 1-6, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

As to Claim 14, neither Jung nor Lyon discloses, wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

Hui discloses in Figure 4(a), wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Jung's apparatus in order to charge different devices simultaneously to minimize the time it takes to charge a plurality of electronic devices.

As to Claim 15, Jung in combination with Lyon and Hui discloses wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device and/or battery placed close to or aligned with the primary coil of the base unit.

As to Claim 16, Jung in combination with Lyon and Hui, wherein the presence of the mobile device and/or battery placed close to or aligned with the primary coil of the base reunite is detected by monitoring the current passing through the primary coil or the switching means

As to Claim 17, Hui discloses in Figure 4a, wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

As to Claim 18, Hui discloses in Figure 4a, wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device and/or battery

As to Claim 23, Hui discloses wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

As to Claim 24, Hui discloses wherein the base unit can be integrated into any of briefcases, bags, carriers, or clothing.

As to Claim 25, Hui discloses wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

As to Claim 26, Jung in combination with Lyon and Hui discloses, wherein one or more of the primary coils are stacked to improve transfer efficiency.

As to Claim 27, Jung in combination with Lyon and Hui discloses, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and/or battery and activates a coil or wire near the mobile device and/or battery to charge or provide power the mobile device and/or battery.

As to Claim 28, Lyon in combination with Hui discloses, wherein the charger or power supply senses the location of the mobile device and/or battery by sensing a change in a resonant circuit in the charger or power supply when the mobile device and/or battery is nearby.

As to Claim 29, Lyon in combination with Hui discloses, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

6. Claims13 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Van Lerberghe (US 5,925,814) (hereinafter Van)

As to Claim 13, neither Jung nor Lyon discloses, wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected.

Van discloses in Figures 1-5, wherein the base unit includes a primary circuit having a switch (28) means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add a switching means in Jung's charger as taught by Van in order to avoid unnecessary power lose due to charging

As to Claim 34, Jung in combination with Lyon and Van discloses, charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

7. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Chen et. al. (US 6,331,744) (hereinafter Chen).

As to Claim 19, neither Jung nor Lyon discloses, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

Chen discloses in Figure 2, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

8. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon, Erikson and Fukuda et. al. (US 4,311,953) (hereinafter Fukuda).

As to claim 20, Fukuda discloses in Column 1, lines 59-67, a charger unit including solar and secondary battery.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

9. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and SUDO (US JP408000838)

As to Claim 32, Sudo discloses in the Abstract, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for vehicle toy as taught by Sudo to extend battery life.

10. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Charych (US 6,798,716)

As to Claim 33, Charych discloses charging RFID tag battery, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for RFID batteries as taught by Charych to extend battery life.

11. Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung, Erikson and Baarman et. al. (US 2005/0007067) (hereinafter Baarman).

As to claim 38, Jung does not disclose explicitly, wherein the system is included within an automobile.

Baarman discloses in figure 2, wherein the base unit is provided within an automobile, for use in charging or powering one or more mobile devices within the automobile [see paragraphs 0005 and 0022].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use the inductive charging system of Jung in the vehicle as taught by Baarman in order to extend battery life of portable devices often carried and used in vehicle

Response to Arguments

12. Applicant's arguments filed 02/05/2016 have been fully considered but they are moot in new ground(s) of rejection.

At the outset, regarding Hui references, the two Hui references mentioned in the Office Action are the same. In order to avoid any discrepancies Examiner rearrange the rejections of claims 14-18 and 23-29.

It is also noted that all the claimed elements of applicant's inventions were known in the prior art (e.g. inductive charger, voltage regulator and protection device, etc.,) and one skilled

in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention, proper motivation/rationale to combine is as given in the office action. See KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396. 10.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller,* 642 F.2d 413,208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that the examiner has combined an excessive number of references, reliance on a large number of references in a rejection does not, without more, weigh against the obviousness of the claimed invention. See *In re Gorman,* 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991).

In response to applicant's argument that there is no teaching, suggestion, or motivation to combine the references, the examiner recognizes that obviousness may be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine,* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), *In re Jones,* 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), and *KSR International Co. v. Teleflex, Inc.,* 550 U.S. 398, 82 USPQ2d 1385 (2007). In this case, Lyon teaches plurality of inductive coils to charge plural devices, Hui discloses activating only one primary coil that is aligned with secondary coil, one skill in the art

can combine the two teachings for the benefit of charging rechargeable battery more efficiently and reliably, to prevent waste.

Conclusion

13. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL BERHANU whose telephone number is (571)272-8430. The examiner can normally be reached on M-F.

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.

//SAMUEL BERHANU/
Primary Examiner
Art Unit 2859

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	Art Unit
	SAMUEL BERHANU	2859

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
320	108	3/22/2013	SB
320	150	3/22/2013	SB
	Updated	2/24/2014	SB
	Updated	8/8/2014	SB
	Updated	6/22/2015	SB
	Updated	11/3/2015	SB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor and PLUS search conducted----------see printout	3/22/2013	SB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI et al. Examiner: BERHANU, Daniel R.
Serial No.: 13/115,811 Group Art Unit: 2859
Filing Date: May 25, 2011 Confirmation No: 4181
Title: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

REQUEST FOR RECONSIDERATION
(FIRST ACTION RESPONSE)

Submitted via EFS

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

Sir:

In response to the Office Action dated November 5, 2015, Applicant hereby requests reconsideration of the USPTO' stance with respect to the allowability of the pending claims.

Claims begin on page 2 of this document.

Remarks begin on page 9 of this document.

AMENDMENTS TO THE CLAIMS

1. (Previously Presented) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

2. (Original) The mobile device of claim 1 further comprising a shell, wherein the receiver is attached to the shell.

3-10. (Canceled)

11. (Previously Presented) A system for use with a mobile device for charging or powering the mobile device inductively, comprising:

a base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;

wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;

wherein one or both of the mobile device and a battery have

a receiver and particular charging characteristics associated therewith,

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit,

a means for avoiding overcharging one or both of the mobile device and battery inductively, and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

12. (Original) The system of claim 11 wherein one or more of the coils are manufactured on printed circuit boards and are manufactured to have a low resistance.

13. (Original) The system of claim 11 wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device is placed close to the primary coil of the base unit or the presence of the mobile device is to be detected.

14. (Original) The system of claim 11 wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices.

15. (Original) The system of claim 14 wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device placed close to or aligned with the primary coil of the base unit.

16. (Original) The system of claim 15 wherein the presence of the mobile device placed close to or aligned with the primary coil of the base unit is detected by monitoring the current passing through the primary coil or the switching means.

17. (Original) The system of claim 11 wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

18. (Original) The system of claim 17 wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device.

19. (Original) The system of claim 11 wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a device is placed directly on top of a coil in the base.

20. (Previously Presented) The system of claim 11 further comprising a battery coupled to and powering the base unit, and wherein the battery can be occasionally charged by an external power supply or solar cell to maintain a charge sufficient to power the inductive device for a period of time.

21. (Canceled)

22. (Original) The system of claim 11, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

23. (Original) The system of claim 11 wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

24. (Original) The system of claim 11 wherein the base unit can be integrated into any of briefcases, bags, or clothing.

25. (Original) The system of claim 11 wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

26. (Original) The system of claim 11 wherein one or more of the primary coils are stacked to improve transfer efficiency.

27. (Original) The system of claim 11, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and activates a coil or wire near the mobile device to charge or provide power the mobile device.

28. (Original) The system of claim 27, wherein the charger or power supply senses the location of the mobile device by sensing a change in a resonant circuit in the charger or power supply when the mobile device is nearby.

29. (Original) The system of claim 11, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

30. (Original) The system of claim 11, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices placed inside would be charged or powered inductively.

31. (Original) The system of claim 11, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

32. (Original) The system of claim 11, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

33. (Original) The system of claim 11, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

34. (Original) The system of claim 11, wherein the mobile device to be charged or powered includes a charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

35. (Canceled)

36. (Original) The system of claim 11, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

37. (Previously Presented) A system capable of inductive powering or charging comprising:

a battery, wherein one or both of a device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the device, wherein the receiver is one of attached to or incorporated into the battery or the device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the device or battery, to be within a range of parameters for the device or the battery;

wherein different devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the device or the battery, for use by the base unit to provide power transfer to the receiver and to the device and the battery according to their particular charging characteristics.

38. (Previously Presented) The system of claim 37 wherein the system is included within an automobile.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, claims 1, 2, 11-20, 22-34 and 36-38 stand rejected, as follows:

Claims 1-2, 11-12, 22, 30-31 and 36 -37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et al. (WO 2006/001557) (hereinafter Jung), in view of Lyon (US 2004/0145342), Hui (US 2005/0189910), in view of Erikson (US 2009/0072784).

On page eight of the office action, claims 14-18 and 23-29 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Jung, Hui, Erikson, Lyon and Hui (US 2005/0189910). **It is unclear whether the two Hui references are the same or different. Applicant would appreciate it if the Examiner would clarify his stance on this matter**;

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Chen et al. (US 6,331,744) (hereinafter Chen);

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Hui, Lyon, Erikson, and Fukuda et al. (US 4,311,953) (hereinafter Fukuda);

It appears that claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Sudo (JP408000838);

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yung in views of Lyon, Hui and Charych (US 6,798,716);

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung and Baarman et al. (US 2005/0007067) (hereinafter Baarman).

AMENDMENTS TO THE CLAIMS:

No amendments have been made due to the ambiguity introduced by the Examiner by mentioning "Hui" twice. It is also unclear exactly what the Examiner's position is on claim 32. Thus, Applicant would appreciate clarification on the Examiner's stance on this matter without deeming the next office action "final."

35 USC 103 REJECTIONS:

All claims appear to be rejected as obvious under pre-AIA 35 U.S.C. 103(a). It appears that all independent claims stand rejected as being obvious over at least Jung, Lyon and Hui and Erikson in combination. In support of these four-reference rejection, the Examiner effectively relied solely on KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396. Interestingly, the term "**common sense**" appears nine (9) times in KSR.

As an initial matter, Applicant incorporates by reference all his previous comments. Thus, Applicant points out again that the Examiner failed to put forward the identify person of ordinary skill in the art, the Examiner has also failed to establish that all four references are sufficiently compatible to be read together. In addition, Applicant submits that at least two of the references cited by the Examiner in support of the outstanding obviousness rejection contain generally incompatible teachings. For example, Lyon is directed to technology requiring at least two inductive fields transmitted at different angles to each other. This means that the associated coils are positioned in **angular relationship** to each other. See paragraph **[0036]**. In contrast, Hui teaches "a planar inductive battery charging system" See Abstract. Thus, primary winding of Hui are **parallel** to each other and the planar charging surface. See paragraph **[0005]**. Accordingly, the technological approach disclosed in Lyon is incompatible with the technological approach disclosed in Hui, and the cited references cannot be properly read together.

In addition, the currently pending claims recite a means for avoiding overcharging one or both of the mobile device and battery inductively. Since this element is neither disclosed nor suggested in any of Jung, Lyon and Hui, withdrawal of the obviousness rejection over the independent claims is warranted.

The Examiner has also rejected a number of dependent claims, further citing—in combination with Jung, Lyon, Hui, Erikson—a bunch of other "prior art." In response, Applicant submits that none of these **quinary** references would cure the defects associated with the art relied on by the Examiner to reject the independent claims. That is, a fifth reference would introduce further technological incompatibilities that would render an obviousness rejection even

more untenable. **Common sense** holds that **persons of ordinary skill in the art** would not read five patent references directed to various electrical technologies that may or may not be relevant to each other and to each and every pending claim. Federal laws governing "relevance" and whether prior art evidence should be read together may be found in Title 35 of the United States Code, the Federal Rules of Evidence Sections 401-403, and associated case law.

Although the Examiner mentions via a telephone interview held on February 3, 2016, that the Manual for Patent Examination Practices (MPEP) does not necessarily prohibit any examiner from citing five or more references in combination, the Examiner is still bound by the laws set forth by the US Supreme Court. KSR mandates that the Examiner use **common sense**. The Examiner has failed to do so.

In short, applicant's stance is that references as a whole are more incompatible than compatible with one another because the USPTO's stance fails to meet the TSM test set forth in KSR. In addition, the Examiner has cited too many references in combination. With respect to the rejection of the independent claims, the examiner has failed to provide any reason why any one of the cited references may properly be read together with all three of the remaining references. With respect to the rejection of the dependent claims, the examiner has failed to provide any reason why any one of the cited references may properly be ready together with all four of the remaining references.

While not wishing to be bound by theory, applicant hereby hypothesizes that the ordinary artisan here is an individual having one (1) year worth of electrical engineering training from an educational institution like Massachusetts Institute of Technology or Columbia University. If the Examiner does not believe that such an individual possesses the skill level of the ordinary artisan, Applicant requests the Examiner to make of record the identity of the ordinary artisan.

CONCLUSION:

Since the Examiner has failed to: (1) provide the identity of the "ordinary artisan"; (2) show why the cited references should be read together; and (3) demonstrate that all claim elements are disclosed or suggested in the cited references given the **holistic** incompatibility of

the references, all claims should now be allowable. A prompt indication to that effect would be appreciated. Should the Examiner have any questions concerning this communication, he is welcome to email or telephone the undersigned.

Submitted with respect,

Date: February 5, 2016 By: /Louis L. Wu/
Customer No. 133328 Louis L. Wu, Registration No. 44413

Electronic Acknowledgement Receipt	
EFS ID:	24841598
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	05-FEB-2016
Filing Date:	25-MAY-2011
Time Stamp:	17:13:31
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		2015-11-05ResponseToOA.pdf	125298 7b8e65fd66997cbc7f37e894ac9f16b3c5f44461	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	12
Warnings:			
Information:			
	Total Files Size (in bytes):	125298	

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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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/115,811	Filing Date 05/25/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT

02/05/2016	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 28	Minus	** 36	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** 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 number found in the appropriate box in column 1.

LIE
/DORRETTA BROOKS/

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

133328 7590 11/05/2015

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

EXAMINER	
BERHANU, SAMUEL	

ART UNIT	PAPER NUMBER
2859	

MAIL DATE	DELIVERY MODE
11/05/2015	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. 13/115,811	Applicant(s) PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	AIA (First Inventor to File) 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 *09/29/2015*.

☐ 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) *1,2,11-20,22-34 and 36-38* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2,11-20,22-34 and 36-38* is/are rejected.

8)☐ Claim(s) _____ 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 *05/25/2011* 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)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *09/29/2015*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

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

Continued Examination Under 37 CFR 1.114

2. 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 09/29/2015 has been entered.

Response to Amendment

This is in response to an amendment/response filed on 02/19/2009

Claims 1-2, 11-20, 22-34 and 36-38 are currently pending.

Claims 1 and 11 are amended.

Claims 3-10, 21 and 35 are cancelled.

Claims 37-38 are new claims

Claim Rejections - 35 USC § 103

3. 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.

4. 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 of this title, 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 negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

6. Claims 1-2, 11-12, 22, 30-31 and 36 -37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et. al. (WO 2006/001557) (hereinafter Jung) in view of Lyon (US 2004/0145342), and Hui (US 2005/0189910), further in view of Erikson (US 2009/0072784).

As to Claims 1, 11 and 37, Jung discloses in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising:

a battery; [see figure 1, element 100 $ page 9, lines 1-2], wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver [charging receiver module, 110; see page 9 lines 14]] for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device:

a regulator [the controller 240; controls and regulates charging], that

wherein different mobile devices and batteries can have different charging characteristics associated therewith [see page 9, lines 14-17]; and

wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit [see page 9, lines 14-17] verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics [page 18, lines 2-15; see also figure 7, steps S100-S140].

Jung also discloses in figure 1, an identification component [RFID Reader for the electronic device and battery, it is located in the body of the device; see page 18, lines 10-15; see associated with the mobile device or the replacement shell skin, door or other device, which is configured to provide wireless identification of the receiver to a based unit [see page 10, lines 12-16].

Jung does not disclose explicitly, regulator senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery.

Lyon discloses in figures 1-2, regulator [controller 214] senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery [see paragraphs 019-0020].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

Neither Jung nor Lyon explicitly discloses, wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil; an identification component associated with the mobile device or battery which is configure d to provide wireless identification of the receiver to a base unit;

Hui discloses in figure 1, wherein the receiver coil [fig 6 shows that the coil is planner] coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil [see also paragraph 005; 0075];

Hui discloses in figure 45, wherein different mobile devices [figure 45, device 3] can have different charging characteristics associated therewith [3V to 24 V, see paragraphs 0016 & 0108] ; and wherein the base unit operates to one or more detect [see paragraph 103], identify and/or authenticate the mobile device with the base unit, determine a selection of the one or more primary coils in alignment with the secondary coil or receiver associated with the mobile device, and communicate information to provide power transfer to the mobile device, via the selection of the one or more primary coils in alignment, according to its particular charging characteristics [see paragraph [0103] and Fig. 45, and paragraphs [0070]-[0072]].

Hui also discloses in figure 13(b) the secondary coil [figure 13(b) element 24] removably attachable as part of a replacement shell, skin, door or other device which includes the secondary coil and receiver and which couples to one or more of a battery electrodes or a power port of the mobile device [noted that the secondary coil is removably attached to the battery (21)].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to activate only primary coil of Jung's that is aligned with the secondary coil apparatus as taught by Hui in order to charge rechargeable battery in a more efficient and reliable manner, and prevent power waste.

However, Jung, Lyon and Hui don't disclose explicitly, a means for avoiding overcharging one or both of the mobile device and battery inductively.

Erikson discloses in figure 1, a means for avoiding overcharging one or both of the mobile device and battery inductively [see ¶007; charger protection to protect overcharging].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use overcharging protection means in Jung's apparatus at taught by Erikson in order to avoid battery damage due to overcharging.

As to Claim 2, Jung discloses in Figure 2, wherein the receiver [110] is attached to the shell of the mobile device or battery.

As to Claim12, Jung discloses in figure 3, wherein one or more of the coils are manufactured by one of printed circuit boards or by etching or stamping or forming copper or other material and are manufactured to have a low resistance.

As to Claim 22, Lyon discloses in Figures 1-6, a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

As to Claim 30, Lyon discloses in Figures 1-6, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices and/or batteries placed inside would be are charged or powered inductively.

As to Claim 31, Lyon discloses in Figures 1-6, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

As to Claim 36, Lyon discloses in Figures 1-6, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

7. Claims13 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Van Lerberghe (US 5,925,814) (hereinafter Van)

As to Claim 13, neither Jung nor Lyon discloses, wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected.

Van discloses in Figures 1-5, wherein the base unit includes a primary circuit having a switch (28) means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add a switching means in Jung's charger as taught by Van in order to avoid unnecessary power lose due to charging

As to Claim 34, Jung in combination with Lyon and Van discloses, charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

8. Claims 14-18 and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Erikson, Lyon and Hui (US 2005/0189910).

As to Claim 14, neither Jung nor Lyon discloses, wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

Hui discloses in Figure 4(a), wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Jung's apparatus in order to charge different devices simultaneously to minimize the time it takes to charge a plurality of electronic devices.

As to Claim 15, Jung in combination with Lyon and Hui discloses wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device and/or battery placed close to or aligned with the primary coil of the base unit.

As to Claim 16, Jung in combination with Lyon and Hui, wherein the presence of the mobile device and/or battery placed close to or aligned with the primary coil of the base reunite is detected by monitoring the current passing through the primary coil or the switching means

As to Claim 17, Hui discloses in Figure 4a, wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

As to Claim 18, Hui discloses in Figure 4a, wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device and/or battery

As to Claim 23, Hui discloses wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

As to Claim 24, Hui discloses wherein the base unit can be integrated into any of briefcases, bags, carriers, or clothing.

As to Claim 25, Hui discloses wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

As to Claim 26, Jung in combination with Lyon and Hui discloses, wherein one or more of the primary coils are stacked to improve transfer efficiency.

As to Claim 27, Jung in combination with Lyon and Hui discloses, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and/or battery and activates a coil or wire near the mobile device and/or battery to charge or provide power the mobile device and/or battery.

As to Claim 28, Lyon in combination with Hui discloses, wherein the charger or power supply senses the location of the mobile device and/or battery by sensing a change in a resonant circuit in the charger or power supply when the mobile device and/or battery is nearby.

As to Claim 29, Lyon in combination with Hui discloses, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Chen et. al. (US 6,331,744) (hereinafter Chen).

As to Claim 19, neither Jung nor Lyon discloses, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the

magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

Chen discloses in Figure 2, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

10. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon, Erikson and Fukuda et. al. (US 4,311,953) (hereinafter Fukuda).

As to claim 20, Fukuda discloses in Column 1, lines 59-67, a charger unit including solar and secondary battery.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

11. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and SUDO (US JP408000838)

As to Claim 32, Sudo discloses in the Abstract, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for vehicle toy as taught by Sudo to extend battery life.

12. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui, Erikson and Charych (US 6,798,716)

As to Claim 33, Charych discloses charging RFID tag battery, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for RFID batteries as taught by Charych to extend battery life.

13. Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung, Erikson and Baarman et. al. (US 2005/0007067) (hereinafter Baarman).

As to claim 38, Jung does not disclose explicitly, wherein the system is included within an automobile.

Baarman discloses in figure 2, wherein the base unit is provided within an automobile, for use in charging or powering one or more mobile devices within the automobile [see paragraphs 0005 and 0022].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use the inductive charging system of Jung in the vehicle as taught by Baarman in order to extend battery life of portable devices often carried and used in vehicle

Response to Arguments

14. Applicant's arguments filed 09/29/2015 have been fully considered but they are moot in new ground(s) of rejection.

It is also noted that all the claimed elements of applicant's inventions were known in the prior art (e.g. inductive charger, voltage regulator and protection device, etc.,) and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention, proper motivation/rationale to combine is as given in the office action. See KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL BERHANU whose telephone number is (571)272-8430. The examiner can normally be reached on M-F.

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.

//SAMUEL BERHANU/
Primary Examiner
Art Unit 2859

Notice of References Cited	Application/Control No. 13/115,811	Applicant(s)/Patent Under Reexamination PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2009/0072784	03-2009	Erickson, Craig	320/108
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	Art Unit
	SAMUEL BERHANU	2859

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
320	108	3/22/2013	SB
320	150	3/22/2013	SB
	Updated	2/24/2014	SB
	Updated	8/8/2014	SB
	Updated	6/22/2015	SB
	Updated	11/3/2015	SB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor and PLUS search conducted----------see printout	3/22/2013	SB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Afshin PARTOVI
Art Unit	2859
Examiner Name	Berhanu
Attorney Docket Number	AFPA-01007US1

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	8234189	B2	2012-07-31	Taylor et al.	
	2	8069100	B2	2011-11-29	Taylor et al.	

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U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20140339916	A1	2014-11-14	Fells et al.	
	2	20120259735	A1	2012-10-11	Taylor et al.	
	3	20120150670	A1	2012-06-14	Taylor et al.	
	4	20120119588	A1	2012-05-17	Baarman et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 09/29/2015	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
(Not for submission under 37 CFR 1.99)	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

	5	20120112552	A1	2012-05-10	Baarman et al.	
	6	20120041843	A1	2012-02-16	Taylor et al.	
	7	20100171369	A1	2010-07-08	Taylor et al.	
	8	20090212637	A1	2009-08-27	Baarman et al.	
	9	20090174263	A1	2009-07-09	Baarman et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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Receipt date: 09/29/2015	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25
	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

EXAMINER SIGNATURE			
Examiner Signature	11/03/2015	Date Considered	11/03/2015

*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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Receipt date: 09/29/2015	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2011-05-25
	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

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)	2015-09-29
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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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 record s.

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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.

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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

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
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	2	8069100	B2	2011-11-29	Taylor et al.	
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U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

	5	20120112552	A1	2012-05-10	Baarman et al.	
	6	20120041843	A1	2012-02-16	Taylor et al.	
	7	20100171369	A1	2010-07-08	Taylor et al.	
	8	20090212637	A1	2009-08-27	Baarman et al.	
	9	20090174263	A1	2009-07-09	Baarman et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Afshin PARTOVI
	Art Unit	2859
	Examiner Name	Berhanu
	Attorney Docket Number	AFPA-01007US1

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.

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	Application Number	13115811
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	Art Unit	2859
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	Attorney Docket Number	AFPA-01007US1

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☒ A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Louis Wu/	Date (YYYY-MM-DD)	2015-09-29
Name/Print	Louis Wu	Registration Number	44413

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Electronic Patent Application Fee Transmittal	
Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Louis L. Wu
Attorney Docket Number:	AFPA-01007US1
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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	1820	1	1700	1700
		Total in USD ($)		**1700**

Electronic Acknowledgement Receipt	
EFS ID:	23635816
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	133328
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	29-SEP-2015
Filing Date:	25-MAY-2011
Time Stamp:	14:50:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1700
RAM confirmation Number	1162
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 Continued Examination (RCE)	RCE.pdf	697426 7d07ab8d9cf2efa944530f5c9ac987915c206144	no	3
Warnings:					
Information:					
2		20150629ResponseToFinalOA.pdf	115840 2729449987dbf1598bfa78f6e0bd8e5a672eeb1c	yes	11

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:					
3	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	612319 cf2fb3263ee0592f0fa4b555414bca37ee99a959	no	5
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30284 29c29b402a6fd1f8e137a943526aab976859025b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1455869		

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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.

PTO/SB/30EFS (07-09)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/115,811	Filing Date	2011-05-11	Docket Number (if applicable)	AFPA-01007US1	Art Unit	2859
First Named Inventor	Afshin Partovi			Examiner Name	BERHANU, SAMUEL		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

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Signature of Registered U.S. Patent Practitioner			
Signature	/Louis Wu/	Date (YYYY-MM-DD)	2015-09-29
Name	Louis Wu	Registration Number	44413

This collection of information is required by 37 CFR 1.114. 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 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.

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

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Afshin PARTOVI et al. Examiner: BERHANU, Daniel R.

Serial No.: 13/115,811 Group Art Unit: 2859

Filing Date: May 25, 2011 Confirmation No: 4181

Title: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

REQUEST FOR CONTIUED EXAMINATION AND 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 Office Action dated June 29, 2015, Applicant hereby submits the accompanying Request for Continued Examination (RCE) as well as requests entry of the following amendment.

Amendments to the Claims begin on page 2 of this document.

Remarks begin on page 9 of this document.

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates ~~one or more of the current drawn, or~~ an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

2. (Original) The mobile device of claim 1 further comprising a shell, wherein the receiver is attached to the shell.

3-10. (Canceled)

11. (Currently Amended) A system for use with a mobile device for charging or powering the mobile device inductively, comprising:

a base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;

wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;

wherein one or both of the mobile device and a battery have

a receiver and particular charging characteristics associated therewith,

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit,

a means for avoiding overcharging one or both of the mobile device and battery inductively, and

a regulator, coupled to the output of the receiver or to the battery, that regulates ~~one or more of the current drawn, or~~ an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

12. (Original) The system of claim 11 wherein one or more of the coils are manufactured on printed circuit boards and are manufactured to have a low resistance.

13. (Original) The system of claim 11 wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device is placed close to the primary coil of the base unit or the presence of the mobile device is to be detected.

14. (Original) The system of claim 11 wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices.

15. (Original) The system of claim 14 wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device placed close to or aligned with the primary coil of the base unit.

16. (Original) The system of claim 15 wherein the presence of the mobile device placed close to or aligned with the primary coil of the base unit is detected by monitoring the current passing through the primary coil or the switching means.

17. (Original) The system of claim 11 wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

18. (Original) The system of claim 17 wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device.

19. (Original) The system of claim 11 wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a device is placed directly on top of a coil in the base.

20. (Previouisly Presented) The system of claim 11 further comprising a battery coupled to and powering the base unit, and wherein the battery can be occasionally charged by an external power supply or solar cell to maintain a charge sufficient to power the inductive device for a period of time.

21. (Canceled)

22. (Original) The system of claim 11, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

23. (Original) The system of claim 11 wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

24. (Original) The system of claim 11 wherein the base unit can be integrated into any of briefcases, bags, or clothing.

25. (Original) The system of claim 11 wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

26. (Original) The system of claim 11 wherein one or more of the primary coils are stacked to improve transfer efficiency.

27. (Original) The system of claim 11, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and activates a coil or wire near the mobile device to charge or provide power the mobile device.

28. (Original) The system of claim 27, wherein the charger or power supply senses the location of the mobile device by sensing a change in a resonant circuit in the charger or power supply when the mobile device is nearby.

29. (Original) The system of claim 11, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

30. (Original) The system of claim 11, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices placed inside would be charged or powered inductively.

31. (Original) The system of claim 11, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

32. (Original) The system of claim 11, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

33. (Original) The system of claim 11, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

34. (Original) The system of claim 11, wherein the mobile device to be charged or powered includes a charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

35. (Canceled)

36. (Original) The system of claim 11, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

37. (Currently Amended) A system capable of inductive powering or charging comprising:

a battery, wherein one or both of a device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the device, wherein the receiver is one of attached to or incorporated into the battery or the device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a means for avoiding overcharging one or both of the mobile device and battery inductively; and

a regulator, coupled to the output of the receiver or to the battery, that regulates ~~one or more of the current drawn, or~~ an output voltage or output current provided by the receiver, to the device or battery, to be within a range of parameters for the device or the battery;

wherein different devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the device or the battery, for use by the base unit to provide power transfer to the receiver and to the device and the battery according to their particular charging characteristics.

38. (Previously Presented) The system of claim 37 wherein the system is included within an automobile.

REMARKS

INTRODUCTORY REMARKS:

In the Office Action under reply, claims 1, 2, 11-20, 22-34 and 36-38 stand finally rejected, as follows:

Claims 1-2, 11-12, 22, 30-31 and 36 -37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et al. (WO 2006/001557) (hereinafter Jung), in view of Lyon (US 2004/0145342), and Hui (US 2005/0189910);

Claims 13 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Van Lerberghe (US 5,952,814—previously misidentified as US 5,925,814) (hereinafter Van);

Claims 14-18 and 23-29 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Hui;

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Chen et al. (US 6,331,744) (hereinafter Chen);

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Hui, Lyon and Fukuda et al. (US 4,311,953) (hereinafter Fukuda);

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Sudo (JP408000838);

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yung in views of Lyon, Hui and Charych (US 6,798,716);

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung and Baarman et al. (US 2005/0007067) (hereinafter Baarman).

AMENDMENTS TO THE CLAIMS:

Upon entry of the above amendments, claims 1, 11, and 37 have been amended recite a means for avoiding overcharging the mobile device inductively. Support for this amendment may be found in paragraph [0064] of the specification as filed. Accordingly, no new matter has been introduced.

35 USC 103 REJECTIONS OVER LYON, HUI, AND JUNG:

Independent claims 1, 11, and 37, as well as a number claims depending therefrom are rejected under pre-AIA 35 U.S.C. 103(a) as being obvious over Jung, Lyon and Hui. In support of this three-reference rejection, the Examiner effectively states that Jung, Lyon and Hui in combination discloses or suggests all elements of the rejected claims. Notably, the Examiner does not state why a person of ordinary skill in the art would read the three references together.

Before an obviousness rejection is issued based on a combination of references, there must be a careful reading of the entirety of each reference to ensure the combination does not include references that themselves teach away from their combination. See *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). This means that it is improper to cherry pick prior art disclosure, i.e., to focus on only selected **portions** of each of a plurality of references while ignoring remaining incompatible portions. See, e.g., *In re Young*, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991). That is, the cited art must altogether be more compatible than not with each other. It would violate common sense to read together prior art references that are more incompatible than not with each other.

Here, not only has the Examiner failed to put forward the identify person of ordinary skill in the art, the Examiner has also failed to establish that all three references are sufficiently compatible to be read together. In addition, Applicant submits that at least two of the references cited by the Examiner in support of the outstanding obviousness rejection contain generally incompatible teachings. For example, Lyon is directed to technology requiring at least two inductive fields transmitted at different angles to each other. This means that the associated coils are positioned in **angular relationship** to each other. See paragraph **[0036]**. In contrast, Hui teaches "a planar inductive battery charging system" See Abstract. Thus, primary winding of Hui are **parallel** to each other and the planar charging surface. See paragraph **[0005]**. Accordingly, the technological approach disclosed in Lyon is incompatible with the technological approach disclosed in Hui, and the cited references cannot be properly read together.

In addition, the currently amended claims recite a means for avoiding overcharging one or both of the mobile device and battery inductively. Since this element is neither disclosed nor suggested in any of Jung, Lyon and Hui, withdrawal of the obviousness rejection is warranted.

35 USC 103 REJECTION OVER JUNG, LYON, AND HUI IN VIEW OF ADDITIONAL REFERENCES:

The Examiner has also rejected a number of dependent claims, further citing—in combination with Jung, Lyon, and Hui—Van, Chen, Fukuda, Sudo, Charych, or Baarman. In response, Applicant submits that none of these quaternary references would cure the defects of using Jung, Lyon and Hui in combination. In addition, a fourth reference would introduce further technological incompatibilities that would render an obviousness rejection even more untenable. For example, Charych is directed to a power transmission system using directional ultrasound for power transmission (see Abstract) and specifically teaches away from use of electromagnetic waves (see column 4, lines 35-38. Persons of ordinary skill in the art would not read three references directed to different types of inductive charging via electromagnetic waves with a fourth reference directed to power transmission via ultrasound. That is, the references as a whole are more incompatible than compatible with one another.

CONCLUSION:

Since the Examiner has failed to show that the cited references should be read together and that all claim elements are disclosed or suggested in the cited references, all claims should now be allowable. A prompt indication to that effect would be appreciated. Should the Examiner have any questions concerning this communication, he is welcome to email or telephone the undersigned.

Respectfully submitted,

Date: September 29, 2015 By: /Louis L. Wu/
Louis L. Wu
Registration No. 44,413

Customer No. 133328
(510) 652-2397
info@wuiplaw.com

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/115,811	Filing Date 05/25/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **09/29/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 28	Minus	** 36	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** 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 number found in the appropriate box in column 1.

LIE
/CHRISTINE MOLLISH/

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1

CONFIRMATION NO. 4181

23910
TUCKER ELLIS LLP
ONE MARKET PLAZA
STEUART TOWER, SUITE 700
SAN FRANCISCO, CA 94105

POWER OF ATTORNEY NOTICE

OC000000076016202

Date Mailed: 07/01/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/23/2015.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

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**.

/sleutchit/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1

CONFIRMATION NO. 4181

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

POA ACCEPTANCE LETTER

OC000000076016301

Date Mailed: 07/01/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/23/2015.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

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**.

/sleutchit/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

23910 7590 06/29/2015

TUCKER ELLIS LLP
ONE MARKET PLAZA
STEUART TOWER, SUITE 700
SAN FRANCISCO, CA 94105

EXAMINER	
BERHANU, SAMUEL	

ART UNIT	PAPER NUMBER
2859	

NOTIFICATION DATE	DELIVERY MODE
06/29/2015	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

officeactions@tuckerellis.com
pctoa@tuckerellis.com

Office Action Summary	Application No. 13/115,811	Applicant(s) PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	AIA (First Inventor to File) 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 *02/19/2015*.

☐ 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) *1,2,11-20,22-34 and 36-38* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2,11-20,22-34 and 36-38* is/are rejected.

8)☐ Claim(s) _____ 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)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *04/29/2015 and 03/11/2015*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

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

Response to Amendment

This is in response to an amendment/response filed on 02/19/2009

Claims 1-2, 11-20, 22-34 and 36-38 are currently pending.

Claims 1 and 11 are amended.

Claims 3-10, 21 and 35 are cancelled.

Claims 37-38 are new claims

Claim Rejections - 35 USC § 103

2. 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.

3. 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 of this title, 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 negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-

AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

5. Claims 1-2, 11-12, 22, 30-31 and 36 -37 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et. al. (WO 2006/001557) (hereinafter Jung) in view of Lyon (US 2004/0145342), and Hui (US 2005/0189910).

As to Claims 1, 11 and 37, Jung discloses in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising:

a battery; [see figure 1, element 100 $ page 9, lines 1-2], wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver [charging receiver module, 110; see page 9 lines 14]] for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device:

a regulator [the controller 240; controls and regulates charging], that

wherein different mobile devices and batteries can have different charging characteristics associated therewith [see page 9, lines 14-17]; and

wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit [see page 9, lines 14-17] verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics [page 18, lines 2-15; see also figure 7, steps S100-S140].

Jung also discloses in figure 1, an identification component [RFID Reader for the electronic device and battery, it is located in the body of the device; see page 18, lines 10-15; see associated

with the mobile device or the replacement shell skin, door or other device, which is configured to provide wireless identification of the receiver to a based unit [see page 10, lines 12-16].

Jung does not disclose explicitly, regulator senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery.

Lyon discloses in figures 1-2, regulator [controller 214] senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery [see paragraphs 019-0020].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

Neither Jung nor Lyon explicitly discloses, wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil; an identification component associated with the mobile device or battery which is configure d to provide wireless identification of the receiver to a base unit;

Hui discloses in figure 1, wherein the receiver coil [fig 6 shows that the coil is planner] coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil [see also paragraph 005; 0075];

Hui discloses in figure 45, wherein different mobile devices [figure 45, device 3] can have different charging characteristics associated therewith [3V to 24 V, see paragraphs 0016 & 0108]

; and wherein the base unit operates to one or more detect [see paragraph 103], identify and/or authenticate the mobile device with the base unit, determine a selection of the one or more primary coils in alignment with the secondary coil or receiver associated with the mobile device, and communicate information to provide power transfer to the mobile device, via the selection of the one or more primary coils in alignment, according to its particular charging characteristics [see paragraph [0103] and Fig. 45, and paragraphs [0070]-[0072]].

Hui also discloses in figure 13(b) the secondary coil [figure 13(b) element 24] removably attachable as part of a replacement shell, skin, door or other device which includes the secondary coil and receiver and which couples to one or more of a battery electrodes or a power port of the mobile device [noted that the secondary coil is removably attached to the battery (21)].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to activate only primary coil of Jung's that is aligned with the secondary coil apparatus as taught by Hui in order to charge rechargeable battery in a more efficient and reliable manner, and prevent power waste.

As to Claim 2, Jung discloses in Figure 2, wherein the receiver [110] is attached to the shell of the mobile device or battery.

As to Claim12, Jung discloses in figure 3, wherein one or more of the coils are manufactured by one of printed circuit boards or by etching or stamping or forming copper or other material and are manufactured to have a low resistance.

As to Claim 22, Lyon discloses in Figures 1-6, a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

As to Claim 30, Lyon discloses in Figures 1-6, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices and/or batteries placed inside would be are charged or powered inductively.

As to Claim 31, Lyon discloses in Figures 1-6, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

As to Claim 36, Lyon discloses in Figures 1-6, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

6. Claims13 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Van Lerberghe (US 5,925,814) (hereinafter Van)

As to Claim 13, neither Jung nor Lyon discloses, wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected.

Van discloses in Figures 1-5, wherein the base unit includes a primary circuit having a switch (28) means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add a switching means in Jung's charger as taught by Van in order to avoid unnecessary power lose due to charging

As to Claim 34, Jung in combination with Lyon and Van discloses, charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

7. Claims 14-18 and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon and Hui (US 2005/0189910).

As to Claim 14, neither Jung nor Lyon discloses, wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

Hui discloses in Figure 4(a), wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Jung's apparatus in order to charge different devices simultaneously to minimize the time it takes to charge a plurality of electronic devices.

As to Claim 15, Jung in combination with Lyon and Hui discloses wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device and/or battery placed close to or aligned with the primary coil of the base unit.

As to Claim 16, Jung in combination with Lyon and Hui, wherein the presence of the mobile device and/or battery placed close to or aligned with the primary coil of the base reunite is detected by monitoring the current passing through the primary coil or the switching means

As to Claim 17, Hui discloses in Figure 4a, wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

As to Claim 18, Hui discloses in Figure 4a, wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device and/or battery

As to Claim 23, Hui discloses wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

As to Claim 24, Hui discloses wherein the base unit can be integrated into any of briefcases, bags, carriers, or clothing.

As to Claim 25, Hui discloses wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

As to Claim 26, Jung in combination with Lyon and Hui discloses, wherein one or more of the primary coils are stacked to improve transfer efficiency.

As to Claim 27, Jung in combination with Lyon and Hui discloses, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and/or battery and activates a coil or wire near the mobile device and/or battery to charge or provide power the mobile device and/or battery.

As to Claim 28, Lyon in combination with Hui discloses, wherein the charger or power supply senses the location of the mobile device and/or battery by sensing a change in a resonant circuit in the charger or power supply when the mobile device and/or battery is nearby.

As to Claim 29, Lyon in combination with Hui discloses, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

8. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Chen et. al. (US 6,331,744) (hereinafter Chen).

As to Claim 19, neither Jung nor Lyon discloses, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that

is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

Chen discloses in Figure 2, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon and Fukuda et. al. (US 4,311,953) (hereinafter Fukuda).

As to claim 20, Fukuda discloses in Column 1, lines 59-67, a charger unit including solar and secondary battery.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

10. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and SUDO (US JP408000838)

As to Claim 32, Sudo discloses in the Abstract, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for vehicle toy as taught by Sudo to extend battery life.

11. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Charych (US 6,798,716)

As to Claim 33, Charych discloses charging RFID tag battery, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for RFID batteries as taught by Charych to extend battery life.

12. Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lyon in views of Hui, Jung, and Baarman et. al. (US 2005/0007067) (hereinafter Baarman).

As to claim 38, Jung does not disclose explicitly, wherein the system is included within an automobile.

Baarman discloses in figure 2, wherein the base unit is provided within an automobile, for use in charging or powering one or more mobile devices within the automobile [see paragraphs 0005 and 0022].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use the inductive charging system of Jung in the vehicle as taught by Baarman in order to extend battery life of portable devices often carried and used in vehicle

Response to Arguments

13. Applicant's arguments filed 6/17/2014 have been fully considered but they are moot in new ground(s) of rejection.

It is also noted that all the claimed elements of applicant's inventions were known in the prior art (e.g. inductive charger, voltage regulator and protection device, etc.,) and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention, proper motivation/rationale to combine is as given in the office action. See KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396.

Conclusion

14. 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 SAMUEL BERHANU whose telephone number is (571)272-8430. The examiner can normally be reached on M-F.

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.

//SAMUEL BERHANU/
Primary Examiner
Art Unit 2859

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

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	BERHANU, SAMUEL
Attorney Docket Number	AFPA-01007US1

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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	7733215		2010-06-08	Kozuma	

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	1	20040145343		2004-07-29	Naskali	
	2	20070236174		2007-10-11	Kaye	
	3	20090212639		2009-08-27	Johnson	
	4	20100235006		2010-09-16	Brown	
	5	20100314946		2010-12-16	Budde	

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Receipt date: 03/11/2015	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	BERHANU, SAMUEL	
	Attorney Docket Number	AFPA-01007US1	

	6	20110115430		2011-05-19	Saunamäki		
	7	20120049991		2012-03-01	Baarman		

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2003045731	JP		2003-02-04	NEC Tokin Corp.		☐
	2	2000341885	JP		2000-12-08	Matsushita Electric Works Ltd.		☐
	3	100836634	KR		2008-04-29	Hanrim Postech Co., Ltd.		☐
	4	2009200174	Jp		2009-09-03	Panasonic Electric Works Co., Ltd.		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	JAPANESE PATENT OFFICE, Examiner's Reconsideration Report for Japanese Patent Application No. 2010-507666, July 17, 2014, 1 page.	☐

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	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

	2	THE PATENT OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA, 2nd Office Action for Chinese Patent Application No. 200880023854.4, April 15, 2013, 4 pages.	☐
	3	UNKNOWN AUTHOR, System Description Wireless Power Transfer, Volume 1: Low Power Part 1: Interface Definition, Version 1.0, July 2010, 83 pages.	☐
	4	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/829,346, February 12, 2015, 10 pages.	☐
	5	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/829,186, January 23, 2015, 12 pages.	☐
	6	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/828,933, February 5, 2015, 11 pages.	☐
	7	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/352,096, August 18, 2014, 14 pages.	☐
	8	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,584, January 23, 2015, 25 pages.	☐
	9	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 12/769,586, June 2, 2014, 23 pages.	☐
	10	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,520, August 14, 2014, 9 pages.	☐
	11	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/115,811, August 20, 2014, 20 pages.	☐
	12	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 14/135,082, December 5, 2014, 14 pages.	☐

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	Attorney Docket Number	AFPA-01007US1

	13	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,520, March 11, 2015, 10 pages.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	06/22/2015

*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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	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	BERHANU, SAMUEL	
	Attorney Docket Number	AFPA-01007US1	

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	/Karl Kenna/	Date (YYYY-MM-DD)	2015-03-11
Name/Print	Karl Kenna	Registration Number	45445

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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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 record s.

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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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1	2006246633	JP		2006-09-14	Sony Corp.		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 04/29/2015	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
(Not for submission under 37 CFR 1.99)	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

	1	JAPANESE PATENT OFFICE, Office Action for Japanese Patent Application No. 2010-507666, March 9, 2015, 8 pages.	☐
	2	JAPANESE PATENT OFFICE, Office Action for Japanese Patent Application No. 2014-104181, March 23, 2015, 14 pages.	☐
	3	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/830,161, April 16, 2015, 24 pages.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	06/22/2015

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[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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	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

CERTIFICATION STATEMENT

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☐ 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	/Karl Kenna/	Date (YYYY-MM-DD)	2015-04-29
Name/Print	Karl Kenna	Registration Number	45445

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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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 record s.

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.

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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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	Art Unit
	SAMUEL BERHANU	2859

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
320	108	3/22/2013	SB
320	150	3/22/2013	SB
	Updated	2/24/2014	SB
	Updated	8/8/2014	SB
	Updated	6/22/2015	SB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor and PLUS search conducted----------see printout	3/22/2013	SB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

PTO/SB/80 (11-08)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 133328

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 133328

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Mojo Mobility Inc.
3350 Scott Blvd., Bldg. 37A
Santa Clara, CA 95054

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	/Afshin Partovi/	Date	June 22, 2015
Name	Afshin Partovi	Telephone	(650) 446-0004
Title	CEO Mojo Mobility		

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 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 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.**

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Mojo Mobility Inc.

Application No./Patent No.: 13/115,811 Filed/Issue Date: May 25, 2011

Titled: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

Mojo Mobility Inc. , a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 28769, Frame 532, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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The document was recorded in the United States Patent and Trademark Office at

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Afshin Partovi/ June 22, 2015

Signature Date

Afshin Partovi CEO, Mojo Mobility Inc.

Printed or Typed Name Title

This collection of information is required by 37 CFR 3.73(b). 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 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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Electronic Acknowledgement Receipt	
EFS ID:	22717582
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	23910
Filer:	Louis L. Wu
Filer Authorized By:	
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	23-JUN-2015
Filing Date:	25-MAY-2011
Time Stamp:	17:32:10
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	Power of Attorney	POAChange.pdf	46019 2ce0a31961b731df48974df06698a08748d9ea5d	no	1
Warnings:					
Information:					

2	Assignee showing of ownership per 37 CFR 3.73	POAChange05.pdf	423989 eb761407d9dcc639714243e0fbc43269aaf9399b	no	2

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	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

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	1	2006246633	JP		2006-09-14	Sony Corp.		☐
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NON-PATENT LITERATURE DOCUMENTS			Remove
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	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
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	2	JAPANESE PATENT OFFICE, Office Action for Japanese Patent Application No. 2014-104181, March 23, 2015, 14 pages.	☐
	3	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/830,161, April 16, 2015, 24 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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	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

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OR

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☐ 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	/Karl Kenna/	Date (YYYY-MM-DD)	2015-04-29
Name/Print	Karl Kenna	Registration Number	45445

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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 the Freedom of Information Act requires disclosure of these record s.

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.

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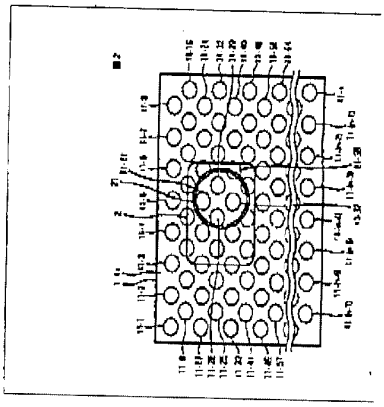
Selected Gazette

JP,2006-246633,A

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PAJ Detail Image

(11)Publication number 2006-246633
(43)Date of publication of application 14.09.2006
(51)Int.Cl. H02J 7/00 (2006.01)
H02J 17/00 (2006.01)
(21)Application number 2005-059747
(22)Date of filing 03.03.2005
(71)Applicant SONY CORP
(72)Inventor KAMITSUMA YDSUKE
NISHIKAWA SHINPEI
KIMURA SHINJI
HORI YUSUKE
SANKEGANO GORO
IWASAKI YUKI
ONITSUKA SHIGETOSHI



(54)SYSTEM, DEVICE AND METHOD FOR SUPPLYING POWER, POWER-RECEIVING DEVICE/METHOD, RECORDING MEDIUM AND PROGRAM

(57)Abstract
PROBLEM TO BE SOLVED: To more speedily supply power to a power-receiving device.
SOLUTION: In a power supply device 1 having power supplies 11-1 to 11-n supplying power by electromagnetic induction, the power supply device 1 selects the power supplies 11-21, the power supplies 11-28, the power supplies 11-29 and the power supplies 11-37, which are placed on an installation face 1a of the power supply device 1 and correspond to positions of a power receiver 21 of the power-receiving device 2 from the power supplies 11-1 to 11-n. The selected power supplies 11-21, the power supplies 11-28, the power supplies 11-29, and the power supplies 11-37 supply power to the power receiver 21 of the power-receiving device 2 through electromagnetic induction. The system, the device and the method can be applied to the power supply device, supplying power to a portable telephone set and the like.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application		PATENT APPLICATION	
Inventor(s):	Partovi, Afshin		
Appl. No.:	13/115,811	Art Unit:	2859
Confirm. No.:	4181	Examiner:	Berhanu, Samuel
Filed:	May 25, 2011		
Title:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	**Customer No. 23910**	

TRANSMITTAL LETTER RE INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.56

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

Sir:

It is requested that the information identified in this statement be considered by the Examiner and made of record in the above-identified application. This statement is not intended to represent that a search has been made or that the information cited in the statement is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56. If this is a continuation, divisional or continuation-in-part application, it is understood that the Examiner will consider all information which was considered by the Office in a parent application. MPEP §609. Such information therefore is not listed herein unless it is desired that the information be printed on a patent issuing from the subject application.

Enclosed with this statement are the following:

✓ Form PTO-1449. The Examiner is requested to initial the form and return it to the undersigned in accordance with M.P.E.P. §609.

✓ As allowed under 37 C.F.R § 1.98(a)(2)(ii), no copies of the U.S. patents and U.S. patent application publications are enclosed, unless required by the office.

✓ A copy of an Examination Report for Japanese Patent Application No. 2010-507666 dated March 9, 2015.

✓ A copy of an Examination Report for Japanese Patent Application No. 2014-104181 dated March 23, 2015.

This statement should be considered because:

___ **37 C.F.R. §1.97(b)**. This statement qualifies under 37 C.F.R. §1.97, subsection (b) because:

(1) It is being filed within three months of the filing date of an application other than a continued prosecution application under § 1.53(d);
-- OR --
(2) It is being filed within 3 months of entry of a national stage;
-- OR --
(3) It is being filed before the mailing date of the first Office Action on the merits,
-- OR --
(4) It is being filed before the mailing date of the first Office Action after the filing of a Request for Continued Examination under 37 C.F.R. §1.114.

✓ **37 C.F.R. §1.97(c)**. Although it may not qualify under subsection (b), this statement qualifies under 37 C.F.R. §1.97, subsection (c) because:

(1) It is being filed before the mailing date of a FINAL Office Action, a Notice of Allowance, or an action that otherwise closes prosecution in the subject application, whichever occurs first.
-- AND *(check at least one of the following)* --
___ (a) It is accompanied by a STATEMENT as set forth in 37 C.F.R. §1.97(e).
-- OR --
✓ (b) It is accompanied by the $180 fee set forth in 37 C.F.R. §1.17(p).

___ **37 C.F.R. §1.97(d)**. Although it may not qualify under subsection (b) or (c), this statement qualifies under 37 C.F.R. §1.97, subsection (d) because:

(1) It is being filed on or before payment of the Issue Fee;
-- AND --
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-- AND --
(3) It is accompanied by the $180 fee set forth in 37 C.F.R. §1.17(p).

✓ ***Fee Authorization.*** The Commissioner is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Account No. 06-1325.

Respectfully submitted,

TUCKER ELLIS LLP

Date: April 29, 2015

By: /Karl Kenna/
Karl Kenna
Reg. No. 45,445

Customer No. 23910
TUCKER ELLIS LLP
One Market Plaza, Suite 700
San Francisco, California 94105
Telephone: (415) 362-3800

Electronic Patent Application Fee Transmittal	
Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	22202873
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	23910
Filer:	Karl Kenna/Christopher Burnharte
Filer Authorized By:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	29-APR-2015
Filing Date:	25-MAY-2011
Time Stamp:	16:15:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	3131
Deposit Account	061325
Authorized User	KENNA, KARL
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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Charge any Additional Fees required under 37 C.F.R. Section 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	Information Disclosure Statement (IDS) Form (SB08)	afpa_1007us1_IDS.pdf	612239 a43ea3d4447bc5a14d6f35bab7b62809e927f289	no	4
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	afpa_1013jp0_OA.pdf	321416 b460ccf3515a4f6acd1d62a8577c5034b4163e47	no	8
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	afpa_1013jp1_OA.pdf	620769 5517edd2a5b8d4895f8a1dd86875a9e19431d6a7	no	14
Warnings:					
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4	Other Reference-Patent/App/Search documents	afpa_1038us1_041615_oa.pdf	925220 2894a84c4c952ea531b9ea83b7f61a84b8f4737a	no	24
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5	Foreign Reference	JP2006246633.pdf	63872 902f727600589513f4b4b21325deec8ab9d04fcc	no	1
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6	Transmittal Letter	afpa_1007us1_042915_IDS_Transmittal.pdf	117011 fd62d8f3158c577d7c42e92511c31314117acb85	no	2
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7	Fee Worksheet (SB06)	fee-info.pdf	30584 479fa3f9ef68affaeb3570fc6226549c548b386a	no	2
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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.

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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.

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

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	1	20040145343		2004-07-29	Naskali	
	2	20070236174		2007-10-11	Kaye	
	3	20090212639		2009-08-27	Johnson	
	4	20100235006		2010-09-16	Brown	
	5	20100314946		2010-12-16	Budde	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	BERHANU, SAMUEL
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	6	20110115430		2011-05-19	Saunamäki	
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	1	2003045731	JP		2003-02-04	NEC Tokin Corp.		☐
	2	2000341885	JP		2000-12-08	Matsushita Electric Works Ltd.		☐
	3	100836634	KR		2008-04-29	Hanrim Postech Co., Ltd.		☐
	4	2009200174	Jp		2009-09-03	Panasonic Electric Works Co., Ltd.		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	JAPANESE PATENT OFFICE, Examiner's Reconsideration Report for Japanese Patent Application No. 2010-507666, July 17, 2014, 1 page.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

	2	THE PATENT OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA, 2nd Office Action for Chinese Patent Application No. 200880023854.4, April 15, 2013, 4 pages.	☐
	3	UNKNOWN AUTHOR, System Description Wireless Power Transfer, Volume 1: Low Power Part 1: Interface Definition, Version 1.0, July 2010, 83 pages.	☐
	4	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/829,346, February 12, 2015, 10 pages.	☐
	5	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/829,186, January 23, 2015, 12 pages.	☐
	6	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/828,933, February 5, 2015, 11 pages.	☐
	7	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/352,096, August 18, 2014, 14 pages.	☐
	8	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,584, January 23, 2015, 25 pages.	☐
	9	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 12/769,586, June 2, 2014, 23 pages.	☐
	10	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,520, August 14, 2014, 9 pages.	☐
	11	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/115,811, August 20, 2014, 20 pages.	☐
	12	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 14/135,082, December 5, 2014, 14 pages.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

	13	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U.S. Patent Application No. 13/708,520, March 11, 2015, 10 pages.	☐

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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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	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	BERHANU, SAMUEL
	Attorney Docket Number	AFPA-01007US1

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	/Karl Kenna/	Date (YYYY-MM-DD)	2015-03-11
Name/Print	Karl Kenna	Registration Number	45445

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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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 record s.

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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)).

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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.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-045731
(43)Date of publication of application : 14.02.2003

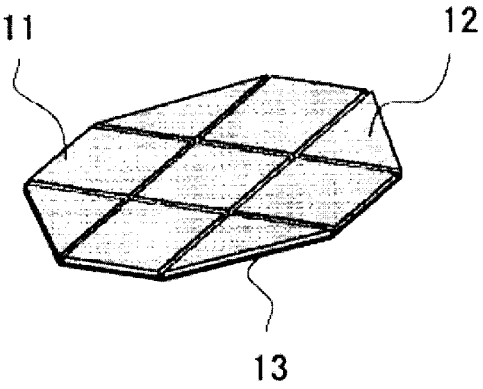
(51)Int.Cl. H01F 38/14
H02J 17/00

(21)Application number : 2001-230023
(22)Date of filing : 30.07.2001

(71)Applicant : NEC TOKIN CORP
(72)Inventor : SATO TADAKUNI

(54) NON-CONTACT POWER TRANSMISSION APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a non-contact power transmission apparatus, in which a coil loading a ferrite plate is given flexibility under the condition that transmission power be increased fully and conversion efficiency be improved fully.
SOLUTION: This non-contact power transmission apparatus transmits electric power on the non-contact basis, by utilizing electromagnetic induction effect in the coils provided opposed to each other via gaps. This apparatus is also configured by loading a ferrite sheet which is formed, by providing a plurality of soft-magnetic ferrite plates to the external side of the coils which are provided opposed to each other.



DOCUMENT 1/1
DOCUMENT NUMBER
@: unavailable

1. JP,2003-045731,A

DETAIL JAPANESE LEGAL STATUS

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2003-045731**
(43)Date of publication of application : **14.02.2003**

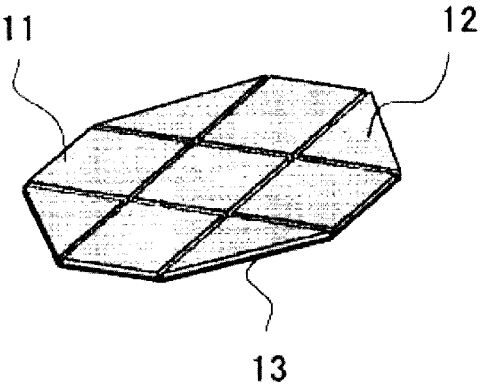
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(71)Applicant : **NEC TOKIN CORP**
(72)Inventor : **SATO TADAKUNI**

(54) NON-CONTACT POWER TRANSMISSION APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a non-contact power transmission apparatus, in which a coil loading a ferrite plate is given flexibility under the condition that transmission power be increased fully and conversion efficiency be improved fully.
SOLUTION: This non-contact power transmission apparatus transmits electric power on the non-contact basis, by utilizing electromagnetic induction effect in the coils provided opposed to each other via gaps. This apparatus is also configured by loading a ferrite sheet which is formed, by providing a plurality of soft-magnetic ferrite plates to the external side of the coils which are provided opposed to each other.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The present invention relates to the non-contact transfer-of-power equipment which transmits electric power via space by the electromagnetic induction action produced between coils.
[0002]
[Description of the Prior Art]Conventionally, a system which transmits electric power to non-contact using an electromagnetic induction action produced between coils made to oppose via a gap is called cordless Power Station, and is disclosed in Journal of the Maganetics Society of Japan [17,485-488] of publication in the 1993 fiscal year.
If it is considered as the example of use, it is mentioned as an effective power supply means to a driving device of an artificial heart from the ability of non-contact transfer of power to be performed, for example as it discloses in Journal of the Institute of Electrical Engineers of Japan [A of publication in the 1991 fiscal year, 111-A, and 807].

[0003]Incidentally, a pair of coil is used for the transformer for artificial hearts of a perfect flush type, and slimming down is demanded of the transformer. Although the thickness is about 3 mm in the transformer using the amorphous magnetic material as a magnetic material for energy transmission of the driving device of an artificial heart, the thickness of the transformer is about 15 mm in the pot-cores type thing using a ferrite. The inventors have realized slimming down of a transformer by the transformer which used the ferrite plate.
[0004]Such cordless Power Station is applicable also to the electric power supply to portable home electronics etc., or battery charge besides the power supply means to the driving device of an artificial heart.
[0005]
[Problem to be solved by the invention]However, by the transformer formed using the amorphous magnetic material mentioned above, although slimming down is realized, at the time of transfer of power, generation of heat by a high-frequency field arises, and when it is prolonged use, with the amorphous magnetic material, it has the fault of carrying out a temperature rise by the time it produces the low temperature burns in a human body.
[0006]When using it for a human body etc., it becomes in many cases that it is more convenient to form coil shape with a certain amount of curvature. Therefore, it becomes useful practically to have a certain amount of [a magnetic body and the arranged coil] flexibility.
[0007]Good flexibility is obtained in the coil equipped with the above-mentioned amorphous magnetic material.
[0008]On the other hand, in the coil equipped with a ferrite plate, generation of heat by the ferrite section at the time of transfer of power is hardly produced, and problems, such as a burn to a living

body, do not occur. On the other hand, since a ferrite plate is hard and it is weak, there is no flexibility of the coil equipped with a ferrite plate.
[0009]It was made that the present invention should solve this problem, and the technical problem is in the state which could aim at sufficiently increase of transmission power, and improvement in conversion efficiency, and there is in giving flexibility to the coil equipped with a ferrite plate.
[0010]
[Means for solving problem]According to the present invention, in the equipment which transmits electric power to non-contact, the non-contact transfer-of-power equipment which equipped the lateral part of the aforementioned coil which counters with the ferrite sheet which lays two or more soft magnetism ferrite plates is obtained using the electromagnetic induction action in the coil which opposes via a gap.
[0011]
[Function]In the present invention, a ferrite sheet provided so that a lateral part of a plane swirl type coil which opposed might be covered with a soft magnetism ferrite chip is arranged. Therefore, non-contact transfer of power is good, there is almost no generation of heat, and a transformer section which has flexibility can be realized.

[0012]Non-contact transfer of power becomes good in a ferrite sheet part because prehension of magnetic flux and magnetic flux combination of a primary side and a secondary improve. Since the electrical resistance of a ferrite is high, generation of heat hardly arises because there is very little eddy current generation of heat by an electromagnetic induction action. By sticking a ferrite chip on a plastic sheet etc. and forming in a ferrite sheet shaped, the flexibility of a ferrite section is that a certain amount of deformation becomes possible, and is given.
[0013]
[Working example]Hereafter, it describes about an working example.
[0014](Working example 1) Fig.1 is a perspective view showing the ferrite sheet used in working example 1 of the present invention.
[0015]First, saturation magnetization used about 0.5 T (5000G) Mn-Zn system spinel ferrite sintered body by about 2500, and amplitude permeability cut this to the diagonal direction with the square-like corner guard 11 of 11 mm of side length who consists of 1 mm in thickness, and produced the isosceles triangle board 12 used as the 2 equilateral length of 10 mm each.
[0016]As a plane spiral coil, carried out 5 turn winding of what bundled 100 copper wire 100 micrometers in diameter, produced in the outer diameter of 30 mm, 15 mm in inner diameter, and thickness of 1.5 mm, these were made to oppose, and the direction where the output of a primary side (input side) generates the direction connected to a power supply in electromagnetic induction was made into the secondary (output side).
[0017]Next, give a 1-mm gap, these plane spiral coil was made to oppose, one pair of plane spiral coils were constituted, and secondary output (maximum transmission power) P_2 and the conversion efficiency eta were searched for under the frequency of 100 kHz, primary side voltage, and the conditions of 4V. However, it is eta=(output power/input power) x100 (%).
[0018](1) The composition of the electromagnetic induction part in measurement In the case only of the coil which opposes. (2) Leave about 0.5-mm gap for five sheets and 4 of the isosceles triangle boards 12 of a Mn-Zn system spinel ferrite sintered body, and stick on the polyester film 13 the square-like corner guard 11 of the Mn-Zn system spinel ferrite sintered body mentioned above, It has measured about two kinds at the time of equipping the both-outsides part of the coil which opposes with the ferrite sheet produced in the shape of a regular octagon. The result is shown in Table 1.
[0019]
[Table 1]

構成 / 特性	フェライトシートの装着	
	なし	あり
2次側出力P_2 (W)	1.4	8.3
変換効率η (%)	8	82

[0020]By equipping with a ferrite sheet shows that secondary output P_2 and the conversion efficiency eta improve remarkably.
[0021]The coil part equipped with a ferrite sheet held flexibility, and has reached easily to the curvature radius of about 50 mm.
[0022](Working example 2) Fig.2 is a perspective view showing the ferrite sheet used in working example 2 of the present invention.
[0023]First, saturation magnetization used about 0.35 T (3500G) nickel-Cu-Zn system spinel ferrite sintered body by about 800, and amplitude permeability produced the square-like corner guard 21 of 5 mm of side length who comprises 0.5 mm in thickness, and the isosceles triangle board 22 which cuts this to a diagonal direction and serves as 2 equilateral length of 4 mm each.
[0024]About 0.5-mm gap was left, these 24 square templates and eight triangle boards were stuck on the silicon rubber sheet 23, and the ferrite sheet was produced in the shape of a regular octagon.

[0025]About the effect which uses this, it measured like the working example 1. The result is shown in Table 2.
[0026]
[Table 2]

構成 / 特性	フェライトシートの装着	
	なし	あり
2次側出力P_2 (W)	1.4	7.9
変換効率η (%)	8	80

[0027]By equipping with a ferrite sheet shows that secondary output P_2 and the conversion efficiency eta improve remarkably.
[0028]The coil part equipped with a ferrite sheet held flexibility, and has reached easily to the curvature radius of about 30 mm.
[0029]
[Effect of the Invention]It comprises the present invention, as described above.
Therefore, according to the present invention, non-contact transfer-of-power equipment which gave flexibility to a coil equipped with a ferrite plate where increase of transmission power and improvement in conversion efficiency can be aimed at sufficiently can be provided.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1]Non-contact transfer-of-power equipment characterized by equipping with a ferrite sheet which lays two or more soft magnetism ferrite plates to a lateral part of the aforementioned coil which counters in equipment which transmits electric power to non-contact using an electromagnetic induction action in a coil which opposes via a gap.

[Translation done.]

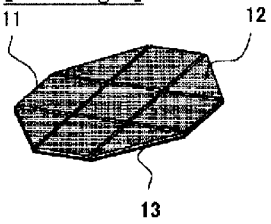
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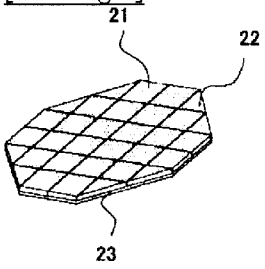
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

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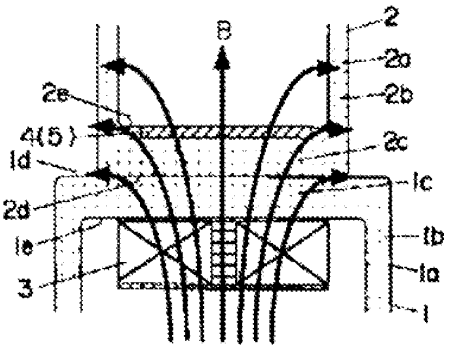
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(71)Applicant : MATSUSHITA ELECTRIC WORKS LTD
(72)Inventor : KATSURA YOSHIKI
TAMURA HIDEKI
OKAMOTO TOYOKATSU

(54) NONCONTACT POWER TRANSMISSION DEVICE AND MANUFACTURE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a noncontact transmission device which can reduce the gap between a primary coil and a secondary coil and increase the power transmitted from the primary coil to the secondary coil.
SOLUTION: In a noncontact power transmission device, a primary coil 3 is placed on a power supply device 1 side, a secondary coil 4 is placed on a load apparatus 2 side, and a power is transmitted from the primary coil 3 to the secondary coil 4 through electromagnetic induction. The primary coil 3 or the secondary coil 4 is formed into a flat coil 5, which is attached to the contact wall 1c(2c) of the mutual connection part 1a(2a)



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The present invention relates to non-contact power transmission equipment and a manufacturing method for the same.
[0002]
[Description of the Prior Art]Fig.9 shows the power transmission part of conventional non-contact power transmission equipment. The primary side coil 3 in which the principal part of the power transmission part of this equipment is arranged in the interconnecting part 1a of the power supply system 1, It comprises the secondary coil 4 arranged in the interconnecting part 2a of the load apparatus 2, and the electromagnetic induction from the primary side coil 3 to the secondary coil 4 performs power transmission by non-contact (the inside B of a figure expresses magnetic flux). The primary side coil 3 is stuck to the inner surface 1e of the contact wall 1c of the housing 1b of the interconnecting part 1a of the power supply system 1, the secondary coil 4 is stuck to the inner surface 2e of the contact wall 2c of housing 2b of the interconnecting part 2a of the load apparatus 2, respectively, and it has arranged.
[0003]By the way, it is possible to increase the inductor of the primary side coil 3 or the secondary coil 4, or to improve a transmission efficiency by core insertion as a method to which the electric power transmited to the secondary coil 4 is made to increase from the primary side coil 3, etc. Since the number of turns of a coil is increased in order to increase an inductor in the case of the method of increasing the inductor of the primary side coil 3 or the secondary coil 4 first, a coil becomes largely and bars the miniaturization of equipment. In the method of improving a transmission efficiency by core insertion as well as the previous method, the miniaturization of equipment will be barred by core insertion, and also it is connected with cost increase.
[0004]Then, how to make the gap between the primary side coil 3 and the secondary coil 4 as small as possible can be considered as methods other than the above. Namely, the thickness of the contact wall 1c of the housing 1b of the interconnecting part 1a of the power supply system 1 with which the primary side coil 3 is arranged as for this, It is the method of making as thin as possible thickness of the contact wall 2c of housing 2b of the interconnecting part 2a of the load apparatus 2 in which the secondary coil 4 is arranged, and making distance between the primary side coil 3 and the secondary coil 4 as small as possible. However, in this method, there is a limit also in making thin thickness of the housing 1b and the contact walls 1c and 2c of housing 2b by restriction of housing strength, housing molding conditions, the distance for insulation, etc. In the case of this method, as shown in Fig.10, depending on the design of goods, the primary side coil 3 and the secondary coil 4 may have to be arranged to the curved surface part 14. In this case, the gap between the primary side coil 3 and the secondary coil 4 becomes largely, and it becomes difficult to secure from the primary side coil 3 the electric power transmited to the secondary coil 4.
[0005]

[Problem to be solved by the invention]In view of the above-mentioned point, it succeeds in the present invention, the gap between a primary side coil and a secondary coil can be made extremely small, and it aims at providing the non-contact power transmission equipment which can increase the electric power transmited to a secondary coil from a primary side coil.
[0006]
[Means for solving problem]The non-contact power transmission equipment concerning Claim 1 of the present invention, In the non-contact power transmission equipment which arranges the primary side coil 3 to the power supply system 1 side, arranges the secondary coil 4 to the load apparatus 2 side, and carries out power transmission by the electromagnetic induction from the primary side coil 3 to the secondary coil 4, The primary side coil 3 or the secondary coil 4 is formed in the plane coil 5, and this plane coil 5 is arranged in the contact wall 1c (2c) of the interconnecting part 1a (2a) of the power supply system 1 or the load apparatus 2.
[0007]The non-contact power transmission equipment concerning Claim 2 of the present invention, In addition to the composition of Claim 1, either the primary side coil 3 formed in the plane coil 5 or the secondary coil 4 is arranged on 1 d (2d) of outer surfaces of the contact wall 1c (2c) of the interconnecting part 1a (2a) of the power supply system 1 or the load apparatus 2.
[0008]The non-contact power transmission equipment concerning Claim 3 of the present invention, In addition to the composition of Claim 1, either the primary side coil 3 formed in the plane coil 5 or the secondary coil 4 is arranged to 1 d (2d) of outer surfaces of the contact wall 1c (2c) of the interconnecting part 1a (2a) of the power supply system 1 or the load apparatus 2, and both sides of the inner surface 1e (2e), And both the coils 3 and 3 (4, 4) arranged to 1 d (2d) of outer surfaces and both sides of the inner surface 1e (2e) are electrically connected.
[0009]In addition to the composition of Claim 2 or either of 3, the non-contact power transmission equipment concerning Claim 4 of the present invention covers the exposed part 5a of the plane coil 5 with the protection seal 6 for protecting the plane coil 5.
[0010]In addition to the composition of Claim 4, the non-contact power transmission equipment concerning Claim 5 of the present invention provided the magnetic part 7 to the central part of the aforementioned protection seal 6.
[0011]In addition to one composition of the Claims 1-4, the non-contact power transmission equipment concerning Claim 6 of the present invention arranged two or more secondary coils 4 at the place which intersects the magnetic flux B generated from the primary side coil 3.
[0012]The manufacturing method of the non-contact power transmission equipment concerning Claim 7 of the present invention arranges the above-mentioned plane coil 5 by hot stamping in the contact wall 1c (2c) of the interconnecting part 1a (2a) of the power supply system 1 or the load apparatus 2.
[0013]
[Mode for carrying out the invention]An embodiment of the invention is described based on Fig.1 thru/or Fig.8.
[0014]An example of an embodiment of the invention is shown in Fig.1 thru/or Fig.3.Fig.1 shows the power transmission part of the non-contact power transmission equipment of the present invention. The power transmission part of non-contact power transmission equipment comprises the interconnecting part 1a of the power supply system 1, and the interconnecting part 2a of the load apparatus 2. The interconnecting part 1a of the power supply system 1 and the interconnecting part 2a of the load apparatus 2, respectively, A coat is formed with cylinder-like-object-with-base-like the housing 1b and housing 2b, and to the inner surface 1e of the contact wall 1c of the housing 1b the primary side coil 3, The secondary coil 4 is arranged by the inner surface 2e of the contact wall 2c of housing 2b so that the winding axis of a coil may correspond to the medial axis of the housing 1b and housing 2b, respectively. In this example, the plane coil 5 which formed copper foil as shown in Fig.2 spirally is used for one secondary coil 4 using the cylindrical coil generally used for the primary side coil 3. Hot stamping performs arrangement to the inner surface 2e of formation of this

plane coil 5, and the contact wall 2c of housing 2b.

[0015]Next, the description of the non-contact power transmission equipment of the present invention of operation is carried out. Fig.3 shows the circuit diagram of this non-contact power transmission equipment, Fig.3 (a) is a circuit diagram of the power supply system 1, and Fig.3 (b) is a circuit diagram of the load apparatus 2. First, in the power supply system 1, the alternating current supplied from AC power supply 8 is converted to the high frequency current by the high frequency generation circuit 9, the high frequency current is sent through the primary side coil 3 arranged to the inner surface 1e of the contact wall 1c of the housing 1b, and the magnetic flux B as shown in Fig.1 is generated. Next, when the aforementioned magnetic flux B intersects the secondary coil 4 which is the plane coil 5 arranged to the inner surface 2e of the contact wall 2c of housing 2b in the load apparatus 2, After electromotive force occurs in the secondary coil 4 by electromagnetic induction and the rectifier diode 10 rectifies, it charges by supplying current to the cell 11. In this way, the load apparatus 2 to which electric power was supplied can make the load 12 drive by turning ON the electric power switch 13 arranged to the load apparatus 2.

[0016]As mentioned above the non-contact power transmission equipment of the present invention, By forming the secondary coil 4 in the plane coil 5, and arranging the plane coil 5 to the inner surface 2e of the contact wall 2c of housing 2b of the interconnecting part 2a of the load apparatus 2, Since the number of the magnetic flux B which intersects the secondary coil 4 among the magnetic flux B generated from the primary side coil 3 by the distance between the primary side coils 3 of the secondary coil 4 which is the plane coil 5 which are all a part and the other party coil becoming short can be increased, Big electromotive force is acquired and the electric power transmited to the secondary coil 4 from the primary side coil 3 can be increased. Since the inductor of the primary side coil 3 or the secondary coil 4 is small and ends compared with the conventional thing when making fixed electric power profitably like conversely at the load apparatus 2 side, the miniaturization of parts and a cost cut can be aimed at. Since it is the plane coil 5 and space of a longitudinal direction is not taken, equipment can be miniaturized and slimmed down. By arranging the above-mentioned plane coil 5 by hot stamping in the contact wall 2c of housing 2b of the interconnecting part 2a of the load apparatus 2, it becomes possible to manufacture the power transmission part of non-contact power transmission equipment by low cost. By hot stamping, since the plane coil 5 can be arranged also to the curved surface part of a housing, the flexibility of the housing form of goods increases.

[0017]Next, other examples of an embodiment of the invention are shown in Fig.4. Other composition except arrangement of the secondary coil 4 in which this non-contact power transmission equipment is the plane coil 5 is the same as the aforementioned example, and in this example, the secondary coil 4 is embedded so that it may become flat-tapped with 2 d of outer surfaces at the contact wall 2c of housing 2b. Since the gap between the primary side coil 3 and the secondary coil 4 serves as only thickness of the contact wall 1c of the housing 1b and becomes short by having such composition, the electric power transmited to the secondary coil 4 from the primary side coil 3 can be increased more.

[0018]Next, other examples of an embodiment of the invention are shown in Fig.5. Other composition except arrangement of the secondary coil 4 in which this non-contact power transmission equipment is the plane coil 5 is the same as a first example, In this example, both the coils 5 and 5 that arranged the two plane coils 5 and 5 as the secondary coil 4 to 2 d of outer surfaces of the contact wall 2c of housing 2b and both sides of the inner surface 2e, and were arranged to 2 d of outer surfaces and both sides of the inner surface 2e are connected via the electrical connection member 15. Both the coils 5 and 5 arranged to 2 d of outer surfaces and both sides of the inner surface 2e are embedded so that it may become flat-tapped with 2 d of outer surfaces of the contact wall 2c, and the inner surface 2e, respectively. Since the gap between the primary side coil 3 and the secondary coil 4 serves as only thickness of the contact wall 1c of the housing 1b and becomes short by having such composition, By being able to increase the electric

power transmited to the secondary coil 4 from the primary side coil 3, and connecting both the coils 5 and 5 arranged in addition to 2 d of outer surfaces of the contact wall 2c of housing 2b, and both sides of the inner surface 2e. Since the number of turns of a coil increases and an inductor increases, the electric power transmited to the secondary coil 4 from the primary side coil 3 can be increased further.

[0019]Next, other examples of an embodiment of the invention are shown in Fig.6. In the composition of a second example, this non-contact power transmission equipment covers the exposed part 5a of the plane coil 5 with the protection seal 6, in order to protect the plane coil 5 embedded under 2 d of the outer surfaces of the contact wall 2c of housing 2b flat-tapped. By having such composition, the disconnection or degradation of the coil of the secondary coil 4 by fall of the load apparatus 2, a fall, and attachment and detachment with the power supply system 1 can be prevented.

[0020]Next, other examples of an embodiment of the invention are shown in Fig.7. This non-contact power transmission equipment provides the magnetic part 7 to the central part of the protection seal 6 in the composition of the aforementioned example. The center of the magnetic part 7 is placed on the same straight line as the winding axis of the primary side coil 3 and the secondary coil 4. The magnetic flux B converges on the magnetic part 7 of the central part of the protection seal 6, and since the number of the magnetic flux B which crosses the secondary coil 4 increases, the transmission efficiency of the electric power transmited to the secondary coil 4 can be raised by having such composition from the primary side coil 3.

[0021]Next, other examples of an embodiment of the invention are shown in Fig.8. Other composition except arrangement of the secondary coil 4 in which this non-contact power transmission equipment is the plane coil 5 is the same as a second example, and two or more secondary coils 4 are arranged in this example at the place which intersects the magnetic flux B generated from the primary side coil 3. Thus, since the number of the magnetic flux B which intersects the secondary coil 4 by providing more than one can be increased so that the magnetic flux B which does not cross in the case of the one secondary coil 4 may intersect the aforementioned magnetic flux B in the secondary coil 4, Big electromotive force is acquired and the electric power transmited to the secondary coil 4 from the primary side coil 3 can be increased more.

[0022]

[Effect of the Invention]In the non-contact power transmission equipment which arranges a primary side coil to the power supply system side, arranges a secondary coil to the load apparatus side, and carries out power transmission by the electromagnetic induction from a primary side coil to a secondary coil if it is in the invention of the present invention according to claim 1, By forming a primary side coil or a secondary coil in a plane coil, and arranging this plane coil in the contact wall of the interconnecting part of a power supply system or load apparatus, Since the primary side coil or the secondary coil is a plane coil, the distance between all the portions of this plane coil and the other party coil becomes short. Since the number of the magnetic flux which intersects a secondary coil among the magnetic flux generated from a primary side coil can be increased, big electromotive force is acquired and the electric power transmited to a secondary coil from a primary side coil can be increased. Since the inductor of a primary side coil or a secondary coil is small and ends compared with the conventional thing when making fixed electric power profitably like conversely at the load apparatus side, the miniaturization of parts and a cost cut can be aimed at. Since it is a plane coil and space of a longitudinal direction is not taken, equipment can be miniaturized and slimmed down.

[0023]If it is in the invention of the present invention according to claim 2, the effect of the invention according to claim 1 -- in addition, either of the primary side coils or secondary coils which were formed in the plane coil by arranging on the outer surface of the contact wall of the interconnecting part of a power supply system or load apparatus, Since the gap between a primary

side coil and a secondary coil serves as only thickness of the contact wall of the interconnecting part of either a power supply system or load apparatus and becomes short, the electric power transmited to a secondary coil from a primary side coil can be increased more.

[0024]If it is in the invention of the present invention according to claim 3, the effect of the invention according to claim 1 -- in addition, either of the primary side coils or secondary coils which were formed in the plane coil to the outer surface of the contact wall of the interconnecting part of a power supply system or load apparatus, and both sides of an inner surface, [arrange and] By and the thing for which both the coils arranged to an outer surface and both sides of the inner surface are electrically connected, Since the gap between a primary side coil and a secondary coil serves as only thickness of the contact wall of the interconnecting part of either a power supply system or load apparatus and becomes short, By being able to increase the electric power transmited to a secondary coil from a primary side coil, and connecting both the coils arranged in addition to the outer surface of the contact wall of the interconnecting part of a power supply system or load apparatus, and both sides of the inner surface, Since the number of turns of a coil increases and an inductor increases, the electric power transmited to a secondary coil from a primary side coil can be increased further.

[0025]If it is in the invention of the present invention according to claim 4, It is covering the exposed part of a plane coil with the protection seal for protecting a plane coil in addition to the effect of the invention of the description to Claim 2 or either of 3, Disconnection or degradation of the coil of either the primary side coil by fall of load apparatus, a fall, and attachment and detachment with a power supply system or a secondary coil can be prevented.

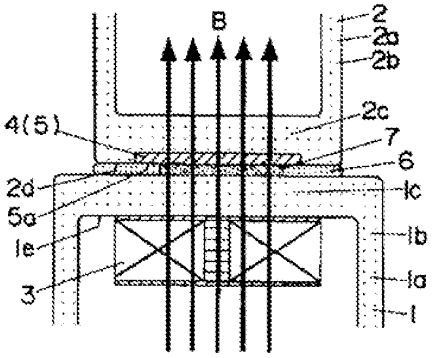
[0026]If it is in the invention of the present invention according to claim 5, the effect of the invention according to claim 4 -- in addition, magnetic flux converges on the magnetic part of the central part of a protection seal, and since the number of the magnetic flux which crosses a secondary coil increases, the transmission efficiency of the electric power transmited to a secondary coil can be raised by having provided the magnetic part to the central part of the aforementioned protection seal from a primary side coil.

[0027]If it is in the invention of the present invention according to claim 6, To the effect of the invention according to any one of claims 1 to 4, a secondary coil by in addition, the thing for which more than one were arranged at the place which intersects the magnetic flux generated from a primary side coil, Since the number of the magnetic flux which intersects a secondary coil by providing more than one can be increased so that the magnetic flux which does not cross in the case of one secondary coil may also intersect the aforementioned magnetic flux in a secondary coil, Big electromotive force is acquired and the electric power transmited to a secondary coil from a primary side coil can be increased more.

[0028]If it is in the invention of the present invention according to claim 7, it is arranging the above-mentioned plane coil by hot stamping in the contact wall of the interconnecting part of a power supply system or load apparatus, and it becomes possible to manufacture the power transmission part of non-contact power transmission equipment by low cost. By hot stamping, since a plane coil can be arranged also to the curved surface part of a housing, the flexibility of the housing form of goods increases.

[Translation done.]

Drawing selection Fig.7



[Translation done.]

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(71) Applicant: • HANRIM POSTECH CO., LTD.
(72) Inventor: • KOOK, YOON SANG

(54) NON-CONTACT CHARGER PERFORMING WIRELESS DATA COMMUNICATION AND POWER TRANSMISSION, A CHARGING BATTERY-PACK, AND A MOBILE DEVICE USING NON-CONTACT CHARGER, CAPABLE OF RECOGNIZING A CHARGING STATE BY THE BATTERY-PACK OF THE MOBILE DEVICE

(57) Abstract:

PURPOSE: A non-contact charger performing wireless data communication and power transmission, a charging battery-pack, and a mobile device using the non-contact charger are provided to supply power while stably transmitting and receiving data.

CONSTITUTION: A non-contact charger performing wireless data communication and power transmission includes a USB(Universal Serial Bus) connector(10), a USB driver block(20), and an MPU (Micro processor Unit) block(30), and a primary coil. The MPU block controls a serial resonant connector(50), a current sensing block (60), and a power supplying member. The serial resonant converter converts and aggregates a data signal transmitted and received between the USB driver block and the mobile device, and a power signal supplied from the USB connector to the mobile device. The current sensing block analyzes a signal of a secondary coil transmitted from the primary coil sensing a load modulation signal by the secondary coil at the side of the mobile device which corresponds to the primary coil and recognizes the mobile device, monitors the primary coil and the secondary coil to control a charging voltage with a stable voltage, and transmits the signal to the MPU block.

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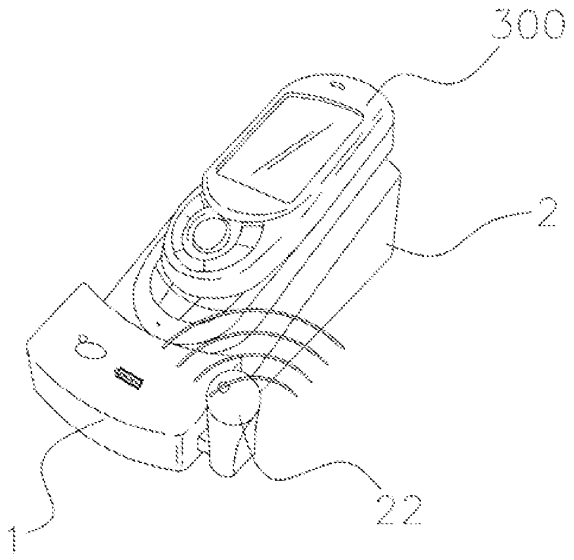
No.	Content
1	It is equipped to one side of the equipment body (2) of the wearable hull shape and one side is connected to USB port of the computer or the notebook and jack bond and separation is possible connected USB connector (10) ; USB connector (10). In order to transmit and receive the computer or the notebook and data data are connected to USB driver block (20) ; USB connector (10) entrusted by USB protocol. In order that the power supplied from the computer or the notebook is supplied to the portable terminal or data are transmitted and receive in order to wirelessly transmit data signal from the MPU block (30); controlling the series resonance converter (50), and the member for the current sensing block (60) and electric power supply and series resonance converter (50) and electric source signal in the portable terminal the primary coil (70) formed in upper part of the equipment body (2) is included. The supplied electric source signal is configured to be converted into the portable terminal from data signal and USB connector (10) in which series resonance converter (50) is transmitted and received between USB driver block (20) and portable terminal Non-contact charger capable of the wireless data communication and the power deliver noising load modulation signal by the secondary coil (80) and is configured to transmit the sensed signal with the MPU block (30) and analyzes the sensed signal about the secondary coil (80) transmitted from the MPU block (30) through the primary coil (70) and current sensing block (60) and is configured to recognize the portable terminal and control the charging voltage to the stabilized voltage of the portable terminal corresponding to the current sensing block (60) in the primary coil (70).
2	The non-contact charger in which the wireless data communication and the power deliver which are the LLC full bridge series resonance converter are possible of claim 1, wherein primary coil (70) are series resonance converter (50) is the half-wave type or the full wave type the serial / parallel resonant converter it is formed with the circular form, and the square or the polygon it is comprised of any one of FPCB of decoupling-type transformer, PCB, and the coil and ferrite core.
3	As for claim 1, the non-contact charger capable of the wireless data communication and the power deliver which more includes the display section (3) in which the signal is transmitted from the primary coil (70) and indicating the state of charge of the rechargeable battery (230) with the control of the MPU block (30) sensing the state of battery charging signal among the gate drive block (40), and secondary coil (80) signal that are equipped and include the boots trap gate driver between USB driver block (20) and the MPU block (30) and series resonance converter (50).
4	As for claim 1, the detecting circuit of dust sensor (90), and non-contact charger capable of the wireless data communication and the power deliver which further includes the ion source (91) generating anion and sprays the antiseptic spray for the bacillus extermination the dust of the himetal (71), and equipment body (2) inner portion and circuit wherein the current flowing through the primary coil (70) it is connected to the thermal protection circuit part (92) which detects the temperature of equipment body (2) inner portion blocks the current it is too much or the inner temperature overheats.

No.	Content
5	Question :
6	As for claim 1, the non-contact charger capable of the wireless data communication and the power deliver which more includes the portable terminal ID detection part wherein USB driver block (30) senses and distinguishes the identification of portable terminal the IrDA port (42) is further that sends and receives each other with the portable terminal by the control of the MPU block (30) data signal further includes 1 and being transformed to the IrDA with IrDA signal converter (21) the IrDA signal transducer (31) converted into USB protocol and IrDA.
7	The battery pack for charge in which the charger circuit (220) transmitting the charge electricity among claim 5 to claim 6 and claim 5 with fillers body (201) configured in the secondary coil (80) it is contactable with the equipment body (2) one side of the non-contact charger (1) of any one claim from each other and for sending and receives data signal in the primary coil (70) and non contact state with the magnetic field and being transmitted the power signal, is one side, fillers control unit (210) in which the primary coil (70) and data signal transmitted and received it transmits in the rechargeable battery (230) the power signal transmitted from the primary coil (70) is processed it is connected to the secondary coil (80) of fillers body (201) inner one side are processed, and the control of fillers control unit (210) in the rechargeable battery (230) is included and charger circuit (220) is configured to be the power source of the rechargeable battery (230) supplied to the portable terminal.
8	As for claim 7, the battery pack for charge comprising the identification part, and the charging detecting part wherein fillers control unit (210) transmits with the non-contact charger (1) through the secondary coil (80) and primary coil (70) the identification on the thing is asked that is first connected from non-contact charger (1), and the charging detecting part senses the charge degree of rechargeable battery (230) and transmitted with the non-contact charger (1).
9	The battery pack for charge of claim 7, wherein fillers body (201) comprises the integrated pack which is composed of the decoupling-type pack formed with the separate body so that portable terminal, the separation and tightening be possible ; and it is input inside the main case of portable terminal and is or integrally formed, and secondary coil (80) it is comprised of any one of ferrite core ; and it is formed with the circular form, and the square of the polygon with FPCB of the decoupling-type transformer, FCB, and the coil.
10	As for claim 9, the battery pack for charge wherein the fillers body (201) of decoupling-type pack more comprises the terminal block (240) that supplies to the portable terminal the power source of the rechargeable battery (230) by the control of fillers control unit (210).

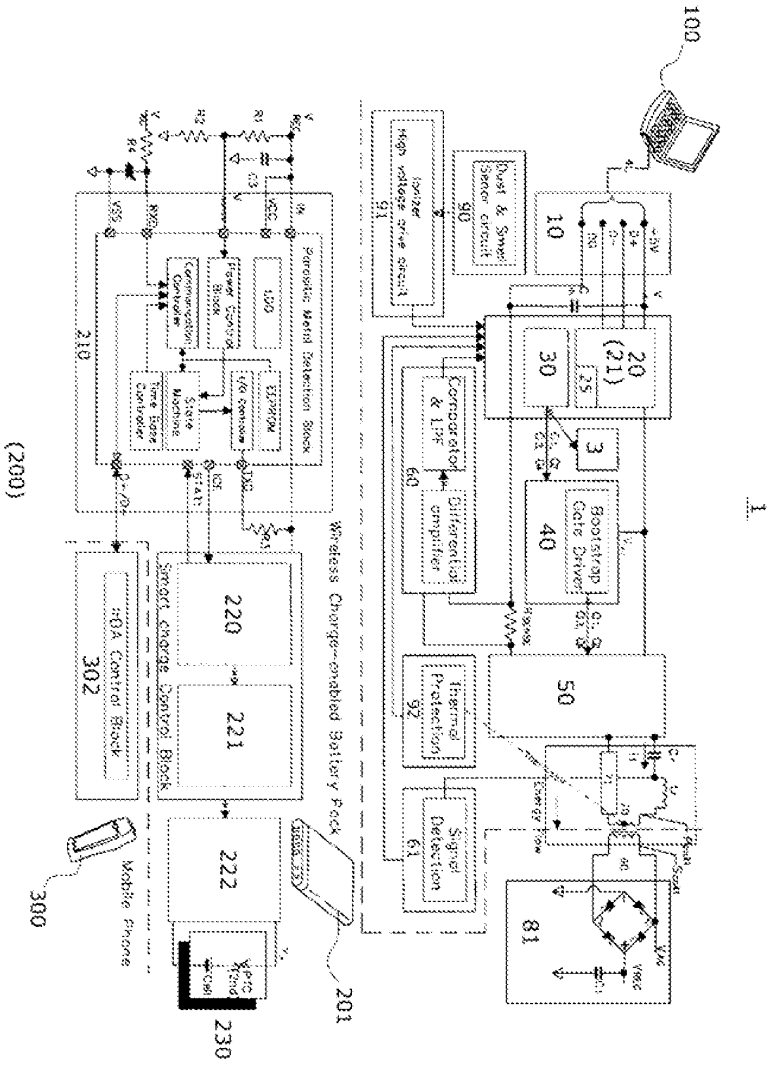
No.	Content
11	As for claim 8, the electricity of being induced from the secondary coil (516) which of charge receive module (517) is wound surrounds the battery cell (512), charged through the wireless power receiving circuit (513) battery cell (512) bottom surface, and up and down four sides The battery pack for charge including the shielding member (501) covering the magnetic field in the wireless power receiving circuit (513) it is equipped between the shielding plate (515) (515-1) (515-2) (515-3) (515-4) which is comprised of the Al, and the Cu or the Ni Alloy metal and protects the battery cell (512) from the magnetic field, and upper shielding board (515) and charge receiver module (517) wireless power receiving circuit (513) are comprised of the Al, and the Cu or the Ni Alloy metal.
12	Portable terminal using the non-contact charger which is provided with the power source from the non-contact charger (1) and transmits and receives data of claim 11.
13	The portable terminal having the battery pack for charge (200) and includes the IrDA port (22) of IrDA controller (302) and non-contact charger (1) and the IrDA port which data communicates including the filler body (201) of the integrated pack of claim 11.
14	Portable terminal using the non-contact charger comprising the charge block (330) filling the terminal block (240) and the electricity of being electrically contacted and being connected to the electricity receiving terminal block (510) provided with the power source and being connected to electricity receiving terminal block (510) and being transformed in the DC/DC converter (320) of converting electricity and DC/DC converter (320) of the battery pack for charge (200) of claim 11.

1
100
10
+5V
Dust & Smoke Sensor circuit
20
I2C
30
3
Bootstrap Gate Driver
40
50
81
Energy Flow
Thermal Protection
32
Signal Detection
61
Differential amplifier
Comparator & LPF
60
91
Ionizer High voltage drive circuit
Parasitic Metal Detection Block
LDO
Power Control Block
Communication Controller
EEPROM
I/O Controller
State Machine
Time Base Controller
210
201
Wireless Charge-enabled Battery Pack
220
221
Smart Charge Control Block
222
230
USB Controller for Mobile
301
Mobile Phone
300
(200)

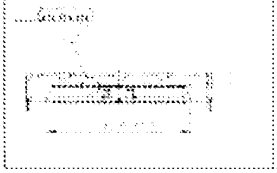
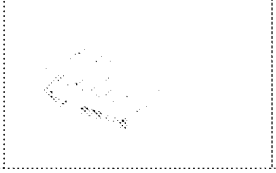
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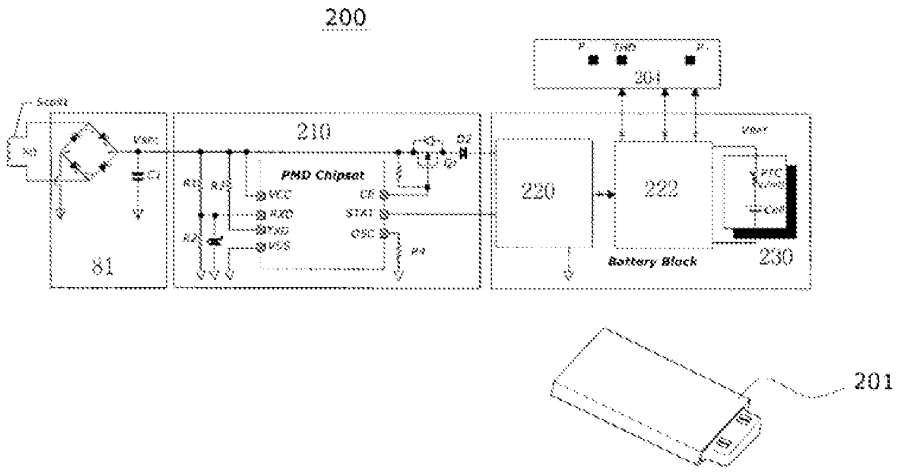
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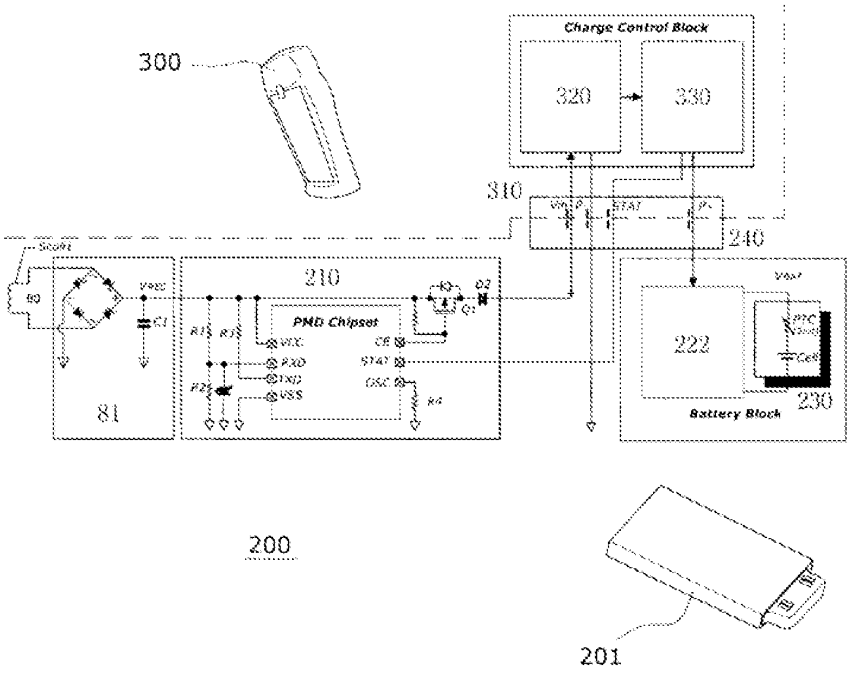
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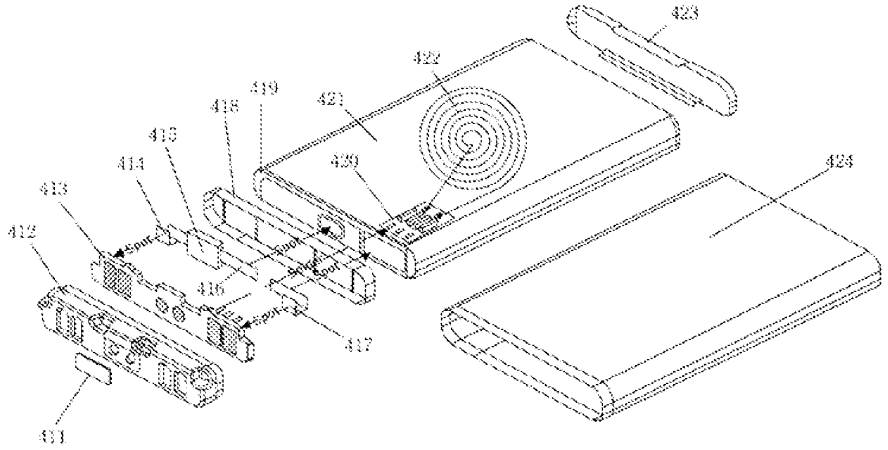
전용폰 충전 거치대 수납	USB 컨넥터	Cigar 소켓
		

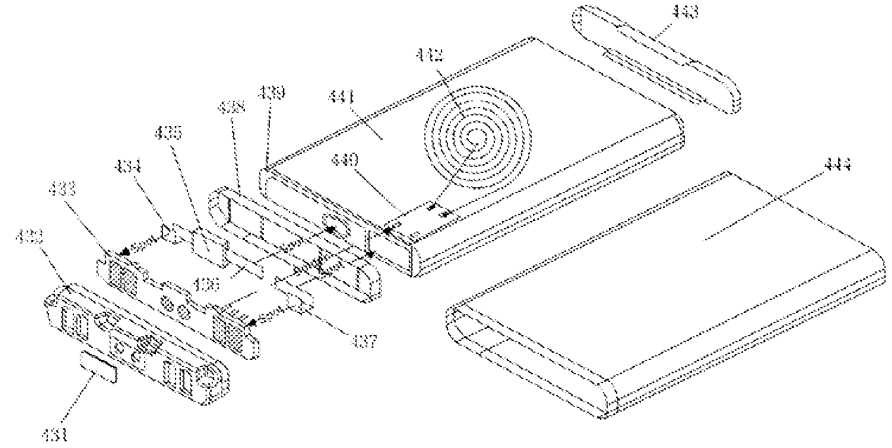
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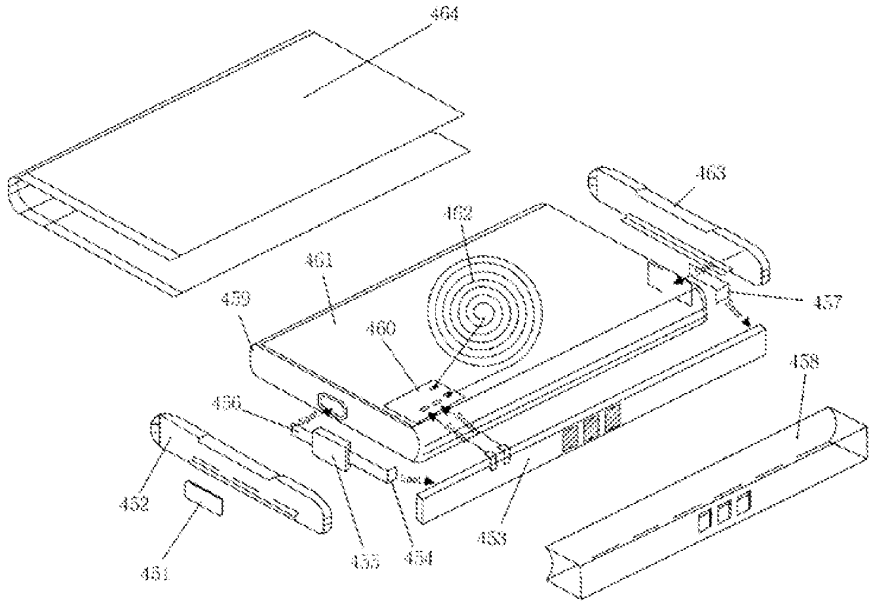

200
301
210
PMD Chipset
220
222
230
Battery Block
81
201

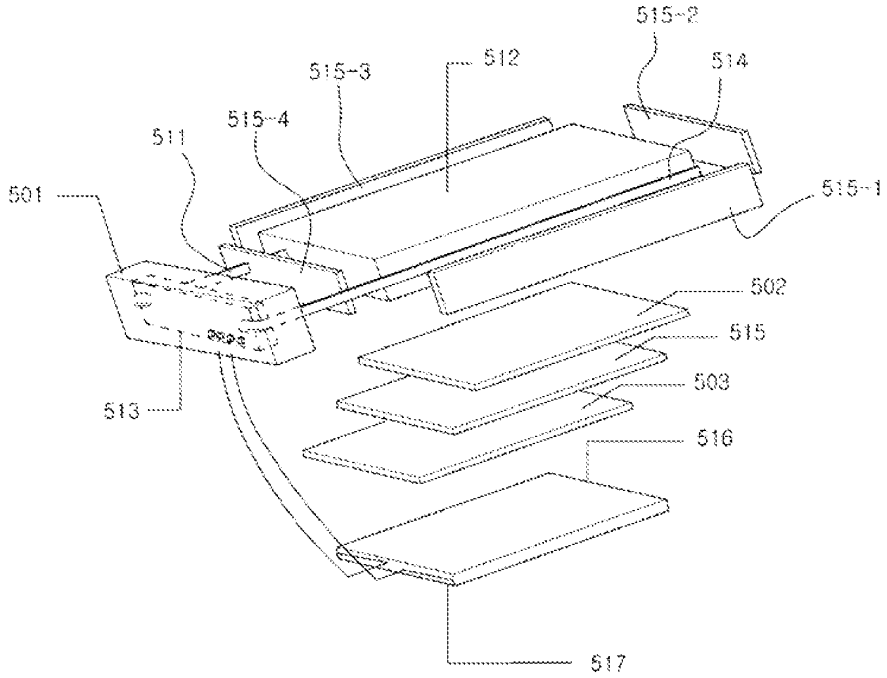
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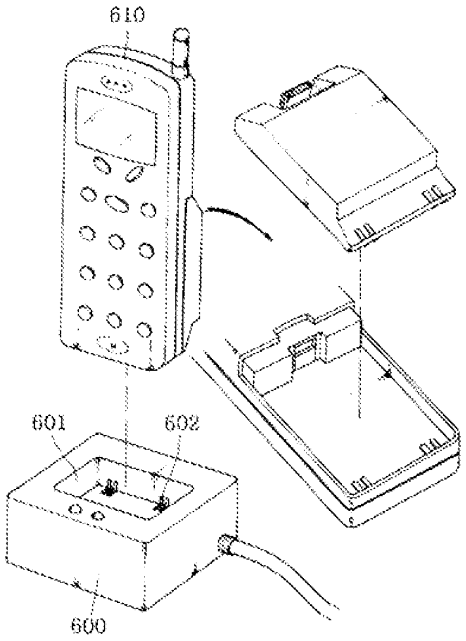

300
Charge Control Block
320
330
310
240
210
PMD Chipset
222
230
Battery Block
81
200
201


423
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421
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418
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515-2
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PATENT ABSTRACTS OF JAPAN

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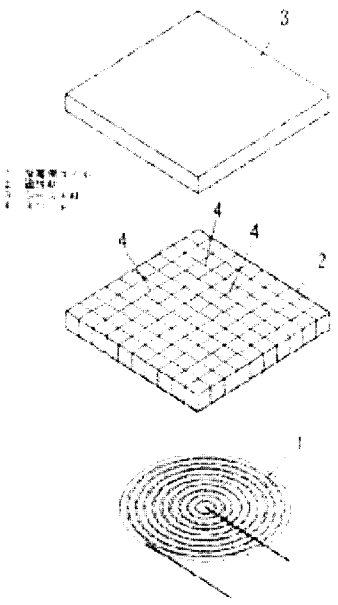
(51)Int.Cl. *H01F 38/14 (2006.01)*
H02J 17/00 (2006.01)

(21)Application number : 2008-039209
(22)Date of filing : 20.02.2008

(71)Applicant : PANASONIC ELECTRIC WORKS CO LTD
(72)Inventor : KITAMURA KOTA
SUZUKI MASAYUKI
YABUUCHI HIDEKAZU

(54) NON-CONTACT POWER TRANSMISSION APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To increase power transmission efficiency by suppressing generation of an eddy current in a magnetic material.
SOLUTION: This non-contact power transmission apparatus is provided with a secondary power-receiving coil 1 for receiving power from a primary power transmitting coil, and a magnetic material 2 is arranged at least on one surface of the coil 1. The magnetic material 2 has slits 4 formed on a surface parallel to facing surfaces of both the coils. The slits formed on the magnetic material for improving power transmission efficiency suppresses an eddy current generated by passage of magnetic flux through the magnetic material, whereby heat loss is reduced.



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CLAIMS

[Claim(s)]
[Claim 1]
While it is non-contact transfer-of-power apparatus provided with a coil for downstream power receiving for receiving electric power from a coil for primary side power transmission and a magnetic material is arranged by at least one side of the above-mentioned coil for downstream power receiving, Non-contact transfer-of-power apparatus, wherein a slit is formed in a surface where the above-mentioned magnetic material is parallel to an opposed face of both the above-mentioned coils.
[Claim 2]
The non-contact transfer-of-power apparatus according to claim 1, wherein the above-mentioned slit is formed in a surface by the side of a coil for downstream power receiving of a magnetic material as what does not penetrate a magnetic material.
[Claim 3]
The non-contact transfer-of-power apparatus according to claim 1 or 2, wherein the above-mentioned slit is the thing of a direction which was along in the direction of magnetic flux which flows through inside of a magnetic material.
[Claim 4]
Non-contact transfer-of-power apparatus of a description in any 1 item of Claims 1-3, wherein the above-mentioned slit is densely provided by portion with high density of magnetic flux which flows through inside of a magnetic material.

[Translation done.]

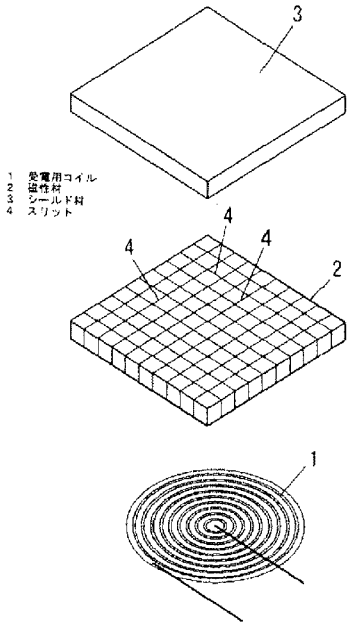
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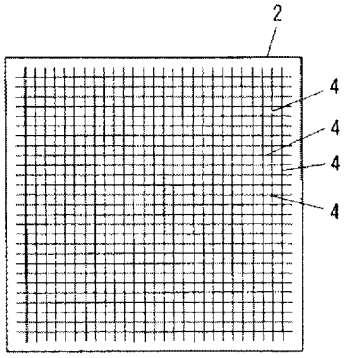
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DRAWINGS

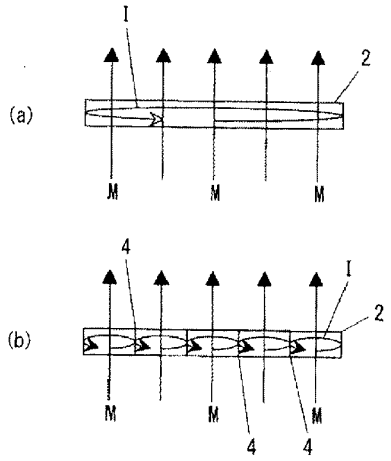
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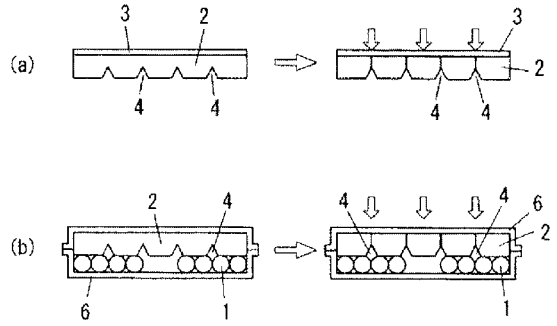
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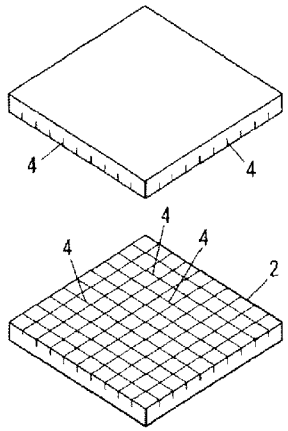
[Drawing 3]



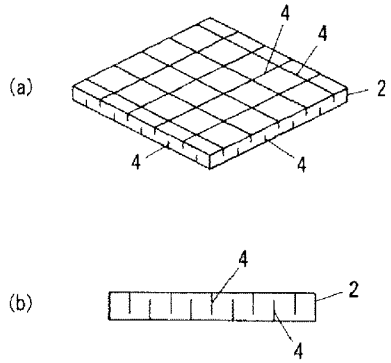
[Drawing 4]



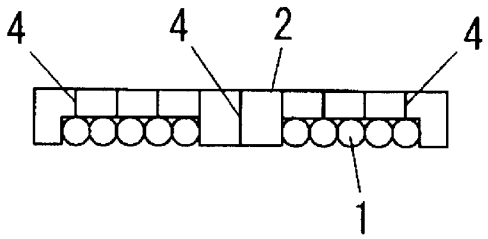
[Drawing 5]



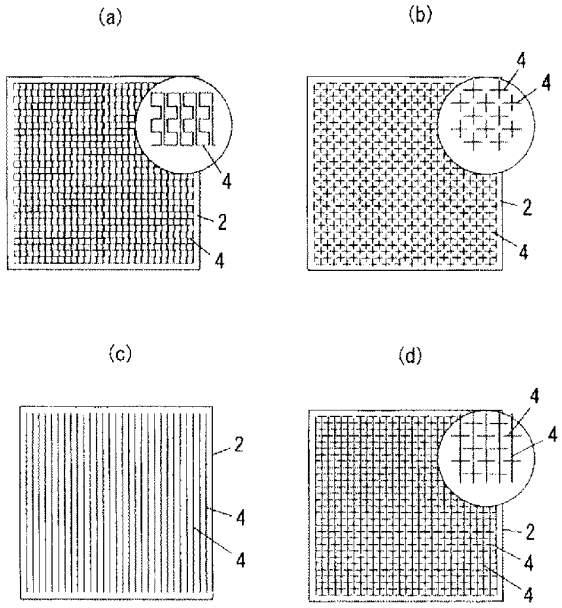
[Drawing 6]



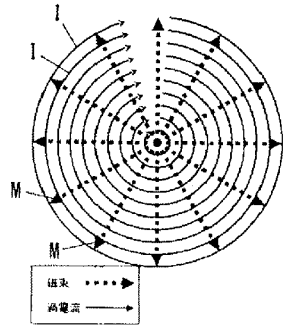
[Drawing 7]



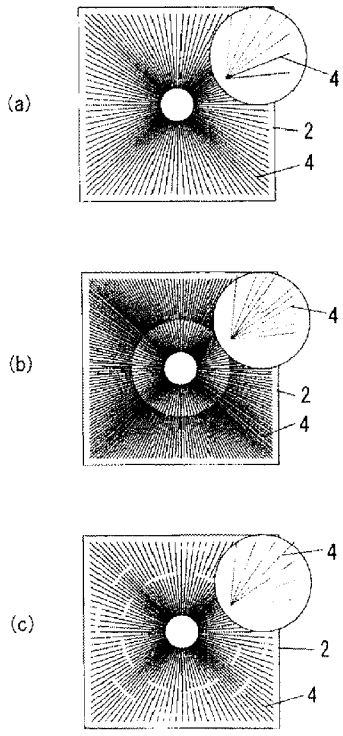
[Drawing 8]



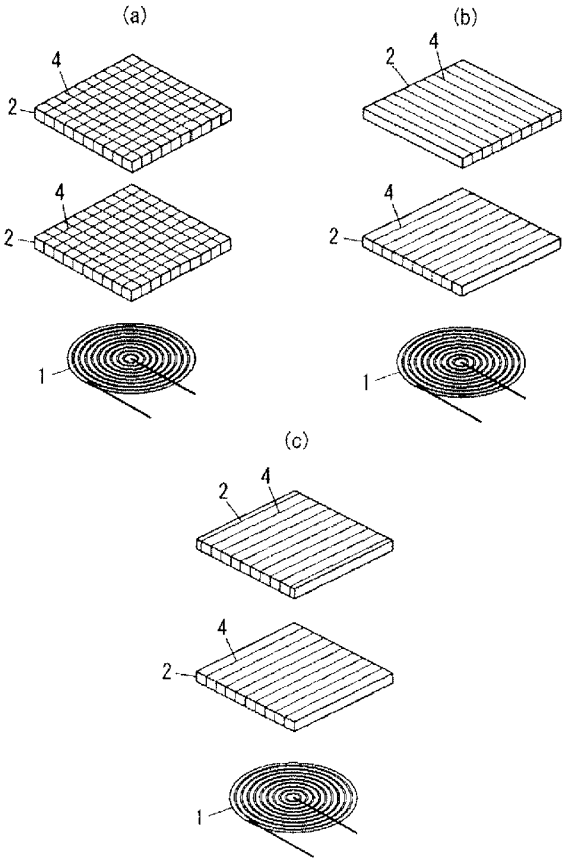
[Drawing 9]



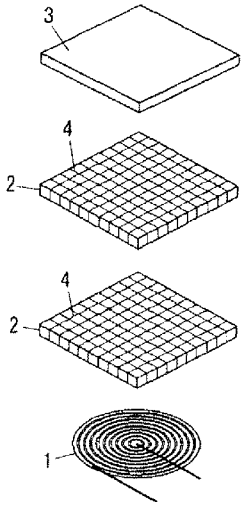
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]

Electronic Patent Application Fee Transmittal	
Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	21736593
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	23910
Filer:	Karl Kenna/Christopher Burnharte
Filer Authorized By:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	11-MAR-2015
Filing Date:	25-MAY-2011
Time Stamp:	19:41:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	5546
Deposit Account	061325
Authorized User	
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	afpa_1007us1_IDS_Trans_031115.pdf	110360 a93d05f81c2e8ee45682bbffeff7ea1d92b1bacb	no	2
Warnings:					
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2	Non Patent Literature	41_UnknownAuthor_WirelessPowerSpecificationPart1.pdf	2657502 78189ec3c3b07cf8e3fdba60b0fc9045f161d59e	no	83
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3	Other Reference-Patent/App/Search documents	afpa_1013jp0_Examiners_Reconsideration_Report.pdf	59723 065c72f96d595c143462c880698adcdc0702de66	no	1
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10	Other Reference-Patent/App/Search documents	Office_Action_12769586_060214.pdf	781937 bfdf60acb68c515c66862e5c66522a33b3f3fa02	no	23
Warnings:					
Information:					
11	Other Reference-Patent/App/Search documents	Office_Action_13708520_081414.pdf	340300 43d8f6fe9a79fc007341279364504b60f3df6d8c	no	9
Warnings:					
Information:					
12	Other Reference-Patent/App/Search documents	Office_Action_13115811_082014.pdf	480993 ac36fb33bdb82ead9b739a9211027190420a714a	no	14
Warnings:					
Information:					
13	Other Reference-Patent/App/Search documents	Office_Action_14135082_120514.pdf	422576 c6a9e8116472aef0bad77bdf743d67917763830a	no	14
Warnings:					
Information:					
14	Other Reference-Patent/App/Search documents	Office_Action_13708520_031115.pdf	370160 d58024e0ec381a9fb20e90f478e2c395f461c8f1	no	10
Warnings:					
Information:					
15	Information Disclosure Statement (IDS) Form (SB08)	afpa_1007us1_IDS.pdf	613196 8d7aa61baf8bb5c2afd00b801e6e19faeadcb6fa	no	6
Warnings:					
Information:					
16	Foreign Reference	JP2003045731_Translation.pdf	438057 b3b6d29754e68100711434b1c0c1bbd4748a1eec	no	7
Warnings:					
Information:					

17	Foreign Reference	JP2000341885_Translation.pdf	2260312 f8580a9bf4bbc0e715e0db9e48bba64352f1cf21	no	7
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18	Foreign Reference	KR100836634_Translation.pdf	1469090 0ad043f63af3ee23b2bf4cde5b3f390a2374d331	no	11
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19	Foreign Reference	JP2009200174_Translation.pdf	305285 81004351c0ca4beca31391db925839a057cfdc26	no	7
Warnings:					
Information:					
20	Fee Worksheet (SB06)	fee-info.pdf	30584 40c7ff6a7c5e736b7d8351e4962544b6b1d7f47b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	13193128		

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:		PATENT APPLICATION	
Inventor(s):	Partovi, Afshin		
Appl. No.:	13/115,811	Art Unit:	2859
Confirm. No.:	4181	Examiner:	Berhanu, Samuel
Filed:	May 25, 2011		
Title:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	**Customer No. 23910**	

TRANSMITTAL LETTER RE INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.56

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

Sir:

It is requested that the information identified in this statement be considered by the Examiner and made of record in the above-identified application. This statement is not intended to represent that a search has been made or that the information cited in the statement is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56. If this is a continuation, divisional or continuation-in-part application, it is understood that the Examiner will consider all information which was considered by the Office in a parent application. MPEP §609. Such information therefore is not listed herein unless it is desired that the information be printed on a patent issuing from the subject application.

Enclosed with this statement are the following:

✓ Form PTO/SB/08a. The Examiner is requested to initial the form and return it to the undersigned in accordance with M.P.E.P. §609.

✓ As allowed under 37 C.F.R § 1.98(a)(2)(ii), no copies of the U.S. patents and U.S. patent application publications are enclosed, unless required by the office.

This statement should be considered because:

___ **37 C.F.R. §1.97(b)**. This statement qualifies under 37 C.F.R. §1.97, subsection (b) because:

(1) It is being filed within three months of the filing date of an application other than a continued prosecution application under § 1.53(d);

-- OR --

(2) It is being filed within 3 months of entry of a national stage;

-- OR --

(3) It is being filed before the mailing date of the first Office Action on the merits,

-- OR --

(4) It is being filed before the mailing date of the first Office Action after the filing of a Request for Continued Examination under 37 C.F.R. §1.114.

✓ **37 C.F.R. §1.97(c)**. Although it may not qualify under subsection (b), this statement qualifies under 37 C.F.R. §1.97, subsection (c) because:

(1) It is being filed before the mailing date of a FINAL Office Action, a Notice of Allowance, or an action that otherwise closes prosecution in the subject application, whichever occurs first.

-- AND *(check at least one of the following)* --

__ (a) It is accompanied by a STATEMENT as set forth in 37 C.F.R. §1.97(e).

-- OR –

✓ (b) It is accompanied by the fee set forth in 37 C.F.R. §1.17(p).

✓ ***Fee Authorization.*** The Commissioner is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Account No. 06-1325.

Respectfully submitted,

MEYER IP LAW GROUP

Date: March 11, 2015

By: /Karl F. Kenna/
Karl F. Kenna
Reg. No. 45,445

Customer No. 23910
MEYER IP LAW GROUP
410 Pacific Avenue
San Francisco, California 94133
Telephone: (415) 362-3800

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		PATENT APPLICATION	
Inventor(s):	Afshin Partovi, et al.		
Appln. No.:	13/115,811	Art Unit:	2859
Confirm. No.:	4181	Examiner:	Berhanu, Samuel
Filed:	May 25, 2011		
Title:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	**Customer No. 23910**	

REPLY TO OFFICE ACTION UNDER 37 C.F.R. §1.111

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

Sir:

This REPLY is in response to the Office Action mailed August 20, 2014.

Amendments

Please amend the above-identified application as follows:

Amendments to the Claims begin on Page 2.

Remarks begin on Page 8.

In the Claims:

Please amend Claims 1, 11 and 20; cancel Claims 21 and 35; and add Claims 37 and 38, all as shown below. Applicant respectfully reserves the right to prosecute any originally presented claims in a continuing or future application.

1. (Currently Amended) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a regulator, coupled to the output of the receiver or the battery, that

~~determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature,~~

~~senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery, and~~

regulates one or more of the current drawn, or [[the]] an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of ~~one of predefined or appropriate power~~ parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with [[a]] the base unit to ~~one or more~~

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or

the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

2. (Original) The mobile device of claim 1 further comprising a shell, wherein the receiver is attached to the shell.

3-10. (Canceled).

11. (Currently Amended) A system for use with a mobile device for charging or powering the mobile device inductively, comprising:

a base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;

wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;

wherein one or both of the mobile device and a battery have

a receiver and particular charging characteristics associated therewith,

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit, and

a regulator, coupled to the output of the receiver or the battery, that

~~determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature,~~

~~senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery, and~~

regulates one or more of the current drawn, or [[the]] an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of ~~one of predefined or appropriate power~~ parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to ~~one or more~~

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

12. (Original) The system of claim 11 wherein one or more of the coils are manufactured on printed circuit boards and are manufactured to have a low resistance.

13. (Original) The system of claim 11 wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device is placed close to the primary coil of the base unit or the presence of the mobile device is to be detected.

14. (Original) The system of claim 11 wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices.

15. (Original) The system of claim 14 wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device placed close to or aligned with the primary coil of the base unit.

16. (Original) The system of claim 15 wherein the presence of the mobile device placed close to or aligned with the primary coil of the base unit is detected by monitoring the current passing through the primary coil or the switching means.

17. (Original) The system of claim 11 wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

18. (Original) The system of claim 17 wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device.

19. (Original) The system of claim 11 wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is

perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a device is placed directly on top of a coil in the base.

20. (Currently Amended) The system of claim 11 further comprising a battery coupled to and powering the base unit, and wherein the battery can be occasionally charged by an external power supply or solar cell to maintain a charge sufficient to power the inductive device for a period of time.

21. (Canceled).

22. (Original) The system of claim 11, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

23. (Original) The system of claim 11 wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

24. (Original) The system of claim 11 wherein the base unit can be integrated into any of briefcases, bags, or clothing.

25. (Original) The system of claim 11 wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

26. (Original) The system of claim 11 wherein one or more of the primary coils are stacked to improve transfer efficiency.

27. (Original) The system of claim 11, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and activates a coil or wire near the mobile device to charge or provide power the mobile device.

28. (Original) The system of claim 27, wherein the charger or power supply senses the location of the mobile device by sensing a change in a resonant circuit in the charger or power

supply when the mobile device is nearby.

29. (Original) The system of claim 11, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

30. (Original) The system of claim 11, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices placed inside would be charged or powered inductively.

31. (Original) The system of claim 11, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

32. (Original) The system of claim 11, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

33. (Original) The system of claim 11, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

34. (Original) The system of claim 11, wherein the mobile device to be charged or powered includes a charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

35. (Canceled).

36. (Original) The system of claim 11, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

37. (New) A system capable of inductive powering or charging comprising:

a battery, wherein one or both of a device and the battery have particular charging

characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the device, wherein the receiver is one of attached to or incorporated into the battery or the device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a regulator, coupled to the output of the receiver or the battery, that

regulates one or more of the current drawn, or an output voltage or output current provided by the receiver, to the device or battery, to be within a range of parameters for the device or the battery;

wherein different devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the device or the battery, for use by the base unit to provide power transfer to the receiver and to the device and the battery according to their particular charging characteristics.

38. (New) The system of claim 37 wherein the system is included within an automobile.

Remarks

This REPLY is in response to the Office Action mailed August 20, 2014.

I. Applicant's Interview Summary

Applicant thanks Examiner Berhanu for the courtesy of a telephone interview with Karl Kenna on August 7, 2014, during the course of which interview the participants generally discussed the application, as set forth in the Examiner's Applicant-Initiated Interview Summary mailed August 20, 2014.

II. Request for Interview

In the event the amendments and remarks provided herein fail to place the application in condition for allowance, Applicant respectfully requests the opportunity to further interview with the Examiner at the Examiner's convenience, and prior to issuance of a subsequent Office Action, to assist in expediting prosecution.

III. Summary of Examiner's Rejections

Prior to the Office Action mailed August 20, 2014, Claims 1, 2 and 11-36 were pending in the Office Action. In the Office Action, Claims 1-8, 11-12, 22, 30-31 and 36 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung et al (WO 2006/001557, hereinafter Jung) in view of Lyon (U.S. Publication No. 2004/0145342) and Hui (U.S. Publication No. 2005/0189910). Claims 13, 15-16 and 34-35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung, Hui and Van Lerberghe (U.S. Patent No. 5,925,814, hereinafter Van). Claims 14, 17-18, 23-29 and 37 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Hui and Lyon. Claim 19 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Chen et al (U.S. Patent No. 6,331,744, hereinafter Chen). Claims 20-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Hui, Lyon and Fukuda et al (U.S. Patent No. 4,311,953, hereinafter Fukuda). Claim 32 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Sudo (JP 408000838). Claim 33 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon, Hui and Charych (U.S. Patent No. 6,798,716).

IV. Summary of Applicant's Amendment

The present Reply amends Claims 1, 11 and 20; cancels Claim 21 and 35; and adds

Claims 37 and 38, leaving for the Examiner's present consideration Claims 1-2, 11-20, 22-34, and 36-38.

V. Claim Rejections under 35 U.S.C. §103(a)

In the Office Action, Claims 1-8, 11-12, 22, 30-31 and 36 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung (WO 2006/001557) in view of Lyon (U.S. Publication No. 2004/0145342) and Hui (U.S. Publication No. 2005/0189910).

Claim 1

Claim 1 has been amended to recite:

1. (Currently Amended) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to a base unit;

a regulator, coupled to the output of the receiver or the battery, that

regulates one or more of the current drawn, or an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to

detect, identify and authenticate the receiver with the base unit, as provided by the identification component,

determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,

verify the continued presence of the receiver near the base unit, and

> *communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.*

Jung describes an embodiment in which a wireless charging pad 200 according to the [ ] invention includes a controller 240 for reading the RFID tag and controlling charging, drive circuits 220 and 220', and primary coils Pcoil1 and Pcoil2. The wireless charging pad 200 may include various input ports having DC inputs, and generates the switching patterns of the primary coils Pcoil1 and Pcoil2 through the drive circuits 220 and 220', respectively, and performs a control function of detecting portable devices placed on the wireless charging pad 200 and indicating the energy saving mode and the charged status of each of the portable devices. The drive circuits 220 and 220' are On/Off switching devices for switching the primary coils Pcoil1 and Pcoil2, respectively, each of which is composed of an upper switch and a lower switch. The drive circuits 220 and 220' are each constructed using a half-bridge or full-bridge resonant converter (serial, parallel or serial-parallel resonant converter). Referring to FIG. 4, in the wireless charging pad 200 according to the [ ] invention, the primary side of the transformer is constructed in such way that the two primary coils Pcoil1 and Pcoil2 are wound on a planar core, which is formed by combining small cobalt-based amorphous metallic cores, such as Co, Fe, Ni, B and Si, or ferrite cores in various shapes, in directions perpendicular to each other as shown in FIG. 4. In this case, the switching patterns perform switching so that a phase difference of 90 degrees occurs between the two primary coils Pcoil1 and Pcoil2. Accordingly, induced energy can be received regardless of the location of the portable device that is placed on the wireless charging pad 200 and has the battery pack 100 equipped with the charging receiver module 100. The input form of the wireless charging pad 200 is described below. A control power source supplies the driving power of the controller 240 and the drive circuits 220 and 220' using a flyback converter in a 110/220 V direct drive fashion. In the resonant converter, DC power obtained by rectifying AC power in a 110/220 V switching fashion is always set to a 110 V input condition. DC power (12, 24, 48 V) is generated using the flyback converter for free voltages ranging from 86 to 265 V and is used as the input power of the resonant converter, and forms the driving power of the controller 240 and the drive circuits 220 and 220' using a regulator. The controller 240 performs both a function of reading an RFID tag and a function of controlling charging. (Pages 17-20).

Lyon describes a method and apparatus used for adaptive inductive charging of a

device. Charging includes detecting the presence of a device capable of receiving an inductive charge, determining a set of parameters for inductively charging the device, and transmitting an inductive charge corresponding to the set of parameters for charging the device. Another aspect of charging includes combining at least two inductive fields transmitted at different angles to each other, delivering the combined inductive field at an orientation to the device, measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device, and charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level. (Abstract).

Lyon further describes an embodiment in which inductive charger 106 includes a variable frequency resonant inverter for multiple inductors 206, an alternating current source 208, a set of inductors 210 through 212, an input frequency control 214, a memory 216, a processor 218, and a communication port 243 used to communicate over a separate data communication channel 220. Variable frequency resonant inverter for multiple inductors, hereinafter inverter 206, senses input voltage changes over power source 208 and controls switching frequency of the inverter to provide a relatively constant power over inductors 210 through 212. Input frequency control 214 maintains an input frequency to inverter 206 as needed by the particular device and above the resonant frequency of the circuit. (Paragraphs [0018]-[0019]).

In the Office Action, it was asserted that Jung discloses, in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith; a receiver for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device; a regulator, that determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature, wherein different mobile devices and batteries can have different charging characteristics associated therewith; and wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit, verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

It was further asserted that Jung does not disclose explicitly, wherein a regulator senses one or more of a current drawn from the receiver, or an output voltage or output current

provided to the mobile device or the battery; but that Lyon discloses, in Figures 1-2, a regulator that senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery; and that it would have been obvious to a person having ordinary skill in the art, at the time the invention was made, to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

It was further asserted that Hui discloses in Figure 1, wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil ant that it would have bene obvious to a person having ordinary skill in the art at the time the invention was made to use different coil arrangements in Jung's apparatus such as the planar coils as taught by Hui in order to cover more charging surface; and (in the *Response to Arguments*) that Jung discloses a protective device 120 located in the battery for monitoring charged status of the battery and controlling charging frequency.

To more clearly recite the embodiment therein, Claim 1 has been amended to recite that, in accordance with an embodiment, the mobile device comprises an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to a base unit; and wherein the receiver communicates with the base unit to detect, identify and authenticate the receiver with the base unit, as provided by the identification component, determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil, verify the continued presence of the receiver near the base unit, and communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

In view of the above remarks, Applicant respectfully submits that Claim 1, as currently amended, is neither anticipated by, nor obvious in view of the cited references, when considered alone or in combination. Reconsideration thereof is respectfully requested.

Claim 11

The remarks provided above with regard to Claim 1 are herein incorporated by reference. Claim 11 has been similarly amended to more clearly recite the embodiment therein. For similar reasons as provided above, Applicant respectfully submits that Claim 11, as currently amended, is likewise neither anticipated by, nor obvious in view of the cited

references, when considered alone or in combination. Reconsideration thereof is respectfully requested.

Claims 2 and 12-36

Claims 21 and 35 have been canceled, rendering moot the rejection of these claims. Claims 2, 12-20, 22-34 and 36 depend from and include all of the features of one of Claims 1 or 11. These claims are not addressed separately herein. However, Applicant respectfully submits that these claims are allowable at least as depending from an allowable independent claim, and further in view of the amendments to the independent claims, and the remarks provided above. Reconsideration thereof is respectfully requested.

VI. Additional Amendments

Claims 37 and 38 have been added by the present Reply. Subject to the approval of the Examiner, Applicant respectfully requests that new Claims 37 and 38 be included in the application, and considered therewith.

VII. Conclusion

In view of the above amendments and remarks, it is respectfully submitted that all of the claims now pending in the subject patent application should be allowable, and reconsideration thereof is respectfully requested. The Examiner is respectfully requested to telephone the undersigned if he can assist in any way in expediting issuance of a patent.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

Date: February 19, 2015

By: /Karl F. Kenna /
Karl F. Kenna
Reg. No. 45445

Customer No.: 23910
MEYER IP LAW GROUP
410 Pacific Avenue
San Francisco, California 94133
Telephone: (415) 362-3800
Fax: (415) 362-2928

Electronic Patent Application Fee Transmittal	
Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Karl Kenna/Christopher Burnharte
Attorney Docket Number:	AFPA-01007US1
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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	1253	1	1400	1400
Miscellaneous:				
			Total in USD ($)	**1400**

Electronic Acknowledgement Receipt	
EFS ID:	21546785
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	23910
Filer:	Karl Kenna/Christopher Burnharte
Filer Authorized By:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	19-FEB-2015
Filing Date:	25-MAY-2011
Time Stamp:	19:57:38
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1400
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Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

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Charge any Additional Fees required under 37 C.F.R. Section 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	Extension of Time	afpa_1007us1_EOT.pdf	162829 a5908dee2cf4239964584898 56ca537498aae1a6	no	2
Warnings:					
Information:					
2		afpa_1007us1_reply_082014.pdf	109131 d9252e1d5f3af39062e312e1ee90bd612199e56a	yes	13

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	13

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30913 783fb3036015848c3ae651d51f63f0c3c6dc416a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	302873		

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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.

PTO/AIA/22 (03-13)
Approved for use through 7/31/2016. OMB 0651-0031
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) AFPA-01007US1
Application Number 13/115,811	Filed 5/25/2011
For INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	
Art Unit 2859	Examiner Berhanu, Samuel

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):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1400
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ 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 061325.

☑ 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 45,445.

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

/Karl Kenna/	February 19, 2015
Signature	Date
Karl Kenna	415-362-3800
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 _____ 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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/115,811	Filing Date 05/25/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **02/19/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 28	Minus	** 36	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $210 =	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) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** 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 number found in the appropriate box in column 1.

LIE
/VICTOR BARLOW/

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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/115,811	Filing Date 05/25/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT	02/19/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 28	Minus	** 36	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ 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.
** 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 number found in the appropriate box in column 1.

SLIE
/BARBARA FRIESON/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/115,811	05/25/2011	Afshin Partovi	AFPA-01007US1	4181

23910 7590 08/20/2014

MEYER IP LAW GROUP
410 PACIFIC AVENUE
SAN FRANCISCO, CA 94133

EXAMINER	
BERHANU, SAMUEL	
ART UNIT	**PAPER NUMBER**
2859	

NOTIFICATION DATE	DELIVERY MODE
08/20/2014	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

officeactions@meyerip.com
pctoa@meyerip.com

Office Action Summary	Application No. 13/115,811	Applicant(s) PARTOVI ET AL.	
	Examiner SAMUEL BERHANU	Art Unit 2859	AIA (First Inventor to File) 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 *6/17/2014*.

☐ 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) *1,2 and 11-36* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2 and 11-36* is/are rejected.

8)☐ Claim(s) _____ 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 *5/25/2011* 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)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *06/17/2014*.

3) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *08/07/2014* .

4) ☐ Other: _____.

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

Continued Examination Under 37 CFR 1.114

2. 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 6/17/2014 has been entered.

Response to Amendment

This is in response to an amendment/response filed on 02/19/2009

Claims 1-2 and 11-36 are currently pending.

Claims 1 and 11 are amended.

Claims 3-10 are cancelled.

No new Claims added.

Claim Rejections - 35 USC § 103

3. 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.

4. 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 of this title, 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 negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

6. Claims 1-8, 11-12, 22, 30-31 and 36 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jung et. al. (WO 2006/001557) (hereinafter Jung) in view of Lyon (US 2004/0145342).

As to Claims 1 and 11, Jung discloses in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising:

a battery; [see figure 1, element 100 $ page 9, lines 1-2], wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver [charging receiver module, 110; see page 9 lines 14]] for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device:

a regulator [the controller 240; controls and regulates charging], that

determines characteristics of the mobile device or the battery [see page 6, lines 23-26, including one or more of a charming capacity, present charge, required voltage, or current temperature [determining charge status of the battery, see page 7, lines 1-3 & 18-21], wherein different mobile devices and batteries can have different charging characteristics associated therewith [see page 9, lines 14-17]; and

wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit [see page 9, lines 14-17] verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics [page 18, lines 2-15; see also figure 7, steps S100-S140].

Jung does not disclose explicitly, regulator senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery.

Lyon discloses in figures 1-2, regulator [controller 214] senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery [see paragraphs 019-0020].

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

Neither Jung nor Lyon explicitly discloses, wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil;

Hui discloses in figure 1, wherein the receiver coil [fig 6 shows that the coil is planner] coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil used to inductively generate a current in the receiver coil [see also paragraph 005; 0075];

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use different coil arrangements in Jung's apparatus such as planner as taught by Hui in order to cover more charging surface.

As to Claim 2, Jung discloses in Figure 2, wherein the receiver [110] is attached to the shell of the mobile device or battery.

As to Claim12, Jung discloses in figure 3, wherein one or more of the coils are manufactured by one of printed circuit boards or by etching or stamping or forming copper or other material and are manufactured to have a low resistance.

As to Claim 22, Lyon discloses in Figures 1-6, a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.

As to Claim 30, Lyon discloses in Figures 1-6, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices and/or batteries placed inside would be are charged or powered inductively.

As to Claim 31, Lyon discloses in Figures 1-6, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

As to Claim 36, Lyon discloses in Figures 1-6, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

8. Claim13, 15- 16 and 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Van Lerberghe (US 5,925,814) (hereinafter Van)

As to Claim 13, neither Jung nor Lyon discloses, wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected.

Van discloses in Figures 1-5, wherein the base unit includes a primary circuit having a switch (28) means for switching the primary coil on and off whenever the mobile device and/or battery is placed close to the primary coil of the base unit or the presence of the mobile device and/or battery is to be detected

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add a switching means in Jung's charger as taught by Van in order to avoid unnecessary power lose due to charging

As to Claim 15, Jung in combination with Lyon and Van discloses wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device and/or battery placed close to or aligned with the primary coil of the base unit.

As to Claim 16, Jung in combination with Lyon and Van, wherein the presence of the mobile device and/or battery placed close to or aligned with the primary coil of the base reunite is detected by monitoring the current passing through the primary coil or the switching means.

As to Claim 34, Jung in combination with Lyon and Van discloses, charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

As to Claim 35, Jung in combination with Lyon and Van discloses, wherein the switch means is a MOSFET and the circuit includes a capacitor connected in parallel to the source to drain terminals of the MOSFET, and wherein the alternating switching in the primary coil is automatically started by the MOSFET when the base unit detects a mobile device and/or battery placed close to or aligned with the primary coil.

9. Claims 14, 17-18, 23-29 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon and Hui (US 2005/0189910)

As to Claim 14, neither Jung nor Lyon discloses, wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

Hui discloses in Figure 4(a), wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices and/or batteries.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Jung's apparatus in order to charge different devices simultaneously to minimize the time it takes to charge a plurality of electronic devices.

As to Claim 17, Hui discloses in Figure 4a, wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

As to Claim 18, Hui discloses in Figure 4a, wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device and/or battery

As to Claim 23, Hui discloses wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

As to Claim 24, Hui discloses wherein the base unit can be integrated into any of briefcases, bags, carriers, or clothing.

As to Claim 25, Hui discloses wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

As to Claim 26, Jung in combination with Lyon and Hui discloses, wherein one or more of the primary coils are stacked to improve transfer efficiency.

As to Claim 27, Jung in combination with Lyon and Hui discloses, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and/or battery and activates a coil or wire near the mobile device and/or battery to charge or provide power the mobile device and/or battery.

As to Claim 28, Lyon in combination with Hui discloses, wherein the charger or power supply senses the location of the mobile device and/or battery by sensing a change in a resonant circuit in the charger or power supply when the mobile device and/or battery is nearby.

As to Claim 29, Lyon in combination with Hui discloses, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Chen et. al. (US 6,331,744) (hereinafter Chen)

As to Claim 19, neither Jung nor Lyon discloses, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery_ is placed directly on top of a coil in the base.

Chen discloses in Figure 2, wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a mobile device and/or battery is placed directly on top of a coil in the base.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

11. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Hui, Lyon and Fukuda et. al. (US 4,311,953) (hereinafter Fukuda).

As to claims 20 and 21, Fukuda discloses in Column 1, lines 59-67, a charger unit including solar and secondary battery.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to add Magnetic material in Jung's charger as taught by Chen in order to strength the inductive charging energy.

12. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and SUDO (US JP408000838)

As to Claim 32, Sudo discloses in the Abstract, wherein the mobile device is one of a kitchen appliance or dish, or a toy that can receive power inductively from the charger or power supply.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for vehicle toy as taught by Sudo to extend battery life.

13. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in views of Lyon, Hui and Charych (US 6,798,716)

As to Claim 33, Charych discloses charging RFID tag battery, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to use inductive charging of Jung for RFID batteries as taught by Charych to extend battery life.

Response to Arguments

6. Applicant's arguments filed 6/17/2014 have been fully considered but they are not persuasive or moot in new ground(s) of rejection.

Applicant argues that in Jung and Lyon the controller and the input frequency controller respectively appear to be provided at the charging pad and charger respectively, rather than, at a mobile device. Examiner disagrees and submits that June discloses protective device (120) located in the battery (BAT) for monitoring charged stats of the battery and control charging frequency [see page 9 of Jung].

Further, it has been held that rearranging parts of an invention only routine skill in the art. In re Japikse, 86 USPQ 70.

It is also noted that all the claimed elements of applicant's inventions were known in the prior art (e.g. inductive charger, voltage regulator and protection device, etc.,) and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention, proper motivation/rationale to combine is as given in the office action. See KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL BERHANU whose telephone number is (571)272-8430. The examiner can normally be reached on M-F.

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.

/SAMUEL BERHANU/
Primary Examiner, Art Unit 2859

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/115,811	PARTOVI ET AL.	
	Examiner	Art Unit	
	SAMUEL BERHANU	2859	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SAMUEL BERHANU*. (3)_____.

(2) *Karl F. Kenna* . (4)_____.

Date of Interview: *07 August 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *Juang and Lyon*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant argues claims 1 and 11 , and the proposed amendment have been discussed and the changes appeared to over come the applied prior art..

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SAMUEL BERHANU/ Primary Examiner, Art Unit 2859	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

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

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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	5311973		1994-05-17	Tseng	
	2	7915858		2011-03-29	Liu	
	3	8169185		2012-05-01	Partovi	
	4	4800328		1989-01-24	Bolger	
	5	5367242		1994-11-22	Hulman	
	6	7554316		2009-06-30	Sevens	
	7	7151357		2006-12-19	Xian	

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Receipt date: 06/17/2014	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120126745		2012-05-24	Partovi	
	2	20110222493		2011-09-15	Mangold	
	3	20120146576		2012-06-14	Partovi	
	4	20060105718		2006-05-18	Ozluturk	
	5	20110162035		2011-06-30	King	
	6	20120235636		2012-09-20	Partovi	
	7	20110193520		2011-08-11	Yamazaki	
	8	20100117596		2010-05-13	Cook	
	9	20090049554		2009-02-19	Vuong	
	10	20060106965		2006-05-18	Falcon	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 06/17/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	11	20070178945		2007-08-02	Cook	
	12	20050007067		2007-02-08	Baarman	
	13	20100007307		2010-01-14	Baarman	
	14	20080272889		2008-11-06	Symons	
	15	20100277121		2010-11-04	Hall	
	16	20100127660		2010-05-27	Cook	
	17	20110012556		2011-01-20	Lai	
	18	20100081473		2010-04-01	Chatterjee	
	19	20090284227		2009-11-19	Mohammadian	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

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Receipt date: 06/17/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	1	2006115368	WO		2006-11-02	Kang		☐
	2	2006001557	WO		2006-01-05	Jung		☐
	3	2012116054	WO		2012-08-30	Steele		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	INTERNATIONAL SEARCHING AUTHORITY AT THE U. S. PATENT AND TRADEMARK OFFICE, International Search Report and Written Opinion for PCT International Patent Application No. PCT/US2013/078534, May 13, 2014, 11 pages.	☐
	2	INTERNATIONAL SEARCHING AUTHORITY AND WRITTEN OPINION FROM THE U. S. PATENT AND TRADEMARK OFFICE, International Search Report and Written Opinion for PCT International Application No. PCT/US2013/069270, April 4, 2014, 9 pages.	☐
	3	EUROPEAN PATENT OFFICE, Office Action for European Patent Publication Application No. EP2151037, April 9, 2014, 5 pages.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	08/07/2014

*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.

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 06/17/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2011-05-25	
	First Named Inventor	Partovi, Afshin	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

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	/Karl F. Kenna/	Date (YYYY-MM-DD)	2014-06-17
Name/Print	Karl F. Kenna	Registration Number	45445

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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

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 record s.

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13115811	PARTOVI ET AL.
	Examiner	Art Unit
	SAMUEL BERHANU	2859

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
320	108	3/22/2013	SB
320	150	3/22/2013	SB
	Updated	2/24/2014	SB
	Updated	8/8/2014	SB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor and PLUS search conducted----------see printout	3/22/2013	SB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Afshin Partovi
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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	7915858		2011-03-29	Liu	
	2	8169185		2012-05-01	Partovi	
	3	4800328		1989-01-24	Bolger	
	4	5367242		1994-11-22	Hulman	
	5	7554316		2009-06-30	Stevens	
	6	7151357		2006-12-19	Xian	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 02/27/2014	Application Number	13115811	13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Afshin Partovi	
	Art Unit	2859	
	Examiner Name	Berhanu, Samuel	
	Attorney Docket Number	AFPA-01007US1	

	1	20070178945		2007-08-02	Cook	
	2	20050007067		2007-02-08	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	

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 02/27/2014	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
(Not for submission under 37 CFR 1.99)	First Named Inventor	Afshin Partovi
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

	12	20100081473		2010-04-01	Chatterjee		

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/708,548, November 20, 2013, 5 pages.	☐
	2	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/115,811, September 23, 2013, 17 pages.	☐
	3	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/708,548, September 13, 2013, 16 pages.	☐
	4	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/158,134 January 22, 2014, 43 pages.	☐
	5	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/708,827 February 5, 2014, 28 pages.	☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 02/27/2014	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2011-05-25
(Not for submission under 37 CFR 1.99)	First Named Inventor	Afshin Partovi
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

	6	UNITED STATES PATENT AND TRADEMARK OFFICE, Office Action for U. S. Patent Application No. 13/708,520 February 5, 2014, 8 pages.	☐
	7	UNKNOWN AUTHOR, System Description Wireless Power Transfer, Volume 1: Low Power Part 1: Interface Definition, Version 1.0, July 2010, 83 pages.	☐
	8	THE PATENT OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA, 2nd Office Action for Chinese Patent Application No. 200880023854.4, April 15, 2013, 4 pages.	☐

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

EXAMINER SIGNATURE

Examiner Signature	/Samuel Berhanu/	Date Considered	08/07/2014

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Receipt date: 02/27/2014	Application Number	13115811 13115811 - GAU: 2859
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2011-05-25
	First Named Inventor	Afshin Partovi
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

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	/Karl F. Kenna/	Date (YYYY-MM-DD)	2014-02-27
Name/Print	Karl F. Kenna	Registration Number	45445

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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

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 record s.

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.B./

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. 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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/115,811	Filing Date	2011-05-25	Docket Number (if applicable)	AFPA-01007US1	Art Unit	2859
First Named Inventor	Partovi, Afshin			Examiner Name	Berhanu, Samuel		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☒ Other
Petition for Extension of Time

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 061325

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. 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.

Signature of Registered U.S. Patent Practitioner			
Signature	/Karl F. Kenna/	Date (YYYY-MM-DD)	2014-06-17
Name	Karl F. Kenna	Registration Number	45445

This collection of information is required by 37 CFR 1.114. 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 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.

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 the Freedom of Information Act requires disclosure of these records.

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PTO/SB/22 (03-13)
Approved for use through 3/31/2013. 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 displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): AFPA-01007US1

Application Number: 13/115,811

Filed: 5/25/2011

For: INDUCTIVE POWER SOURCE AND CHARGING SYSTEM

Art Unit: 2859

Examiner: Berhanu, Samuel

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):

		Fee	Small Entity Fee	Micro Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$ 200
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ 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 061325.

☑ 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/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration number 45445.

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

/Karl F. Kenna/ — Signature

June 17, 2014 — Date

Karl F. Kenna — Typed or printed name

415-362-3800 — 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 _____ 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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).
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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)).
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		PATENT APPLICATION	
Inventor(s):	Afshin Partovi, et al.		
Appln. No.:	13/115,811	Art Unit:	2859
Confirm. No.:	4181	Examiner:	Berhanu, Samuel
Filed:	May 25, 2011		
Title:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	**Customer No. 23910**	

REQUEST FOR CONTINUED EXAMINATION UNDER 37 C.F.R. §1.114

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

Sir:

This REQUEST FOR CONTINUED EXAMINATION and REPLY is in response to the Office Action mailed March 4, 2014.

Amendments

Please amend the above-identified application as follows:

Amendments to the Claims begin on Page 2.

Remarks begin on Page 7.

In the Claims:

Please amend Claims 1 and 11, and cancel Claims 3-10, as shown below. Applicant respectfully reserves the right to prosecute any originally presented claims in a continuing or future application.

1. (Currently Amended) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

a regulator, coupled to the output of the receiver or the battery, that

determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature,

senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery, and

regulates one or more of the current drawn, or the output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of one of predefined or appropriate power parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with a base unit to one or more

detect, identify and authenticate the receiver with the base unit,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

2. (Original) The mobile device of claim 1 further comprising a shell, wherein the receiver is attached to the shell.

3-10. (Canceled).

11. (Currently Amended) A system for use with a mobile device for charging or powering the mobile device inductively, comprising:

a base unit including one or more primary coils therein, ~~the~~ each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;

wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;

wherein one or both of the mobile device and a battery have a receiver and particular charging characteristics associated therewith, and a regulator, coupled to the output of the receiver or the battery, that

determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature,

senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery, and

regulates one or more of the current drawn, or the output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of one of predefined or appropriate power parameters for the mobile device or the battery;

wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with the base unit to one or more

detect, identify and authenticate the receiver with the base unit,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

12. (Original) The system of claim 11 wherein one or more of the coils are manufactured on printed circuit boards and are manufactured to have a low resistance.

13. (Original) The system of claim 11 wherein the base unit includes a primary circuit having a switch means for switching the primary coil on and off whenever the mobile device is placed

close to the primary coil of the base unit or the presence of the mobile device is to be detected.

14. (Original) The system of claim 11 wherein the base unit includes multiple primary coils that can be used to simultaneously charge multiple mobile devices.

15. (Original) The system of claim 14 wherein the alternating switching is periodically started and stopped to automatically detect a presence of a mobile device placed close to or aligned with the primary coil of the base unit.

16. (Original) The system of claim 15 wherein the presence of the mobile device placed close to or aligned with the primary coil of the base unit is detected by monitoring the current passing through the primary coil or the switching means.

17. (Original) The system of claim 11 wherein the base unit is in the shape generally of a pad and wherein the multiple primary coils are distributed within layers of the pad.

18. (Original) The system of claim 17 wherein the multiple primary coils can move within their plane to more closely align with the secondary coil of a mobile device.

19. (Original) The system of claim 11 wherein a magnet is placed at the center of each primary, wherein the magnet at the center of each primary has a magnetic axis that is perpendicular to the plane of the coil, and wherein one or more of the devices to be charged include a magnet at the center of their receiver coil, so that the magnets in the devices and the magnets in the base are oriented to attract each other when a coil in a device is placed directly on top of a coil in the base.

20. (Original) The system of claim 11 further comprising a battery coupled to and powering the base unit, and wherein the battery can be occasionally charged by an external power supply to maintain a charge sufficient to power the inductive device for a period of time.

21. (Original) The system of claim 20 further comprising a solar cell coupled to the battery for charging the battery in the base unit.

22. (Original) The system of claim 11, further comprising a data storage component for

storage of data, for subsequent transmission of data to or from the mobile device.

23. (Original) The system of claim 11 wherein the cover surface of the base unit or pad includes a decorative or non-slip surface.

24. (Original) The system of claim 11 wherein the base unit can be integrated into any of briefcases, bags, or clothing.

25. (Original) The system of claim 11 wherein the base unit is integrated into a charging kiosk for occasional charging of mobile devices.

26. (Original) The system of claim 11 wherein one or more of the primary coils are stacked to improve transfer efficiency.

27. (Original) The system of claim 11, further comprising a plurality of coils or wires, wherein the charger or power supply senses the location of the mobile device and activates a coil or wire near the mobile device to charge or provide power the mobile device.

28. (Original) The system of claim 27, wherein the charger or power supply senses the location of the mobile device by sensing a change in a resonant circuit in the charger or power supply when the mobile device is nearby.

29. (Original) The system of claim 11, wherein the mobile device includes an inductively charged battery where a receiver for the inductive power is made of flexible PCB material and can be shaped into a curve to fit the battery, an application or a device.

30. (Original) The system of claim 11, wherein the charger or power supply is made in the shape of a cup, bowl, or other container and mobile devices placed inside would be charged or powered inductively.

31. (Original) The system of claim 11, wherein a plurality of modular chargers or power supplies can be interconnected to form a single unit.

32. (Original) The system of claim 11, wherein the mobile device is one of a kitchen

appliance or dish, or a toy that can receive power inductively from the charger or power supply.

33. (Original) The system of claim 11, wherein the mobile device is a charger for inductively charging active RFID batteries, including an active RFID tag which includes a battery such that the battery can be charged inductively with the system.

34. (Original) The system of claim 11, wherein the mobile device to be charged or powered includes a charging circuit having a Zener diode, wherein the Zener diode clamps the voltage to the mobile device to a predetermined maximum voltage.

35. (Original) The system of claim 13, wherein the switch means is a MOSFET and the circuit includes a capacitor connected in parallel to the source to drain terminals of the MOSFET, and wherein the alternating switching in the primary coil is automatically started by the MOSFET when the base unit detects a mobile device placed close to or aligned with the primary coil.

36. (Original) The system of claim 11, wherein, the mobile device includes an after-market or field-replaceable battery pack compatible with an original battery pack for the device, and wherein the matching secondary coil or coils within the mobile device are incorporated into the after-market or field-replaceable battery pack.

Remarks

This REQUEST FOR CONTINUED EXAMINATION and REPLY is in response to the Office Action mailed March 4, 2014.

I. Request for Interview

In the event the amendments and remarks provided herein fail to place the application in condition for allowance, Applicant respectfully requests the opportunity to interview with the Examiner at the Examiner's convenience, and prior to issuance of a subsequent Office Action, to assist in expediting prosecution.

II. Summary of Examiner's Rejections

Prior to the Office Action mailed March 4, 2014, Claims 1-36 were pending in the Office Action. In the Office Action, Claims 3-5 were rejected under 35 U.S.C. 102(a) as being anticipated by Hui (U.S. Publication No. 2005/0189910). Claims 1-8, 10-12, 22, 30-31 and 36 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung et al (WO 2006/001557, hereinafter Jung) in view of Lyon (U.S. Publication No. 2004/0145342). Claims 9, 13, 15-16 and 34-35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Van Lerberghe (U.S. Patent No. 5,925,814). Claims 14, 17-18, 23-29 and 37 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Hui. Claim 19 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Chen et al (U.S. Patent No. 6,331,744, hereinafter Chen). Claims 20-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Fukuda et al (U.S. Patent No. 4,311,953, hereinafter Fukuda). Claim 32 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Sudo (JP 408000838). Claim 33 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Charych (U.S. Patent No. 6,798,716).

III. Summary of Applicant's Amendment

The present Reply amends Claims 1 and 11, and cancels Claims 3-10, leaving for the Examiner's present consideration Claims 1-2 and 11-36.

IV. Claim Rejections under 35 U.S.C. §102(a)

In the Office Action, Claims 3-5 were rejected under 35 U.S.C. 102(a) as being anticipated by Hui (U.S. Publication No. 2005/0189910).

Claims 3-5 have been canceled, rendering moot the rejection of these claims. Applicant respectfully reserves the right to prosecute any originally presented claims in a continuing or future application.

V. Claim Rejections under 35 U.S.C. §103(a)

In the Office Action, Claims 1-8, 10-12, 22, 30-31 and 36 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung (WO 2006/001557) in view of Lyon (U.S Publication No. 2004/0145342). Claims 9, 13, 15-16 and 34-35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Van Lerberghe (U.S. Patent No. 5,925,814). Claims 14, 17-18, 23-29 and 37 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Hui (U.S. Publication No. 2005/0189910). Claim 19 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Chen (U.S. Patent No. 6,331,744). Claims 20-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Fukuda (U.S. Patent No. 4,311,953). Claim 32 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Sudo (JP 408000838). Claim 33 was rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Lyon and Charych (U.S. Patent No. 6,798,716).

Claim 1

Claim 1 has been amended to recite:

1. (Currently Amended) A mobile device capable of inductive powering or charging comprising:

a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith;

a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil;

a regulator, coupled to the output of the receiver or the battery, that

determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature,

senses one or more of a current drawn from the receiver, or an

output voltage or output current provided to the mobile device or the battery, and

regulates one or more of the current drawn, or the output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of one of predefined or appropriate power parameters for the mobile device or the battery; wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

wherein the receiver communicates with a base unit to one or more

detect, identify and authenticate the receiver with the base unit,

verify the continued presence of the receiver near the base unit, and

communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

Jung describes an embodiment in which a wireless charging pad 200 according to the [ ] invention includes a controller 240 for reading the RFID tag and controlling charging, drive circuits 220 and 220', and primary coils Pcoil1 and Pcoil2. The wireless charging pad 200 may include various input ports having DC inputs, and generates the switching patterns of the primary coils Pcoil1 and Pcoil2 through the drive circuits 220 and 220', respectively, and performs a control function of detecting portable devices placed on the wireless charging pad 200 and indicating the energy saving mode and the charged status of each of the portable devices. The drive circuits 220 and 220' are On/Off switching devices for switching the primary coils Pcoil1 and Pcoil2, respectively, each of which is composed of an upper switch and a lower switch. The drive circuits 220 and 220' are each constructed using a half-bridge or full-bridge resonant converter (serial, parallel or serial-parallel resonant converter). Referring to FIG. 4, in the wireless charging pad 200 according to the [ ] invention, the primary side of the transformer is constructed in such way that the two primary coils Pcoil1 and Pcoil2 are wound on a planar core, which is formed by combining small cobalt-based amorphous metallic cores, such as Co, Fe, Ni, B and Si, or ferrite cores in various shapes, in directions perpendicular to each other as shown in FIG. 4. In this case, the switching patterns perform switching so that a phase difference of 90 degrees occurs between the two primary coils Pcoil1 and Pcoil2. Accordingly, induced energy can be received regardless of the location of the portable device that is placed

on the wireless charging pad 200 and has the battery pack 100 equipped with the charging receiver module 100. The input form of the wireless charging pad 200 is described below. A control power source supplies the driving power of the controller 240 and the drive circuits 220 and 220' using a flyback converter in a 110/220 V direct drive fashion. In the resonant converter, DC power obtained by rectifying AC power in a 110/220 V switching fashion is always set to a 110 V input condition. DC power (12, 24, 48 V) is generated using the flyback converter for free voltages ranging from 86 to 265 V and is used as the input power of the resonant converter, and forms the driving power of the controller 240 and the drive circuits 220 and 220' using a regulator. The controller 240 performs both a function of reading an RFID tag and a function of controlling charging. (Pages 17-20).

Lyon describes a method and apparatus used for adaptive inductive charging of a device. Charging includes detecting the presence of a device capable of receiving an inductive charge, determining a set of parameters for inductively charging the device, and transmitting an inductive charge corresponding to the set of parameters for charging the device. Another aspect of charging includes combining at least two inductive fields transmitted at different angles to each other, delivering the combined inductive field at an orientation to the device, measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device, and charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level. (Abstract).

Lyon further describes an embodiment in which inductive charger 106 includes a variable frequency resonant inverter for multiple inductors 206, an alternating current source 208, a set of inductors 210 through 212, an input frequency control 214, a memory 216, a processor 218, and a communication port 243 used to communicate over a separate data communication channel 220. Variable frequency resonant inverter for multiple inductors, hereinafter inverter 206, senses input voltage changes over power source 208 and controls switching frequency of the inverter to provide a relatively constant power over inductors 210 through 212. Input frequency control 214 maintains an input frequency to inverter 206 as needed by the particular device and above the resonant frequency of the circuit. (Paragraphs [0018]-[0019]).

In the Office Action, it was asserted that Jung discloses, in Figures 1-6, a mobile device and/or battery capable of being inductively powered or charged comprising a battery, wherein one or both of a mobile device and the battery have particular charging characteristics associated therewith; a receiver for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the

battery or the mobile device: a regulator, that determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature, wherein different mobile devices and batteries can have different charging characteristics associated therewith; and wherein the receiver communicates with a base unit to one or more detect, identify and authenticate the receiver with the base unit, verify the continued presence of the receiver near the base unit, and communicate information to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.

It was further asserted that Jung does not disclose explicitly, wherein a regulator senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery; but that Lyon discloses, in Figures 1-2, a regulator that senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery; and that it would have been obvious to a person having ordinary skill in the art, at the time the invention was made, to modify controller of Jung and allow to regulate the charging current or voltage as taught by Lyon in order to improve magnetic coupling between the charger and the device necessary for charging.

However, Applicant respectfully submits that, based on the above description, in Jung and Lyon, the controller and input frequency controller respectively appear to be provided at the charging pad and charger respectively, rather than, for example, at a mobile device.

Additionally, based on the above description, Jung appears to describe an embodiment in which the primary side of the transformer is constructed in such way that the two primary coils Pcoil1 and Pcoil2 are wound on a planar core in directions perpendicular to each other; but does not appear to describe, for example, a primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil, or a receiver coil having a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil.

To more clearly recite the embodiment therein, Claim 1 has been amended to recite that, in accordance with an embodiment, the mobile device comprises a receiver and receiver coil, for one of inductively powering the device or charging the battery in the mobile device, wherein the receiver is one of attached to or incorporated into the battery or the mobile device, and wherein the receiver coil has a generally planar shape so that a magnetic field received in a direction substantially perpendicular to the plane of the receiver coil is used to inductively generate a current in the receiver coil.

Claim 1 has also been amended to recite that, in accordance with an embodiment, the mobile device comprises a regulator, coupled to the output of the receiver or the battery, that determines characteristics of the mobile device or the battery, including one or more of a charging capacity, present charge, required voltage, or current temperature, senses one or more of a current drawn from the receiver, or an output voltage or output current provided to the mobile device or the battery, and regulates one or more of the current drawn, or the output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of one of predefined or appropriate power parameters for the mobile device or the battery.

In view of the above remarks, Applicant respectfully submits that Claim 1, as currently amended, is neither anticipated by, nor obvious in view of the cited references, when considered alone or in combination. Reconsideration thereof is respectfully requested.

Claim 11

The remarks provided above with regard to Claim 1 are herein incorporated by reference. Claim 11 has also been amended to more clearly recite the embodiment therein. For similar reasons as provided above, Applicant respectfully submits that Claim 11, as currently amended, is likewise neither anticipated by, nor obvious in view of the cited references, when considered alone or in combination. Reconsideration thereof is respectfully requested.

Claims 2-10 and 12-36

Claims 3-10 have been canceled, rendering moot the rejection of these claims. Claims 2 and 12-36 depend from and include all of the features of one of Claims 1 or 11. Claims 2 and 12-36 are not addressed separately herein. However, Applicant respectfully submits that these claims are allowable at least as depending from an allowable independent claim, and further in view of the amendments to the independent claims, and the remarks provided above. Reconsideration thereof is respectfully requested.

VI. Conclusion

In view of the above amendments and remarks, it is respectfully submitted that all of the claims now pending in the subject patent application should be allowable, and reconsideration thereof is respectfully requested. The Examiner is respectfully requested to telephone the undersigned if he can assist in any way in expediting issuance of a patent.

The Commissioner is authorized to charge any underpayment or credit any overpayment

to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

Date: June 17, 2014

By: /Karl F. Kenna /
Karl F. Kenna
Reg. No. 45445

Customer No.: 23910
MEYER IP LAW GROUP
410 Pacific Avenue
San Francisco, California 94133
Telephone: (415) 362-3800
Fax: (415) 362-2928

Electronic Patent Application Fee Transmittal

Application Number:	13115811
Filing Date:	25-May-2011
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Filer:	Karl Kenna/Christopher Burnharte
Attorney Docket Number:	AFPA-01007US1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

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:				
Extension - 1 month with $0 paid	1251	1	200	200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1400**

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EFS ID:	19325556
Application Number:	13115811
International Application Number:	
Confirmation Number:	4181
Title of Invention:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM
First Named Inventor/Applicant Name:	Afshin Partovi
Customer Number:	23910
Filer:	Karl Kenna/Christopher Burnharte
Filer Authorized By:	Karl Kenna
Attorney Docket Number:	AFPA-01007US1
Receipt Date:	17-JUN-2014
Filing Date:	25-MAY-2011
Time Stamp:	18:43:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

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Payment Type	Deposit Account
Payment was successfully received in RAM	$1400
RAM confirmation Number	5300
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Warnings:					
Information:					
2	Transmittal Letter	afpa_1007us1_IDS_Trans_061714.pdf	121137 8e8bfa24aec81a364ea6c12a758fdb48b2222fbd	no	2
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	afpa_1013ep0_OA.pdf	204706 8870edf98230f93667f6db23d5ac1540896f4a48	no	5
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4	Other Reference-Patent/App/Search documents	afpa_1037wo0_ISR.pdf	700602 17a2205574a4280bfab9af99e1ec770fefb521ac	no	9
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7	Foreign Reference	WO2006115368.pdf	2596077 20e3c40ad05cadfaa0c62e311076fa76ecd5e093	no	52
Warnings:					
Information:					
8	Foreign Reference	WO2012116054.pdf	6780712 7aa034e1228c80cd34779743a61a8c79467946f6	no	111

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10	Extension of Time	afpa_1007us1_EOT.pdf	194960 c9773d8c41bf6b0ecf3bf9262e59f8f5e10b8005	no	2
Warnings:					
Information:					
11		afpa_1007us1_RCE_030414.pdf	113663 7480410c02603fd5613634fcd0916096688725e0	yes	13

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	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	13

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12	Fee Worksheet (SB06)	fee-info.pdf	32226 0c49413ceb76a084c025ffdada18e3f2f7bf2945	no	2
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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13115811
Filing Date	2011-05-25
First Named Inventor	Partovi, Afshin
Art Unit	2859
Examiner Name	Berhanu, Samuel
Attorney Docket Number	AFPA-01007US1

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	5311973		1994-05-17	Tseng	
	2	7915858		2011-03-29	Liu	
	3	8169185		2012-05-01	Partovi	
	4	4800328		1989-01-24	Bolger	
	5	5367242		1994-11-22	Hulman	
	6	7554316		2009-06-30	Sevens	
	7	7151357		2006-12-19	Xian	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120126745		2012-05-24	Partovi	
	2	20110222493		2011-09-15	Mangold	
	3	20120146576		2012-06-14	Partovi	
	4	20060105718		2006-05-18	Ozluturk	
	5	20110162035		2011-06-30	King	
	6	20120235636		2012-09-20	Partovi	
	7	20110193520		2011-08-11	Yamazaki	
	8	20100117596		2010-05-13	Cook	
	9	20090049554		2009-02-19	Vuong	
	10	20060106965		2006-05-18	Falcon	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

	11	20070178945		2007-08-02	Cook	
	12	20050007067		2007-02-08	Baarman	
	13	20100007307		2010-01-14	Baarman	
	14	20080272889		2008-11-06	Symons	
	15	20100277121		2010-11-04	Hall	
	16	20100127660		2010-05-27	Cook	
	17	20110012556		2011-01-20	Lai	
	18	20100081473		2010-04-01	Chatterjee	
	19	20090284227		2009-11-19	Mohammadian	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

	1	2006115368	WO		2006-11-02	Kang		☐
	2	2006001557	WO		2006-01-05	Jung		☐
	3	2012116054	WO		2012-08-30	Steele		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	INTERNATIONAL SEARCHING AUTHORITY AT THE U. S. PATENT AND TRADEMARK OFFICE, International Search Report and Written Opinion for PCT International Patent Application No. PCT/US2013/078534, May 13, 2014, 11 pages.	☐
	2	INTERNATIONAL SEARCHING AUTHORITY AND WRITTEN OPINION FROM THE U. S. PATENT AND TRADEMARK OFFICE, International Search Report and Written Opinion for PCT International Application No. PCT/ US2013/069270, April 4, 2014, 9 pages.	☐
	3	EUROPEAN PATENT OFFICE, Office Action for European Patent Publication Application No. EP2151037, April 9, 2014, 5 pages.	☐

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

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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13115811
	Filing Date	2011-05-25
	First Named Inventor	Partovi, Afshin
	Art Unit	2859
	Examiner Name	Berhanu, Samuel
	Attorney Docket Number	AFPA-01007US1

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	/Karl F. Kenna/	Date (YYYY-MM-DD)	2014-06-17
Name/Print	Karl F. Kenna	Registration Number	45445

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 record s.

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		PATENT APPLICATION	
Inventor(s):	Partovi, Afshin		
Appl. No.:	13/115,811	Art Unit:	2859
Confirm. No.:	4181	Examiner:	Berhanu, Samuel
Filed:	May 25, 2011		
Title:	INDUCTIVE POWER SOURCE AND CHARGING SYSTEM	**Customer No. 23910**	

TRANSMITTAL LETTER RE INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.56

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

Sir:

It is requested that the information identified in this statement be considered by the Examiner and made of record in the above-identified application. This statement is not intended to represent that a search has been made or that the information cited in the statement is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56. If this is a continuation, divisional or continuation-in-part application, it is understood that the Examiner will consider all information which was considered by the Office in a parent application. MPEP §609. Such information therefore is not listed herein unless it is desired that the information be printed on a patent issuing from the subject application.

Enclosed with this statement are the following:

✓ Form PTO/SB/08a. The Examiner is requested to initial the form and return it to the undersigned in accordance with M.P.E.P. §609.

✓ As allowed under 37 C.F.R § 1.98(a)(2)(ii), no copies of the U.S. patents and U.S. patent application publications are enclosed, unless required by the office.

✓ A copy of an International Search Report and Written Opinion dated May 13, 2014 for International Patent Application No. PCT/US2013/078534.

✓ A copy of an International Search Report and Written Opinion dated April 4, 2014 for International Patent Application No. PCT/US2013/069270.

This statement should be considered because:

✓ **37 C.F.R. §1.97(b)**. This statement qualifies under 37 C.F.R. §1.97, subsection (b) because:

(1) It is being filed within three months of the filing date of an application other than a continued prosecution application under § 1.53(d);

-- OR --

(2) It is being filed within 3 months of entry of a national stage;

-- OR --

(3) It is being filed before the mailing date of the first Office Action on the merits,

-- OR --

(4) It is being filed before the mailing date of the first Office Action after the filing of a Request for Continued Examination under 37 C.F.R. §1.114.

___ **37 C.F.R. §1.97(c)**. Although it may not qualify under subsection (b), this statement qualifies under 37 C.F.R. §1.97, subsection (c) because:

(1) It is being filed before the mailing date of a FINAL Office Action, a Notice of Allowance, or an action that otherwise closes prosecution in the subject application, whichever occurs first.

-- AND *(check at least one of the following)* --

__ (a) It is accompanied by a STATEMENT as set forth in 37 C.F.R. §1.97(e).

-- OR –

___ (b) It is accompanied by the fee set forth in 37 C.F.R. §1.17(p).

✓ ***Fee Authorization.*** The Commissioner is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Account No. 06-1325.

Respectfully submitted,

MEYER IP LAW GROUP

Date: June 17, 2014

By: /Karl F. Kenna/
Karl F. Kenna
Reg. No. 45,445

Customer No. 23910
MEYER IP LAW GROUP
410 Pacific Avenue
San Francisco, California 94133
Telephone: (415) 362-3800

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: KARL F. KENNA
410 PACIFIC AVENUE
SAN FRANCISCO, CA 94133

MEYER IP
File: AFPA-01013US2
Action Item: ISR-IDS
Date Due: May 7, 2014
Critical Date: July 4, 2014
Atty Path: KFK
Docketed By: MMP
Verified By: MMP

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference: AFPA1037WO0	Date of mailing (day/month/year) 04 APR 2014
	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US2013/069270	International filing date (day/month/year) 08 November 2013
Applicant MOJO MOBILITY, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300
Facsimile No. 571-273-3201	Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference AFPA1037WO0	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2013/069270	International filing date *(day/month/year)* 08 November 2013	(Earliest) Priority Date *(day/month/year)* 13 November 2012
Applicant MOJO MOBILITY, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 1

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/069270

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H02J 7/00 (2014.01)
USPC - 320/108
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B60L11/18, H02J7/00, H02J7/02, H02J7/04, H02J17/00, H01M10/44 (2014.01)
USPC - 320/101, 104, 108, 109, 137

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - B60L11/1816, H02J7/025, Y02E60/12, Y02T10/7005 Y02T90/163, Y02T90/14 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2012/0235636 A1 (PARTOVI) 20 September 2012 (20.09.2012) entire document	1-5, 7-13, 15, 17, 18, 20 --- 6, 14, 16, 19
Y	WO 2012/116054 A2 (STEELE) 30 August 2012 (30.08.2012) entire document	6, 14, 16, 19
A	US 2011/0193520 A1 (YAMAZAKI et al) 11 August 2011 (11.08.2011) entire document	1-20
A	US 2010/0117596 A1 (COOK et al) 13 May 2010 (13.05.2010) entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2014	04 APR 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: KARL F. KENNA
410 PACIFIC AVENUE
SAN FRANCISCO, CA 94133

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	04 APR 2014
Applicant's or agent's file reference AFPA1037WO0	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/069270	08 November 2013	13 November 2012

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H02J 7/00 (2014.01)
USPC - 320/108

Applicant MOJO MOBILITY, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	16 March 2014	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/069270

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/069270

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	6, 14, 16, 19	YES
	Claims	1-5, 7-13, 15, 17, 18, 20	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-5, 7-13, 15, 17, 18, and 20 lack novelty under PCT Article 33(2) as being anticipated by Partovi et al. (hereinafter Partovi).

Regarding claim 1, Partovi discloses a system for enabling efficient wireless power transfer and charging of devices and/or batteries (para. [0003]), comprising: means, including a charger coil and a receiver coil (para. [0006], Fig. 1 shows a charger coil and a receiver coil), for inductively charging one or more mobile, electronic, electric, lighting, batteries, power tools, kitchen, military, medical, industrial tools or systems, robots, trains, buses, trucks and/or vehicles, or other devices (para. [0231], "The same surface can also power or charge multiple devices including lamps, kitchen appliances, laptops, keyboards, computer mice, mobile phones, power tools, batteries, etc. as needed by simple placement on or near the surface.").

Regarding claim 20, Partovi discloses a method for enabling efficient wireless power transfer and charging of devices and/or batteries (para. [0003]), comprising the steps of: providing means, including a charger coil and a receiver coil (para. [0006], Fig. 1 shows a charger coil and a receiver coil), for inductively charging one or more mobile, electronic, electric, lighting, batteries, power tools, kitchen, military, medical, industrial tools or systems, robots, trains, buses, trucks and/or vehicles, or other devices (para. [0231], "The same surface can also power or charge multiple devices including lamps, kitchen appliances, laptops, keyboards, computer mice, mobile phones, power tools, batteries, etc. as needed by simple placement on or near the surface.").

Regarding claim 2, Partovi discloses wherein the charger coil and receiver coil and magnetics axes are crossed to provide overlap of some portion of the charger and receiver coil and magnetics over a wide range of x and y axes (para. [0129], "This type of system is characterized by coils that are typically similar in size and/or spatially close together in distance (z axis) and with good lateral (x,y) overlap."), allowing for a degree of positioning tolerance (para. [0129], "This so called tightly coupled system is typically associated with high power transfer efficiencies defined here as the ratio of output power from the receiver coil to input power to transmitter coil. The methods described above for position independent operation (array of transmitter coils and moving coils), typically may use tightly coupled coils.").

Regarding claim 3, Partovi discloses wherein the electromagnetic emission from the charger is generally contained to the location where the receiver is in alignment with (Fig. 34; para. [0245], "a layer comprising magnetic or ferrite or other material is added to the charger to limit the emission from the charger into space.").

Regarding claim 4, Partovi discloses wherein the system includes one or more magnetic guiding layer(s) that extends beyond one or more of the charger coil and/or receiver coil dimensions (para. [0173], "In accordance with another embodiment, the charger/transmitter also includes magnetic flux guide layer/shield at the bottom of the charger as shown in FIGS. 20 and 21..."; Fig. 21, charger shield is shown to extend beyond the receiver coil), to provide a low reluctance path for the magnetic field and improved power transfer efficiency (para. [0170], "Choosing the appropriate magnetic layer and receiver shield/guide layer permeabilities and thicknesses is important to provide a low reluctance path for the magnetic flux to allow higher power transfer and efficiencies while achieving sufficient field shielding at other locations of the charger.").

Regarding claim 5, Partovi discloses wherein the system allows power transfer to one or more devices being charged at a variety of positions on the charger (Fig. 46(a); para. [0286], "FIG. 46(a) shows a charger which broadcasts power to a number of receivers placed anywhere on its surface.").

Regarding claim 7, Partovi discloses wherein a build-up of magnetic field between the coils at any particular location allows a change in the properties of a magnetic material to allow more efficient of power transfer from the charger to one or more receivers (para. [0170], "Significant power transfer was achieved with receiver coil at distances of several mm to 2-3 cm from the charger surface. The power transfer and efficiency increased with introduction of a 0.5 mm thick ferrite magnetic material or layer above the coil to guide and shield the flux as shown in FIG. 20.").

Regarding claim 8, Partovi discloses wherein the device is one or more of a mobile, electronic, electric, lighting, battery, power tool, kitchen, military, medical, industrial tools or other device (para. [0058], "The term device, product, or battery is used herein to include any electrical, electronic, mobile, lighting, or other product, batteries, power tools, industrial, kitchen, military or medical products...").

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/069270

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 9, Partovi discloses wherein the device is one or more electric vehicle, robot, train, bus, truck, electric bicycle, motorcycle, Segway type of device and/or other electric vehicles or other moving equipment (para. [0058], "The term device, product, or battery is used herein to include...vehicles or movable machines such as robots whereby the product, part, or component is powered by electricity or an internal or external battery.").

Regarding claim 10, Partovi discloses wherein a communication between the charger and the receiver can follow one or a number of protocols, including in the case of an electric vehicle such as a wireless charging specific or automotive-specific procedures or protocols including DSRC (para. [0064], "The receiver may also include optional additional features such as including Near Field Communication, Bluetooth, WiFi, RFID or other communication and/or verification technology;" para. [0084], "As an example, FIG. 3 shows a system 130 in accordance with an embodiment, wherein a dedicated RF channel for uni-directional or bi-directional communication between the charger and receiver is implemented for validation and/or regulation purposes.").

Regarding claim 11, Partovi discloses wherein the approach of a device including a receiver, such as a vehicle or system or robot to be charged, has been detected and verified through a communication such as RFID, Bluetooth, WiFi, Wireless USB, NFC, Felica, Zigbee, Wireless Gigabit (WiGig), WPC, A4WP, DSRC, or a ping or other communication (para. [0064], "The receiver may also include optional additional features such as including Near Field Communication, Bluetooth, WiFi, RFID or other communication and/or verification technology.") is communicated from the charger to energize and power the receiver circuit (para. [0072], "the charger can periodically be turned on to be driven with a periodic pattern (a ping process) and if a receiver in proximity begins to draw power from it, the charger can detect power being drawn from it and would stay in a transmitting state.").

Regarding claim 12, Partovi discloses wherein the charger and receiver can communicate information such as one or more output voltage, current, power, device or battery status, validation ID for receiver, end of charge or various charge status information, receiver battery, device, or coil temperature, and/or user data such as information about the user, verification of ability to account and charge a customer for a charging/power service, or other data that can be used to perform system or firmware updates, diagnostics, or other tasks (para. [0064], "Additionally, the receiver may include a method for the receiver to communicate with the charger;" para. [0069], "The communicated information can be the output voltage, current, power, device or battery status, validation ID for receiver, end of charge or various charge status information, receiver battery, device, or coil temperature, and/or user data such as music, email, voice, photos or video, or other form of digital or analog data used in a device.").

Regarding claim 13, Partovi discloses wherein initiation of wireless charging can be signaled to the device, such as a vehicle, to provide visual and/or auditory signal to the user, disable the device or vehicle movement during charge, or other actions (para. [0076], "In addition, MCU1 is responsible for processes such as periodic start of the charger to seek a receiver at the start of charge...providing audio or visual indications to the user on the status of charging or power process, etc.").

Regarding claim 15, Partovi discloses wherein the charger, receiver or the device or vehicle connected to the receiver communicates with the owner or a designated person by text, email, telephone message, custom application or other means of communication about the state of charging of the device or vehicle, error conditions or other important information (para. [0076], "For example, the charger can be built into a car, and when a valid receiver and/or an NFC, RFID or other ID mechanism integrated into or on a mobile device, its case or skin, dongle or battery is found, the charger may activate some other functions such as Bluetooth connectivity to the device, displaying the device identity or its status or state of charge on a display, etc.").

Regarding claim 17, Partovi discloses wherein a communication such as RFID or NFC, Bluetooth, or other wireless detection between the charger and receiver can be used to indicate approach of a valid device (para. [0064], "The receiver may also include optional additional features such as including Near Field Communication, Bluetooth, WiFi, RFID or other communication and/or verification technology;" para. [0072], "the charger can periodically be turned on to be driven with a periodic pattern (a ping process) and if a receiver in proximity begins to draw power from it, the charger can detect power being drawn from it and would stay in a transmitting state.") such as a vehicle (para. [0224], "In yet another embodiment to allow for charging an automobile or other vehicle or movable system such as a robot, etc., the coil on the stationary part (the road or the floor) or alternately the moving part (car, robot, etc.), can be made to be much longer and/or wider than the other coil to avoid the need for precise alignment. For example a charger coil on a floor or road can be in a rectangular or oval shape while the receiver coil in a car is circular and placed at any location at the bottom center line of the car. In this way, the driver does not have to precisely align the coils in the front and back direction to use the charger. Similarly, different cars with the receiver coils placed at different locations in the car can use the same charger.").

Regarding claim 18, Partovi discloses wherein once a rough or approximate alignment is reached a wireless communication link between the charger and receiver and the battery and its charging system can be established and diagnostic tests, verification or other actions performed (para. [0283], "It may be therefore advantageous to subdivide a large area charger into smaller sections and by detecting the receiver's placement on this section through in coil or separate coil communication, RF, mechanical, optical, magnetic or weight detection, etc. and only activate the section where a receiver is placed to enable higher efficiencies or output powers. Of course this can be combined with verification, etc. to provide further security and safety in these conditions.").

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/069270

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Claims 6, 14, 16, and 19 lack an inventive step under PCT Article 33(3) as being obvious over Partovi in view of Steele.

Regarding claim 6, Partovi teaches a system enabling power transfer to a device (para. [0003]). Partovi also teaches that the system includes the use of one or more charger coils along a length upon which the device to power powered or charged moves (para. [0224], "In yet another embodiment to allow for charging an automobile or other vehicle or movable system such as a robot, etc., the coil on the stationary part (the road or the floor) or alternately the moving part (car, robot, etc.), can be made to be much longer and/or wider than the other coil to avoid the need for precise alignment. For example a charger coil on a floor or road can be in a rectangular or oval shape while the receiver coil in a car is circular and placed at any location at the bottom center line of the car. In this way, the driver does not have to precisely align the coils in the front and back direction to use the charger. Similarly, different cars with the receiver coils placed at different locations in the car can use the same charger.").

Partovi does not explicitly teach that the system enables power transfer to and/or charging of a moving device.

Steele, also in the field of wireless charging (para. [0002]), teaches a system enabling power transfer to and/or charging of a moving device (para. [0063], "Figure 1 depicts a means for seamlessly charging batteries of all-electric or plug-in hybrid electric vehicles under a variety of conditions, both statically while a vehicle is parked or otherwise stationary and dynamically while a vehicle is in motion"), including use of one or more charger coils along a length upon which the device to power powered or charged moves (para. [0081], "As seen in Figure 2, a typical WAVES 10 system for roadway 36 is composed of continuous chains of PTMs 14 forming PTM lanes 40, with each PTM 14 containing many individual PTM coils and their associated PTM-CES units 34.").

At the time of the invention, it would have been obvious to one skilled in the art to allow the system and device taught by Partovi to charge the device while the device is in motion, as taught by Steele as a move towards near-and long term elimination of battery technology limitations regarding range, charging time and associated lifetime cost and real-time performance trades (Steele, para. [0061]).

Regarding claim 14, Partovi does not teach wherein initiation of wireless charging of the device, such as a vehicle can include billing/tolling of the electricity used during charging in public locations such as public or office parking, hotel, restaurant, roadway or other structures.

Steele teaches wherein initiation of wireless charging of the device, such as a vehicle can include billing/tolling of the electricity used during charging in public locations such as public or office parking, hotel, restaurant, roadway or other structures (para. [0066], "In either stationary or mobile mode, the driver can be automatically charged for energy use (and tolls as they may apply), such as in a manner directly analogous to the current EZ Pass system where a credit card account is periodically charged for usage fees.").

At the time of the invention, it would have been obvious to one skilled in the art to apply the billing capabilities taught by Steele to the invention taught by Partovi to provide a return on the long term investment infrastructure required to put the system in place on a given highway as well as shorter term maintenance costs (Steele, para. [0099]).

Regarding claim 16, Partovi does not teach wherein the charger and/or the receiver or the vehicle can also be programmed to contact utility service providers and optimize the charge commencement and/or termination time or charge rate for optimum network load, minimum electricity cost or other desirable performance attributes.

Steel teaches wherein the charger and/or the receiver or the vehicle can also be programmed to contact utility service providers and optimize the charge commencement and/or termination time or charge rate for optimum network load, minimum electricity cost or other desirable performance attributes (para. [0098], "Grid energy has a cost that varies with the type and location of power sources which in turn can vary throughout the day and days of the week. The instantaneous cost of energy to the driver can and should be adjusted both to provide fair price to the grid but also as a way to provide adaptive choices that drivers can use to minimize their driving expenses while at the same time providing the power grid with greater capacity margins. Thus at peak driving times such as early morning, noontime and early evening, the cost per kilowatt-hour passed to the driver may be substantially greater than at other times of the day. The driver may in turn choose other commute times or avoid engagement the PRM during these times;" see also paras. [0099]-[00100]).

At the time of the invention, it would have been obvious to one skilled in the art to allow the system taught by Partovi to contact the utility service providers to contact utility service providers and optimize the charge commencement and/or termination time or charge rate for optimum network load, minimum electricity cost or other desirable performance attributes as taught by Steele to reduce the probability of having to increase existing capacity or of over-stressing existing power generation and distribution equipments (Steele, para. [0098]).

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/069270

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 19, Partovi does not teach wherein a proximity sensor such as a capacitive, resistive, laser or diode or rangefinder, optical, thermal, photocell, radar, sonar, ultrasonic, weight or cameras or infrared sensors or other method of detection can be used to determine the presence of a live animal or person in a region of high magnetic field close to the charger or between the charger and receiver coils and take appropriate action.

Steele teaches a proximity sensor such as a capacitive, resistive, laser or diode or rangefinder, optical, thermal, photocell, radar, sonar, ultrasonic, weight or cameras or infrared sensors or other method of detection can be used to determine the presence of a live animal or person in a region of high magnetic field close to the charger or between the charger and receiver coils and take appropriate action (para. [00135], "In either MPIU 96 or 60Hz configurations, a ground fault circuit interrupter can be utilized that provides immediate power shutdown and safety protection in the circumstance that an environmental breech has occurred either along/within the power distribution cable or PTM-CES 34.").

At the time of the invention, it would have been obvious to one of ordinary skill to include the ground fault circuit interrupter taught by Steele with the invention of Partovi to provide safety protection (Steele, para. [00135]).

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: Karl F. Kenna
410 Pacific Avenue
San Francisco, California 94133
United States of America

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference AFPA1038WO0 ✓	Date of mailing *(day/month/year)* 13 MAY 2014 **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US13/78534 ✓	International filing date *(day/month/year)* 31 December 2013 (31.12.2013) ✓
Applicant MOJO MOBILITY, INC. ✓	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
AFPA1038WO0		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US13/78534	31 December 2013 (31.12.2013)	04 January 2013 (04.01.2013)
Applicant MOJO MOBILITY, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☐ the text is approved as submitted by the applicant.

   ☒ the text has been established by this Authority to read as follows:

CHARGING MULTIPLE RECEIVERS WIRELESSLY WITH POWER TRANSMITTER

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 1

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US13/78534

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H02J 7/04, 17/00; H05B 6/36 (2014.01)
USPC - 320/106, 108; 335/285
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): H02J 7/04, 17/00; H05B 6/36 (2014.01)
USPC: 320/106, 108; 335/285

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); Google; Google Scholar; ProQuest; KEYWORDS: inductive charge portable mobile device coil degrees of freedom movable communicate identify sensor voltage magnet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2012/0126745 A1 (PARTOVI, A. et al.) May 24, 2012; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0148, 0178-0179].	1-4, 6-16, 18-21, 23-33 --- 5, 17, 22, 34
Y	US 2011/0222493 A1 (MANGOLD, S. et al.) September 15, 2011; figure 4; paragraphs [0057-0059].	5, 22
Y	US 5,311,973 A (TSENG, D. et al.) May 17, 1994; abstract; column 1, lines 45-65.	17, 34
A	US 2012/0146576 A1 (PARTOVI, A.) June 14, 2012; entire document.	1-34

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 April 2014 (16.04.2014)	13 MAY 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: Karl F. Kenna
410 Pacific Avenue
San Francisco, California 94133
United States of America

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	13 MAY 2014
Applicant's or agent's file reference AFPA1038WO0	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US13/78534	31 December 2013 (31.12.2013)	04 January 2013 (04.01.2013)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H02J 7/04, 17/00; H05B 6/36 (2014.01)
USPC - 320/106, 108; 335/285

Applicant MOJO MOBILITY, INC.

1. This opinion contains indications relating to the following items:

- [X] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [X] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [X] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	16 April 2014 (16.04.2014)	Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US13/78534

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US13/78534

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	5, 17, 22, 34	YES
	Claims	1-4, 6-16, 18-21, 23-33	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-34	NO
Industrial applicability (IA)	Claims	1-34	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1-4, 6-16, 18-21 and 23-33 lack novelty under PCT Article 33(2) as being anticipated by US 2012/0126745 A1 to PARTOVI, A. et al. (hereinafter 'Partovi').

As per claim 1, Partovi discloses a system for powering or charging multiple receivers wirelessly with a power transmitter (power source, charging system, and inductive receiver for mobile devices [system]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]) comprising: a base unit having one or more transmitter coils (pad 100 (base unit) comprises multiple coils or sets of wires 104 [base unit]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]); and one or more components within the base unit and/or a mobile device to be charged by the base unit, including a degree of positioning freedom (the coils are mounted such that they can move laterally within the pad, such that the pad senses the position of a secondary coil (component within base unit or mobile device) and moves the coils to the right position to optimize power transfer [degree of freedom]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), and support for different voltages, wireless power protocols, and/or power levels, for powering or charging multiple receivers wirelessly (receiver can also comprise electronic components or logic to set the voltage and current to the appropriate levels required by the mobile devices [support for different voltages], and may support multiple mobile devices; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 2, Partovi discloses the system of claim 1. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger include a coil and/or magnetic material and/or structure system that allows position free multi-charging, including one or more magnetic resonance or loosely coupled systems, flux guide structures, Magnetic Coupling, Magnetic Aperture coil and/or other coil and/or magnetic material and structures (the coils are mounted such that they can move laterally within the pad, such that the pad senses the position of a secondary coil (component within base unit or mobile device) and moves the coils to the right position to optimize power transfer [coil for position free multi-charging]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 3, Partovi discloses the system of claim 1. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger include a receiver having an output regulator stage with a large acceptable operating input voltage range (regulator can be placed between the output of the receiver and the battery, where regulator can sense the appropriate parameters of the battery (voltage, current, capacity), and regulate the current drawn from the receiver appropriately and set the voltage and current to the appropriate levels required by the mobile device [output regulator stage]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 4, Partovi discloses the system of claim 1. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger operate a communication method that allows multiple receivers to communicate with a single charger and avoid message collision (receiver may in some instances contain a means of synchronizing communication of information and data from the mobile device to the pad, where unique RFID tags, including those using Felicia or NFC protocols, are used to communicate charging information between devices and pad [communication method]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 6, Partovi discloses the system of claim 1. Partovi further discloses wherein the system uses a control algorithm for power transfer to the multiple receivers, which attempts to keep all of the receivers operating simultaneously such that the range of each particular receiver's voltage at its output stage regulator input is within the acceptable operating range for that particular receiver (Zener diode 352 is incorporated to clamp the maximum voltage at the output of the receiver prior to the regulator, where 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 mis-aligned, such that once the battery charger starts operation after detection of the appropriate voltage at the input, the battery charger circuitry would pull the voltage at this point to the pre-programmed voltage or voltage of the battery [control algorithm]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0148, 0178-0179]).

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US13/78534

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 10, 13, 27, and 30 are objected to under PCT Rule 66.2(a)(iii) as containing the following defect in the form or contents thereof:

Claims 10 and 27 contain a typographical error in the phrase "the WPT" in line 3 of each claim. For the purposes of this opinion, the phrase "the WPT" shall be interpreted to read "a wireless power system" in accordance with the specification of the instant application and PCT Rules regarding claim clarity and proper antecedent basis.

Claims 13 and 30 contain a typographical error in the phrases "the charger coil area" and "the charger magnetic area" in line 2 of each claim. For the purposes of this opinion, the phrases "the charger coil area" and "the charger magnetic area" shall be interpreted to read "a charger coil area" and "a charger magnetic area" in accordance with PCT Rules regarding proper antecedent basis.

Supplemental Box

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-***-Continued from Box V: Citations and Explanations-***-

As per claim 7, Partovi discloses the system of claim 1. Partovi further discloses wherein the system includes components for use in powering the multiple receivers from the same charger, including support for one or more of the following features: standby and initial set up/ping or identification of receivers; changes to number of receivers due to introduction or removal of a receiver during operation; handling of changes to power requirement of one or more receivers due to movement of the receiver in an X, Y, or Z direction or change in their load; end of charge at one or more receivers; foreign object or metal detection; and/or over temperature and/or other fault handling in the system (unique RFID tags are used to communicate charging information between devices and pad, including device identification information [ID of receivers]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 8, Partovi discloses the system of claim 1. Partovi further discloses wherein the system includes a combination of physical power layer (PPL) (pad 100 comprises multiple coils or sets of wires 104 for charging a plurality of receivers within the base unit and external to it [PPL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), physical communication and control layer (PCCL) (printed circuit board used as hardware for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [PCCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), command and control layer (CCL) (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [CCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]), and user application layer (UAL) components, for use in powering or charging the multiple receivers wirelessly (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of a mobile device to determine position of the device and arrange coils 104 of the pad 100 accordingly [UAL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

As per claim 9, Partovi discloses the system of claim 8. Partovi further discloses wherein the PPL comprises the mobile device, coil, magnetic and other hardware components, systems and specifications in the base unit transmitter, or chargers and receivers that allow power to be transmitted from one or more transmitters to one or more receivers (pad 100 comprises multiple coils or sets of wires 104 for inductively charging a plurality of receivers within the base unit or external to it [chargers and receivers]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 10, Partovi discloses the system of claim 8. Partovi further discloses wherein the PCCL comprises components, hardware, systems and specifications that allow device identification, communication and control of a wireless power system, and components used to detect and interrupt power flow, such as interlock switches, temperature or magnetic field detectors, and charging flags (printed circuit board used as hardware for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [PCCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 11, Partovi discloses the system of claim 8. Partovi further discloses wherein the CCL comprises a firmware and/or software and associated protocols and specifications in transmitters and/or chargers and receivers that control the charger and receiver operations and allow detection and/or identification of the receivers, control of power transmission, power regulation, end of charge actions and/or handling of any extraordinary or fault conditions (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [CCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

As per claim 12, Partovi discloses the system of claim 8. Partovi further discloses wherein the UAL comprises physical, software and hardware connections, communications, control, protocols and specifications for connectivity and display or execution of additional functionality between transmitters or chargers and/or receivers and devices, systems, environments or vehicles where they are integrated or attached to (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of a mobile device to determine position of the device and arrange coils 104 of the pad 100 accordingly [UAL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

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As per claim 13, Partovi discloses the system of claim 1. Partovi further discloses wherein the base unit uses a saturable magnetic layer placed above a charger coil area to shield a charger magnetic layer from the surrounding area for use with a Magnetic Aperture (MA) or Magnetic Coupling (MC) receiver (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to each of the coils 104 in the pad 100 (collectively saturable magnetic layer), where a matching magnet at the center of the receiver coil attracts the nearby primary magnet in the pad 100 and centers it automatically with respect to the secondary (MC) receiver magnet [saturable magnetic layer, MC]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 14, Partovi discloses the system of claim 1. Partovi further discloses wherein the base unit uses a magnetic layer that extends beyond the physical dimensions of the base unit coil or coils on the side opposing the receiver or receivers and provides a flux return path to allow better guiding of the electromagnetic power flux and some degree of positioning freedom and efficient power transfer to one or more receivers (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to the bottom center (beyond physical dimensions of base unit coils) each coil in the pad, where a matching magnet at the center of the receiver coil attracts the primary magnet nearby and centers it (positioning freedom) automatically with respect to the secondary (allowing guiding of EM flux) [magnetic layer beyond coil dimensions]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 15, Partovi discloses the system of claim 1. Partovi further discloses wherein the receiver or receivers use magnetic layer(s) that extends beyond the physical dimensions of the receiver coil or coils on the side opposing the base unit and provide a flux return path to allow some degree of positioning freedom and efficient power transfer from the base unit to one or more receivers (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to the bottom center (beyond physical dimensions of base unit coils) each coil in the pad, where a matching magnet at the center of the receiver coil attracts the primary magnet nearby and centers it (positioning freedom) automatically with respect to the secondary (efficient power transfer) [magnetic layer beyond coil dimensions]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 16, Partovi discloses the system of claim 1. Partovi further discloses wherein the base unit is provided within an automobile, train, bus or other vehicle, for use in charging or powering one or more mobile devices each having receivers, within the vehicle (an after market inductive or wire free charger for a car where the inductive or wire free charger 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 [automobile]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 18, Partovi discloses a method for powering or charging multiple receivers wirelessly with a power transmitter (power source, charging system, and inductive receiver for mobile devices [system]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]) comprising: providing a system including a base unit having one or more transmitter coils (pad 100 (base unit) comprises multiple coils or sets of wires 104 [base unit]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]); and providing one or more components within the base unit and/or a mobile device to be charged by the base unit, including a degree of positioning freedom (the coils are mounted such that they can move laterally within the pad, such that the pad senses the position of a secondary coil (component within base unit or mobile device) and moves the coils to the right position to optimize power transfer [degree of freedom]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), and support for different voltages, wireless power protocols, and/or power levels, for powering or charging multiple receivers wirelessly (receiver can also comprise electronic components or logic to set the voltage and current to the appropriate levels required by the mobile devices [support for different voltages]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 19, Partovi discloses the method of claim 18. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger include a coil and appropriate magnetic material and structure system that allows position free multi-charging, including one or more magnetic resonance or loosely coupled systems, flux guide structures, Magnetic Coupling, Magnetic Aperture coil and/or other magnetic material and structures (the coils are mounted such that they can move laterally within the pad, such that the pad senses the position of a secondary coil (component within base unit or mobile device) and moves the coils to the right position to optimize power transfer [coil for position free multi-charging]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 20, Partovi discloses the method of claim 18. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger includes a receiver having an output regulator stage with a large acceptable operating input voltage range (regulator can be placed between the output of the receiver and the battery, where regulator can sense the appropriate parameters of the battery (voltage, current, capacity), and regulate the current drawn from the receiver appropriately and set the voltage and current to the appropriate levels required by the mobile device [output regulator stage]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 21, Partovi discloses the method of claim 18. Partovi further discloses wherein the components for use in powering the multiple receivers from the same charger operate a communication method that allows multiple receivers to communicate with a single charger and avoid message collision (receiver may in some instances contain a means of synchronizing communication of information and data from the mobile device to the pad, where unique RFID tags, including those using Felicia or NFC protocols, are used to communicate charging information between devices and pad [communication method]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

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As per claim 23, Partovi discloses the method of claim 18. Partovi further discloses wherein the system uses a control algorithm for power transfer to the multiple receivers, which attempts to keep all of the receivers operating simultaneously such that the range of each particular receiver's voltage at its output stage regulator input is within the acceptable operating range for that particular receiver (Zener diode 352 is incorporated to clamp the maximum voltage at the output of the receiver prior to the regulator, where 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 mis-aligned, such that once the battery charger starts operation after detection of the appropriate voltage at the input, the battery charger circuitry would pull the voltage at this point to the pre-programmed voltage or voltage of the battery [control algorithm]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0148, 0178-0179]).

As per claim 24, Partovi discloses the method of claim 18. Partovi further discloses wherein the system includes components for use in powering the multiple receivers from the same charger, including support for one or more of the following features: standby and initial set up I ping or identification of receivers; changes to number of receivers due to introduction or removal of a receiver during operation; handling of changes to power requirement of one or more receivers due to movement of the receiver in an X, Y, or Z direction or change in their load; end of charge at one or more receivers; foreign object or metal detection; and/or over temperature and/or other fault handling in the system (unique RFID tags are used to communicate charging information between devices and pad, including device identification information [ID of receivers]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 25, Partovi discloses the method of claim 18. Partovi further discloses wherein the system includes a combination of physical power layer (PPL) (pad 100 comprises multiple coils or sets of wires 104 for charging a plurality of receivers within the base unit and external to it [PPL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), physical communication and control layer (PCCL) (printed circuit board used as hardware for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [PCCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]), command and control layer (CCL) (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [CCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]), and user application layer (UAL) components, for use in powering or charging the multiple receivers wirelessly (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of a mobile device to determine position of the device and arrange coils 104 of the pad 100 accordingly [UAL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

As per claim 26, Partovi discloses the method of claim 25. Partovi further discloses wherein the PPL comprises the mobile device, coil, magnetic and other hardware components, systems and specifications in the base unit transmitter, or chargers and receivers that allow power to be transmitted from one or more transmitters to one or more receivers (pad 100 comprises multiple coils or sets of wires 104 for inductively charging a plurality of receivers within the base unit or external to it [chargers and receivers]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 27, Partovi discloses the method of claim 25. Partovi further discloses wherein the PCCL comprises components, hardware, systems and specifications that allow device identification, communication and control of of a wireless power system, and components used to detect and interrupt power flow, such as interlock switches, temperature or magnetic field detectors, and charging flags (printed circuit board used as hardware for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [PCCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

As per claim 28, Partovi discloses the method of claim 25. Partovi further discloses wherein the CCL comprises a firmware and/or software and associated protocols and specifications in transmitters and/or chargers and receivers that control the charger and receiver operations and allow detection and/or identification of the receivers, control of power transmission, power regulation, end of charge actions and/or handling of any extraordinary or fault conditions (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of circuit and antenna in the device to be charged, such that the information on the tag can be detected to identify the voltage in the device to be charged required and to authenticate the circuit to be genuine or under license [CCL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

As per claim 29, Partovi discloses the method of claim 25. Partovi further discloses wherein the UAL comprises physical, software and hardware connections, communications, control, protocols and specifications for connectivity and display or execution of additional functionality between transmitters or chargers and/or receivers and devices, systems, environments or vehicles where they are integrated or attached to (software code instructions stored on a storage medium executed by printed circuit board, where software instructions include a process for RFID communication between mobile device and charger device, where RFID reader 280 can detect an RFID tag of a mobile device to determine position of the device and arrange coils 104 of the pad 100 accordingly [UAL]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147, 0178-0179]).

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As per claim 30, Partovi discloses the method of claim 25. Partovi further discloses wherein the base unit uses a saturable magnetic layer placed above a charger coil area to shield a charger magnetic layer from the surrounding area for use with a Magnetic Aperture (MA) or Magnetic Coupling (MC) receiver (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to each of the coils 104 in the pad 100 (collectively saturable magnetic layer), where a matching magnet at the center of the receiver coil attracts the nearby primary magnet in the pad 100 and centers it automatically with respect to the secondary (MC) receiver magnet [saturable magnetic layer, MC]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 31, Partovi discloses the method of claim 18. Partovi further discloses wherein the base unit uses a magnetic layer that extends beyond the physical dimensions of the base unit coil or coils on the side opposing the receiver or receivers and provides a flux return path to allow better guiding of the electromagnetic power flux and some degree of positioning freedom and efficient power transfer to one or more receivers (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to the bottom center (beyond physical dimensions of base unit coils) each coil in the pad, where a matching magnet at the center of the receiver coil attracts the primary magnet nearby and centers it (positioning freedom) automatically with respect to the secondary (allowing guiding of EM flux) [magnetic layer beyond coil dimensions]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 32, Partovi discloses the method of claim 18. Partovi further discloses wherein the receiver or receivers use magnetic layer(s) that extends beyond the physical dimensions of the receiver coil or coils on the side opposing the base unit and provide a flux return path to allow some degree of positioning freedom and efficient power transfer from the base unit to one or more receivers (coils 104 of pad 100 are arranged in an overlapping layered manner, where a magnet is attached to the bottom center (beyond physical dimensions of base unit coils) each coil in the pad, where a matching magnet at the center of the receiver coil attracts the primary magnet nearby and centers it (positioning freedom) automatically with respect to the secondary (efficient power transfer) [magnetic layer beyond coil dimensions]; figures 1, 6, 10-11, 14-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0135-0147]).

As per claim 33, Partovi discloses the method of claim 18. Partovi further discloses wherein the base unit is provided within an automobile, train, bus or other vehicle, for use in charging or powering one or more mobile devices each having receivers, within the vehicle (an after market inductive or wire free charger for a car where the inductive or wire free charger 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 [automobile]; figures 1, 6, 10-11, and 16-17; paragraphs [0013-0014, 0037-0056, 0068-0082, 0124-0131, 0137-0147]).

Claims 5 and 22 lack an inventive step under PCT Article 33(3) as being obvious over Partovi in view of US 2011/0222493 A1 to MANGOLD, S. et al. (hereinafter 'Mangold').

As per claims 5 and 22, Partovi discloses the system and method of claims 4 and 21, respectively. However, Partovi fails to disclose wherein, to avoid message collisions, each receiver is configured to send messages at time intervals which are random or different from other receivers, such that if a collision occurs with a particular message, the charger can ignore that particular message, or reset the communication. However, Mangold discloses wherein, to avoid message collisions, each receiver is configured to send messages at time intervals which are random or different from other receivers, such that if a collision occurs with a particular message, the charger can ignore that particular message, or reset the communication (time division multiplexing (differing time intervals) can still include data collisions, where, in the event of a collision, traditional collision recovery can be used including sending resend (reset communication) requests [sending message at time intervals]; figure 4; paragraphs [0057-0059]). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the system and method of Partovi to include wherein, to avoid message collisions, each receiver is configured to send messages at time intervals which are random or different from other receivers, such that if a collision occurs with a particular message, the charger can ignore that particular message, or reset the communication, as taught by Mangold, because it is advantageous to utilize a time randomization communication involving time dividing messages, ignoring collision messages, and resending the given communication in the event of collision, such as the time division multiplexed method of Mangold, for the purpose or mitigating the occurrence of message collision while still successfully completing message transmission even in the event of a collision (see Mangold, paragraph [0059]).

Claims 17 and 34 lack an inventive step under PCT Article 33(3) as being obvious over Partovi in view of US 5,311,973 A to TSENG, D. et al. (hereinafter 'Tseng').

As per claims 17 and 34, Partovi discloses the system and method of claims 1 and 18, respectively. However, Partovi fails to disclose wherein the receiver is incorporated within or otherwise coupled to an electric train, bus, automobile or other vehicle, and the base unit is used to charge the electric train, bus, automobile or other vehicle. However, Tseng discloses wherein the receiver is incorporated within or otherwise coupled to an electric train, bus, automobile or other vehicle, and the base unit is used to charge the electric train, bus, automobile or other vehicle (battery of an electric vehicle is inductively charged while the electrical vehicle is moving, using a magnetic field along different portions of an extended linear distance and an inductive coil mounted on an electric vehicle [base unit charging automobile]; abstract; column 1, lines 45-65). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the system and method of Partovi to include wherein the receiver is incorporated within or otherwise coupled to an electric train, bus, automobile or other vehicle, and the base unit is used to charge the electric train, bus, automobile or other vehicle, as taught by Tseng, because it is well known in the relevant art to utilize a inductive car battery charging device, such as the inductive car charger of Tseng, for the purpose of utilizing inductive electric energy that may be generated by the movement of the vehicle itself (see Tseng, column 1, lines 45-65).

Claims 1-34 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

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(71) Applicant *(for all designated States except US)*: **HANRIM POSTECH CO., LTD.** [KR/KR]; 626-1 Pajang-dong, Jangan-gu, Suwan-si, Gyeonggi-do 440-290 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **JUNG, Chun-Kil** [KR/KR]; 77-9 Nonhyeong-dong, Gangnam-gu, Seoul 135-010 (KR). **KOOK, Yoon-Sang** [KR/KR]; 123-102 Jugong Apartment, 37 Jungang-dong, Gwacheon-si, Gyeonggi-do 427-010 (KR).

(74) Agent: **KIM, Sung-Gyu**; 4th FL. Jangan Bldg., 827-3 Yoksam-dong, Kangnam-gu, Seoul 135-080 (KR).

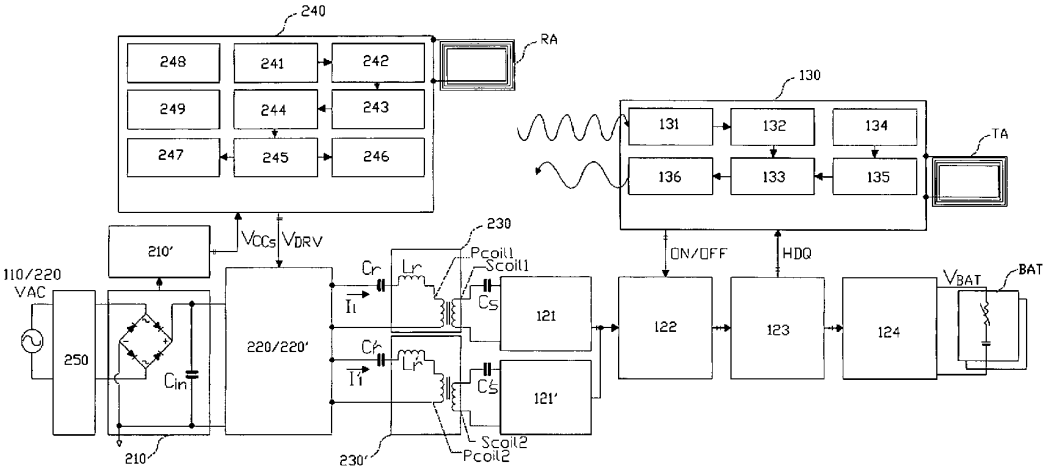
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(54) Title: WIRELESS CHARGING PAD AND BATTERY PACK USING RADIO FREQUENCY IDENTIFICATION TECHNOLOGY



(57) Abstract: The present invention relates to a wireless charging pad and a battery pack, to which a radio frequency identification technology is applied, which can detect the charged status of the battery pack in real time, and which includes a means for detecting devices placed on the wireless charging pad. Thus effectively coping with the case where a plurality of battery packs, or an object that cannot be charged, is placed on the wireless charging pad.

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DESCRIPTION

WIRELESS CHARGING PAD AND BATTERY PACK USING RADIO FREQUENCY IDENTIFICATION TECHNOLOGY

Technical Field

The present invention relates, in general, to a wireless charging pad and a battery pack to which a radio frequency identification technology is applied and, more particularly, to a wireless charging pad and a battery pack, to which a radio frequency identification technology is applied, which can detect the charged status of the battery pack in real time, and which includes a means for detecting devices placed on the wireless charging pad, thus effectively coping with the case where a plurality of battery packs, or an object that cannot be charged, is placed on the wireless charging pad.

Background Art

Recently, with the development of communication and information processing technologies, the use of portable devices that are convenient to carry, such as a mobile phone, is increasing, and with the development of technologies, new model terminals having improved efficiency are continuously popularized. To charge such portable devices, a contact type charging method is used,

or a non-contact type charging method in which a battery is charged using magnetic coupling without electrical contact is used so as to overcome the problem of the contact type charging method that is attributable to the exposure of contact terminals to an outside.

As for technology corresponding to a non-contact charger, a method of charging a battery through wireless communication between a battery pack and a charging device using magnetic cores is disclosed in Korean Unexamined Pat. Pub. No. 2002-0035242 entitled "Non-contact Charging Device for Battery of Portable Device using Inductive Coupling," and a method of solving a problem of a magnetic core using a transformer formed in such a way that coils are wound on a Printed Circuit Board (PCB) is disclosed in Korean Unexamined Pat. Pub. No. 2002-0057469 entitled "Thin PCB Transformer without Core and Non-contact Battery Charger using PCB Transformer."

The present applicant proposed the technology in which a wireless charging pad for functioning as a wireless charger was constructed and the battery pack of a portable device was charged in a non-contact manner by placing the battery pack on the wireless charging pad through "Non-contact Battery Charging System capable of Multi-Charging and Method of Designing Core Block" (Korean Pat. application No. 2004-21335).

However, in the prior art, the wireless charging pad

could not detect the charged status of the battery pack in real time and a means for detecting devices placed on the wireless charging pad was not implemented, so that a problem arises in that the prior art is difficult to cope with the case where a plurality of battery packs, or an object that cannot be charged, is placed on a wireless charging pad.

Description of Drawings

FIG. 1 is a view showing the construction of a battery pack charged by a wireless charging pad in a non-contact manner, according to the present invention;

FIG. 2 is a view showing the entire construction of a non-contact battery charging system composed of the wireless charging pad and the battery pack, according to the present invention;

FIGS. 3 to 5 are views illustrating the components of the wireless charging pad or battery pack, according to the present invention;

FIG. 6 is a view showing a method of generating a magnetic field based on the switching patterns of the wireless charging pad, according to the present invention;

FIG. 7 is a view showing the size expansion of the wireless charging pad according to the number of charging devices, according to the present invention;

FIG. 8 is a view showing the detailed construction of

the non-contact battery charging system composed of the wireless charging pad and the battery pack, according to the present invention;

FIG. 9 is a flowchart showing a method of charging a battery using the wireless charging pad of FIG. 8;

FIGS. 10 and 11 are views showing the equivalent circuits of series and parallel resonant converters, respectively, provided to the wireless charging pad of the present invention;

FIGS. 12 to 17 are views showing the operation of a half-bridge series resonant converter provided to the wireless charging pad of the present invention, according to modes;

FIG. 18 is a view showing the voltage and current waveforms of a transformer according to the gate signal of the half-bridge series resonant converter provided to the wireless charging pad of the present invention;

FIG. 19 is a view showing the rotating directions of a magnetic field according to the operation of the half-bridge series resonant converter provided to the wireless charging pad of the present invention, according to modes;

FIGS. 20 to 23 are views showing the rectifying circuits of a charging receiver module according to the present invention;

FIG. 24 is a view showing the construction of a controller provided to the wireless charging pad of the

present invention; and

FIG. 25 is a view showing the flow of an RF signal between the wireless charging pad and the battery pack according to the present invention.

Disclosure

Technical Problem

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a wireless charging pad and a battery pack, to which a radio frequency identification technology is applied, which can detect the charged status of the battery pack in real time, and which includes a means for detecting devices placed on the wireless charging pad, thus effectively coping with the case where a plurality of battery packs, or an object that cannot be charged, is placed on the wireless charging pad.

Technical Solution

In order to accomplish the above objects, the present invention provides a wireless charging pad (200) for charging a battery pack (100) mounted on a portable device in a non-contact manner, to which a radio frequency identification technology is applied, including a controller (240) for switching to an active mode and

controlling drive circuits (220 and 220') while standing by in an energy saving mode when access of the battery pack (100) is detected, for transmitting a Radio Frequency (RF) carrier signal to the battery pack (100) in the active mode, receiving RF data, which is modulated and includes wireless identification information and charged status information of the battery pack (100), through a reader antenna (RA) in response to the RF carrier signal, and indicating the charged status of the battery pack (100), and for switching to the energy saving mode again when charging of the battery pack (100) is completed; the drive circuits (220 and 220') for switching two primary coils (Pcoil1 and Pcoil2) under control of the controller (240); and a primary-side transformer formed by constructing a pad core, which is adapted to generate induced electromotive force through switching of the drive circuits (220 and 220') and charge the battery pack (100), and which is formed by connecting a plurality of small cobalt-based amorphous metallic or ferrite planar cores in a square or rectangular shape, and winding two primary coils (Pcoil1 and Pcoil2) on the pad core in directions perpendicular to each other.

Preferably, the controller (240) may read wireless identification information and charged status information of each of battery packs (100) in order in which the battery packs (100) are placed, indicate charged status of

each battery pack (100), and switch to the energy saving mode when charging of all the battery packs (100) are completed, and therefore, fully charged status may be established.

Preferably, the controller (240) may include an oscillator (241) for generating an oscillation signal of a certain frequency; an antenna driver (242) for using the oscillation signal of the oscillator (241) as a clock, monitoring the access of the battery pack (100) by transmitting the RF carrier signal to an outside through the reader antenna (RA) and monitoring whether a return signal exists, and wirelessly receiving RF data, which is modulated and includes the wireless identification information and charged status information of the battery pack (100), in response to the RF carrier signal when the battery pack (100) makes access; a demodulator (243) for demodulating the RF data received by the antenna driver (242); a filter and amplification unit (244) for filtering the wireless identification information and charged status information from the demodulated data and amplifying the filtered information; a data decoder (245) for decoding the wireless identification information and the charged status information received by the filter and amplification unit (244); and a display unit (247) for displaying the data decoded by the data decoder (245).

Preferably, the drive circuits (220 and 220') may

include two half-bridge series-parallel resonant converters to control the primary coils (Pcoil1 and Pcoil2) perpendicular to each other, and switch the primary coils (Pcoil1 and Pcoil2) at a frequency higher than a resonant point so that switching patterns of the primary coils (Pcoil1 and Pcoil2) have a phase difference of 90 degrees, thus allowing linkage flux to vary while rotating in a sequence of 180°→ 135°→ 90°→ 45°→ 0°→ -45°→ -90°→ -135°, and thereby, generating a magnetic field that rotates by 360 degrees.

Preferably, the wireless charging pad may further include an electromagnetic wave filter (250) combined with a power input terminal to block electromagnetic waves from Alternating Current (AC) power input; an AC/Direct Current (DC) conversion circuit (210) for receiving the AC power, the electromagnetic waves of which are blocked, from the electromagnetic wave filter (250) and rectifying the AC power into DC power; and a flyback converter (210') connected to the AC/DC conversion circuit (210) and the controller (240) to accumulate power while a transistor is turned on and transmit the accumulated power to the controller (240) when the transistor is turned off so as to drive the drive circuits (220 and 220').

Preferably, the wireless charging pad (200) may include input ports that are combined with at least one of an AC adapter, a Universal Serial Bus (USB) port and a

cigar lighter jack for a vehicle.

The present invention provides a battery pack (B) mounted on a portable device to be charged by a wireless charging pad (A) in a non-contact manner, to which a radio frequency identification technology is applied, including a charging receiver module (110) formed of an amorphous metallic planar core and two secondary coils (Scoil1 and Scoil2), which are wound on the planar core in vertical and horizontal directions, to induce power through magnetic coupling with the wireless charging pad (200); a charging protection circuit module (120) combined with the charging receiver module (110) and the battery (BAT) to record charged status information generated by periodically monitoring charged status of the battery (BAT) in an Radio Frequency Identification (RFID) tag (130), and to control whether to charge or discharge the battery (BAT) by selectively supplying or blocking the power induced to the charging receiver module (110) to the battery (BAT); the RFID tag (130) combined with the charging protection circuit module (120) to store wireless identification information of the battery (BAT), to periodically record the charged status information, and to generate and modulate RF data including the wireless identification information and charged status information of the battery (BAT) and transmit the modulated RF data to the wireless charging pad (200) when an RF carrier signal is transmitted

from the wireless charging pad (200) through a tag antenna (TA); and the battery (BAT) to be charged under control of the protection circuit (124).

Preferably, the wireless charging pad may further include an amorphous metallic electromagnetic protector (140) for minimizing a rise in temperature of the battery (BAT) attributable to frequency interference, which is caused by radio signals or induced electromotive force in a magnetic field, or attributable to inductive heating, by magnetically blocking a gap between the battery (BAT) and the charging receiver module (110).

Preferably, the wireless charging pad may further include a battery casing (150) manufactured using a cool polymer to perform an operation of emitting heat generated due to charging while admitting the induced electromotive force, and to entirely surround a structure that is formed by assembling the components.

Preferably, the charging protection circuit module (120) may include rectifying circuits 121 and 121' for rectifying the power induced to the charging receiver module (110) and supplying the rectified power to a charging control circuit (122); the charging control circuit (122) combined with the rectifying circuits (121 and 121') to supply the power rectified by the rectifying circuits (121 and 121') to a fuel gauge (123) under On/Off control of the RFID tag (130); the fuel gauge (123) for

supplying the power supplied from the charging control circuit (122) to the battery (BAT) through a protection circuit (124), and generating the charged status information while monitoring the charged status of the battery (BAT), and periodically recording the charged status information in the RFID tag (130); and the protection circuit (124) combined with the fuel gauge (123) and the battery (BAT) to protect the battery (BAT) by controlling whether to charge or discharge according to the charged status of the battery (BAT).

Preferably, the rectifying circuits (121 and 121') may be series-parallel resonant center tap half-bridge rectifying circuits using an output of a single center tap rectifying diode and an output filter capacitor, or series-parallel resonant full-bridge rectifying circuits using an output of a full-bridge rectifying diode and an output filter capacitor.

Preferably, the RFID tag (130) may include a clock extraction unit (131) for extracting a clock from the RF carrier signal wirelessly received from the wireless charging pad (200); a sequencer (132) for inspecting an sequence of arranged data extracted from the clock extraction unit (131) and transmitting a control signal to a data encoder (133); the data encoder (133) for receiving the wireless identification information and charged status information of the battery (BAT) from a tag (135) when the

control signal is transmitted from the sequencer (132), and transmitting the wireless identification information and charged status information to a data modulator (136) after coding the wireless identification information and charged status information; the data modulator (136) for generating RF data generated by modulating the data received from the data encoder (133), and wirelessly transmitting the RF data to the wireless charging pad (200); Read Only Memory (ROM) (134) for recording the wireless identification information and charged status information therein; and the tag (135) for reading the wireless identification information and charged status information of the battery (BAT) stored in the ROM (134), and transmitting the wireless identification information and charged status information to the data encoder (133).

Preferably, the wireless identification information may correspond to one of a product name of the battery (BAT), a serial number of the battery (BAT) and a user identification number that is stored in the RFID tag (130) through communication between a body of a portable device, on which the battery pack (100) is mounted, and the battery pack (100).

Preferably, the RF carrier signal may be a signal that accesses an RFID signal stored in the battery pack (100) using a carrier signal in High Frequency (HF) (3 to 30 MHz) or Ultra High Frequency (UHF) (300 to 3000 MHz)

bands.

Advantageous Effects

As described above, the present invention is advantageous in that there is provided a wireless charging pad and a battery pack, to which a radio frequency identification technology is applied, which can detect the charged status of the battery pack in real time, and which includes a means for detecting devices placed on the wireless charging pad, thus effectively coping with the case where a plurality of battery packs, or an object that cannot be charged, is placed on the wireless charging pad.

Best Mode

Preferred embodiments of the present invention are described in detail with reference to the attached drawings below, but detailed descriptions of related well-known functions and construction may be omitted if the detailed descriptions are determined to make the gist of the present invention unclear.

FIG. 1 is a view showing the entire construction of a battery pack charged by a wireless charging pad in a non-contact manner, according to the present invention.

Referring to FIG. 1, a battery pack 100 includes a charging receiver module 110 provided with secondary coils Scoil1 and Scoil2 to receive induced electromotive force

from a primary-side wireless charging pad 200 (refer to FIG. 2), a charging protection circuit module 120 and a battery BAT having fuel gauge and charging functions, an RFID tag 130 (refer to FIG. 2) and a tag antenna TA adapted to transmit and receive radio signals, and an electromagnetic protector 140 that is an amorphous metal-based electromagnetic interference shield for magnetically isolating the battery BAT and the charging receiver module 110 so that the battery BAT does not affect the inductive coupling between the receiver module 110 and the wireless charging pad 200 (refer to FIG. 2).

The electromagnetic protector 140 is made of an amorphous metal-based magnetic material to remove frequency interference in a magnetic field attributable to radio signals and induced electromotive force, and generally functions to minimize a rise in temperature of the battery BAT in a magnetic field attributable to inductive heating caused by a metallic battery casing, so that the electromagnetic protector 140 must be inserted.

The battery pack 100 may further include the battery casing 150 for surrounding all the components, such as the charging receiver module 110, the charging protection circuit module 120, the battery BAT and the electromagnetic protector 140, combined into a single structure. In this case, the battery casing 150 is manufactured using a cool polymer material, such as cobalt or nickel, so that the

battery casing 150 functions to pass the induced electromotive force or electromagnetic waves, and emit heat generated inside the battery casing 150 due to charging.

FIG. 2 is a view showing the construction of a non-contact battery charging system composed of the wireless charging pad and the battery pack, according to the present invention.

Referring to FIG. 2, the non-contact battery charging system composed of the wireless charging pad and the battery pack separately comprises the wireless charging pad 200 adapted to function as a non-contact charger and the battery pack 100 charged with power provided by the wireless charging pad 200. A separative transformer is provided between the wireless charging pad 200 and the battery pack 100 so that a primary side of the transformer is provided in the wireless charging pad 200 and a secondary side of the transformer is provided in the battery pack 100.

The battery pack 100 includes the charging receiver module 110, the charging protection circuit module 120, the RFID tag 130, the tag antenna TA and the battery BAT that constitute the secondary side of the transformer.

The charging receiver module 110 receives the power induced from the wireless charging pad 200 and supplies the power to the charging protection circuit module 120.

The charging protection circuit module 120 having

fuel gauge and charging functions includes rectifying circuits 121 and 121' for rectifying the power supplied from the charging receiver module 110 by performing AC/DC conversion, a switch mode charging control circuit 122 for charging the battery BAT made of lithium ion or lithium polymer at Constant Voltage (CV) and Constant Current (CC), and a protection circuit 124 for detecting the charged status of the battery BAT and determining whether to supply or block the power supplied to the battery BAT from the charging control circuit 122 so as to protect the battery BAT. The charging protection circuit module 120 is constructed in such a way that the output of the charging receiver module 110 is the input of the rectifying circuits 121 and 121' and the output of the rectifying circuits 121 and 121' is connected to the input of the switch mode charging control circuit 122. Furthermore, the output of the charging control circuit 122 is connected to a fuel gauge 123, and the fuel gauge 123 is connected to the protection circuit 124 that protects the battery BAT from excessive charging and excessive current. Such components are mounted in the battery pack 100 of a portable device, and can be applied to a hard pack or an inner pack according to the type of the battery pack 100.

The wireless charging pad 200 functioning as a non-contact charger has various input ports having DC inputs, so that the wireless charging pad 200 can be used in

connection with various types of external power sources (e.g., the output of an AC adapter, a USB port of a computer, cigar lighter jack of a vehicle, etc.). In the wireless charging pad 200, the primary side of the transformer is provided, switching loss is reduced through zero voltage and zero current soft switching by switching at a frequency higher than a resonant point using a half-bridge resonant converter, and linkage flux is induced to the battery pack 100 of a portable device that constitutes a secondary side. Furthermore, the wireless charging pad 200 has a function of detecting the wireless identification information of the battery BAT and indicating charged status information on the wireless charging pad 200 through radio communication when the battery pack 100 equipped with the charging receiver module 110 is placed on the wireless charging pad 200, and a function of entering a shutdown mode and an energy saving mode when an object other than a battery pack 100 is placed on the wireless charging pad 200. Furthermore, when a plurality of portable devices is placed on the wireless charging pad 200, the wireless charging pad 200 reads the wireless identification information (e.g., personal phone numbers, etc.) stored in the RFID tag 130, indicates the wireless identification information on the wireless charging pad 200, indicates charged status, and indicates charging completion status on the wireless charging pad 200 after receiving information

on the completion of charging from the battery pack 100.

The RFID tag 130 and the tag antenna TA function to interface with the fuel gauge 123 that controls the charged status information of the battery BAT and transmit the charged status information of the battery BAT to the wireless charging pad 200 in a radio data form using a radio frequency in HF (13.56MHz) or UHF (900MHz) bands. The RFID tag 130 includes a memory block and a logic block, and stores the wireless identification information, such as a product name, a serial number and a user identification number (e.g., personal telephone number), therein. In this case, the user identification number is stored in the memory block of the RFID tag 130 through the communication between the terminal body of the portable device and the battery pack 100.

FIGS. 3 and 4 are views illustrating the components of the wireless charging pad and the battery pack according to the present invention, respectively.

Referring to FIG. 3, the wireless charging pad 200 according to the present invention includes a controller 240 for reading the RFID tag and controlling charging, drive circuits 220 and 220', and primary coils Pcoil1 and Pcoil2.

The wireless charging pad 200 may include various input ports having DC inputs, and generates the switching patterns of the primary coils Pcoil1 and Pcoil2 through the

drive circuits 220 and 220', respectively, and performs a control function of detecting portable devices placed on the wireless charging pad 200 and indicating the energy saving mode and the charged status of each of the portable devices. The drive circuits 220 and 220' are On/Off switching devices for switching the primary coils Pcoil1 and Pcoil2, respectively, each of which is composed of an upper switch and a lower switch. The drive circuits 220 and 220' are each constructed using a half-bridge or full-bridge resonant converter (serial, parallel or serial-parallel resonant converter).

Referring to FIG. 4, in the wireless charging pad 200 according to the present invention, the primary side of the transformer is constructed in such way that the two primary coils Pcoil1 and Pcoil2 are wound on a planar core, which is formed by combining small cobalt-based amorphous metallic cores, such as Co, Fe, Ni, B and Si, or ferrite cores in various shapes, in directions perpendicular to each other as shown in FIG. 4. In this case, the switching patterns perform switching so that a phase difference of 90 degrees occurs between the two primary coils Pcoil1 and Pcoil2. Accordingly, induced energy can be received regardless of the location of the portable device that is placed on the wireless charging pad 200 and has the battery pack 100 equipped with the charging receiver module 100.

The input form of the wireless charging pad 200 is

described below.

A control power source supplies the driving power of the controller 240 and the drive circuits 220 and 220' using a flyback converter in a 110/220 V direct drive fashion. In the resonant converter, DC power obtained by rectifying AC power in a 110/220 V switching fashion is always set to a 110 V input condition. DC power (12, 24, 48 V) is generated using the flyback converter for free voltages ranging from 86 to 265 V and is used as the input power of the resonant converter, and forms the driving power of the controller 240 and the drive circuits 220 and 220' using a regulator.

The controller 240 performs both a function of reading an RFID tag and a function of controlling charging. The construction of the controller 240 is described below.

First, a controller 240 is provided to detect the battery pack 100 equipped with the charging receiver module 110 and control charging. Wireless identification information, such as the product code and serial number of the battery BAT, and charged status information are read from the RFID tag 130 of the battery pack 100 through the controller 240. Furthermore, when the battery pack 100 equipped with the charging receiver module 110 is placed on the wireless charging pad 200 while the controller 240 in a sleep mode is maintained in a standby mode (energy saving mode: below 1 W) and monitors the battery pack 100, the

controller 240 wakes up and switches to an active mode to generate induced electromotive force by controlling the drive circuits 220 and 220', starts to charge the battery pack 100, and indicates the charged status of the battery pack 100. When the charging of the battery pack 100 is completed, the wireless charging pad 200 switches from the active mode to the energy saving mode again to save energy.

Second, when a plurality of battery packs 100 each equipped with a charging receiver modules 110 is placed on the wireless charging pad 200, wireless identification information stored in the RFID tags 130 of the battery packs 100 is read in order in which the battery packs 100 are placed. Furthermore, a fully charged battery pack 100 is indicated by a green Light Emitting Diode (LED) and a discharged battery pack 100 is indicated by a red LED. When the battery pack 100 is fully charged, the LED switches from red to green by receiving the wireless identification information of the RFID tag 130 so that the charged status is indicated by the wireless charging pad 200.

The construction of the drive circuits 220 and 220' is described below.

Two resonant converters control perpendicularly arranged primary coils Pcoil1 and Pcoil2, respectively, and the primary coils Pcoil1 and Pcoil2 are switched at a frequency higher than a resonant point so that the switching patterns of the primary coils have a phase

difference of 90 degrees. Accordingly, linkage flux rotates by 360 degrees in eight steps, thus enabling the battery pack 100 to be charged regardless of the location of the battery pack 100.

The construction of the primary side of the transformer is described below.

A single square or rectangular pad core is formed by connecting a plurality of small planar cores, is surrounded by an insulation tape, is provided with a coil wound thereon in a vertical direction, and is insulated by an insulation tape. Furthermore, the pad core is provided with a coil wound thereon in a horizontal direction and is insulated by an insulation tape, thus manufacturing the primary side of a planar transformer. In this case, the coil may be formed into a bobbinless type and be inserted into the pad core in vertical and horizontal directions. The charging receiver module 110 is operated as the secondary side of the transformer.

FIG. 5 is a view showing the charging receiver module 110. The charging receiver module 110 is manufactured in such a way that a plurality of cobalt-based amorphous metallic cores is stacked to form a single planar core, and secondary coils Scoil1 and Scoil2 are wound on the single planar core in vertical and horizontal directions, respectively. In this case, the planar core is made of an amorphous metal-based material that has high magnetic

permeability (>80,000) and a non-breakable characteristic. In the charging receiver module 110, the magnitude of induced electromotive force varies according to a function of the number of stacked cores forming the planar core, the sectional area of the planar core and the number of windings of the coils. The charging receiver module 110 has a load curve in which voltage is inversely proportional to current.

FIG. 6 is a view showing a method of generating a magnetic field depending on the switching patterns of the wireless charging pad according to the present invention.

In the wireless charging pad 200, a magnetic field rotates by 360 degrees in the case where current is applied by successively switching regions in the sequence of a first region→ a second region→ a third region→ a fourth region→ a fifth region→ a sixth region→ a seventh region→ an eighth region at a predetermined frequency, thus enabling a portable device equipped with the charging receiver module 110 to be charged regardless of the location and direction of the portable device when the portable device is placed on the wireless charging pad 200 (the magnetic field is rotated by 180°→ 135°→ 90°→ 45°→ 0°→ -45°→ -90°→ -135°). In this case, the drive circuits 220 and 220' include two half-bridge series-parallel resonant converters to control the perpendicularly arranged primary coils Pcoil1 and Pcoil2, respectively, and switch

the primary coils Pcoil1 and Pcoil2 at a frequency higher than a resonant point so that the switching patterns of the primary coils Pcoil1 and Pcoil2 have a phase difference of 90 degrees, thus allowing linkage flux to vary while rotating by 360 degrees in the sequence of 180°→ 135°→ 90°→ 45°→ 0°→ -45°→ -90°→ -135°, and thereby, generating a magnetic field that rotates by 360 degrees.

FIG. 7 is a view showing the size expansion of the wireless charging pad according to the number of charging devices, according to the present invention.

In a process of forming a pad core constituting the wireless charging pad 200, a wireless charging pad 200 having a desired size and shape can be formed by combining a plurality of small cobalt-based metallic or ferrite planar cores. For example, a pad core is formed by combining m cores in a longitudinal direction and n cores in a transverse direction according to the number of portable devices desired to be charged.

FIG. 8 is a view showing the detailed construction of a non-contact battery charging system composed of the wireless charging pad and the battery pack according to the present invention.

As shown in FIG. 8, a primary-side wireless charging pad 200 and a secondary-side battery pack 100 equipped with the charging receiver module 110 are magnetically combined with each other.

The primary-side wireless charging pad 200 includes a power input terminal, an AC/DC conversion circuit 210, a controller 240 for detecting wireless identification information transmitted from the secondary side, two half-bridge serial-parallel resonant converters, drive circuits 220 and 220′ for generating a magnetic field by generating control signals for controlling the two primary coils Pcoil1 and Pcoil2, respectively, a primary-side transformer constructed by winding the two primary coils Pcoil1 and Pcoil2 on the pad core in vertical and horizontal directions, respectively, and inductive couplers 230 and 230′ formed by providing L_r and L_r' to the corresponding primary-side transformer.

Furthermore, the primary-side wireless charging pad 200 may further include an electromagnetic wave filter 250 connected to the power input terminal for the purpose of blocking the electromagnetic waves of input AC power, and a flyback converter 210′ connected to the AC/DC conversion circuit 210 for receiving the AC power, the electromagnetic waves of which are blocked, from the electromagnetic wave filter 250 and rectifying the AC power into DC power and the controller 240 for the purpose of accumulating power while an equipped transistor is turned on and transmitting the accumulated power to the controller 240 when the equipped transistor is turned off so as to enable the drive circuits 220 and 220′ to be driven.

The secondary-side battery pack 100 includes a receiver module 110 composed of an amorphous metallic planar core and two secondary coils Scoil1 and Scoil2 that are wound on the planar core in vertical and horizontal directions, respectively, to be magnetically combined with the wireless charging pad 100, thus inducing induced electromotive force; a charging protection circuit module 120 for generating charged status information by periodically monitoring the charged status of a battery BAT, recording the generated charged status information in an RFID tag 130 and controlling whether to charge or discharge the battery BAT by selectively supplying or blocking the power, which is induced to the charging receiver module 110, to the battery BAT under the On/Off control of the RFID tag 130; the RFID tag 130 combined with the charging protection circuit module 120 to store the wireless identification information of the battery BAT and periodically record the charged status information therein, generate and modulate RFID data including the wireless identification information and charged status information of the battery BAT and transmit the modulated RFID data to the wireless charging pad 200 in response to an RFID carrier signal transmitted from the wireless charging pad 200 through a tag antenna TA; and the battery BAT to be charged under the control of the protection circuit 124.

The charging protection circuit module 120 may

include rectifying circuits 121 and 121' adapted to rectify the power induced to the charging receiver module 110 and supply the rectified power to a charging control circuit 122, the charging control circuit 122 combined with the rectifying circuits 121 and 121' to supply the power, rectified by the rectifying circuits 121 and 121' under the On/Off control of the RFID tag 130, to a fuel gauge 123, the fuel gauge 123 adapted to supply the power supplied from the charging control circuit 122 to the battery BAT through the protection circuit 124, and generate the charged status information by monitoring the charged status of the battery BAT and periodically record the charged status information in the RFID tag 130, and the protection circuit 124 combined with the fuel gauge 123 and the battery BAT to protect the battery BAT by controlling whether to charge or discharge in accordance with the charged status of the battery BAT.

When the RFID carrier signal is transmitted from the wireless charging pad 200 through the tag antenna TA, the RFID tag 130 generates and modulates RFID data that includes previously stored wireless identification information of the battery BAT and charged status information, which is periodically recorded through the fuel gauge 123, in response to the RFID carrier signal, and transmits the modulated RFID data to the wireless charging pad 200. In this case, the RFID tag 130 is composed of a

memory block and a logic block. The memory block can be implemented using ROM 134 in which the wireless identification information and the charged status information are recorded. It is preferable to use Electrically Erasable and Programmable Read Only Memory (EEPROM) as the ROM 134. The logic block can be implemented using a clock extraction unit 131 for extracting a clock from the RFID carrier signal that is wirelessly received from the wireless charging pad 200, a sequencer 132 for inspecting the sequence of arranged data extracted from the clock extraction unit 131 and transmitting a control signal to a data encoder 133, the data encoder 133 for receiving the wireless identification information and charged status information of the battery BAT from a tag 135 when the control signal is transmitted from the sequencer 132, encoding the received information and transmitting the encoded information to a data modulator 136, the data modulator 136 for generating the modulated RFID data by modulating the data received from the data encoder 133 and wirelessly transmitting the modulated RFID data to the wireless charging pad 200, and the tag 135 for reading the wireless identification information and charged status information of the battery BAT stored in the ROM 134 and transmitting the wireless identification information and charged status information to the data encoder 133.

FIG. 9 is a flowchart showing a method of charging a

battery through the wireless charging pad of FIG. 8. The method of charging a battery using the wireless charging pad 200 according to the present invention is described with reference to FIG. 9 below.

Step S100) First, when the secondary-side battery pack 100 is placed on the primary-side wireless charging pad 200, the primary-side wireless charging pad 200 generates an RFID carrier signal and inspects an object placed on the wireless charging pad 200.

Step S110) If, as a result of the inspection, the object does not contain information indicating that the object is a battery pack 100 equipped with a charging receiver module 110, the primary-side wireless charging pad 200 always enters an energy saving mode.

Step S120) If, as a result of the inspection, the object contains information indicating that the object is a battery pack 100 equipped with a charging receiver module 110, the wireless charging pad 200 wakes up to detect wireless identification information and starts charging control.

Step S130) Wireless identification information about the battery pack 100 of each of various portable devices is displayed, and whether the battery pack 100 is in charging status or fully charged status is indicated after receiving charged status information. The battery 100 in fully charged status that indicates charging is completed is

indicated by a green LED, and the battery 100 being charged is indicated by a red LED.

Step S140) When the fully charged status in which the charging of all the battery packs 100 are completed is established, the wireless charging pad 200 collects the wireless identification information and enters a standby mode, that is, the energy saving mode.

FIGS. 10 and 11 are views showing the equivalent circuits of series and parallel resonant converters provided to the wireless charging pad according to the present invention.

FIGS. 10 and 11 are views showing the equivalent circuits of a separative transformer that has a gap between the wireless charging pad 200 and the battery pack 100. In a non-contact type charging method in which energy is transmitted using the magnetic coupling of the transformer, the primary side of the transformer is included in the wireless charging pad 200 functioning as a non-contact charger and the secondary side of the transformer is included in the battery pack 100, so that a gap exists between the primary and secondary sides, thus causing inefficiency in energy transmission because a coupling coefficient and magnetizing inductance are reduced and leakage inductance is increased. Besides, it is problematic in that it is difficult to electrically transmit output information to a primary-side controller at the time of

controlling feedback. In the present invention, in order to overcome the disadvantages of the separative transformer and effectively transmit energy, a half-bridge serial resonant converter is applied to the primary side of the transformer. The serial resonant converter applied to the primary side of the transformer reduces the influence of leakage inductance on the primary side of the separative transformer, thus enabling effective energy transmission.

The self-inductance L_1 and L_2 are measured in such a way that a secondary-side module is opened and primary-side inductance is measured, and the leakage inductance L_{11} and L_{12} are measured in such a way that a secondary-side module is shorted and primary-side inductance is measured.

Mutual inductance L_M is calculated in such a way that impedance L_P is measured by connecting the primary and secondary sides in parallel, impedance L_S is measured by connecting the primary and secondary sides in series, and the measured impedance L_P and L_S are substituted for L_P and L_s of Equation 1,

$$L_M = \frac{L_P - L_s}{4} \quad (1)$$

The magnetizing inductance L_m is measured using Equations 2 to 4,

$$L_m = L_M(\frac{N_1}{N_2}), \quad N = \frac{N_2}{N_1} \tag{2}$$

(N_1: number of primary windings, N_2: number of secondary windings)

$$k = \frac{L_M}{\sqrt{L_1 L_2}} \tag{3}$$

$$L_{l1} = L_1 - L_m, \quad L_{l2} = L_2 - NL_M \tag{4}$$

Voltage imposed in the primary side of the transformer is applied to the primary side of the transformer through the voltage distribution of L_{l1} and L_{l2}, and is transmitted to the secondary side based on a winding ratio. The secondary-side voltage is transmitted to the actual secondary side of the transformer through the voltage distribution of L_{l2} and secondary-side load, so that the voltage gain is lower than that of an ideal transformer.

Furthermore, if the coupling coefficient is low, the magnetizing inductance L_m of the transformer is low, so that current flowing to the primary side of the transformer is not transmitted to the secondary side of the transformer through L_{l2}, but is circulated and transmitted to the first side of the transformer again through the magnetizing inductance L_m that has lower impedance. That is, in order to supply current required by the load, input current must be large. If the primary-side current increases, continuity loss in a switch increases, thus causing the efficiency of

a system to decrease. Accordingly, in order to increase the efficiency of the system by reducing the primary-side current, the coupling coefficient of the transformer must be increased. In the non-contact charger, the primary- and secondary-side cores are separated by a gap, and winding areas are also separated. Furthermore, the gap is located in a path through which magnetic flux passes, so that magnetic resistance is increased, thus lowering the magnetic flux density inside the cores.

When a large gap exists between the primary- and secondary-side cores, magnetic flux density is expressed by Equation 5,

$$B_f = \frac{NI}{\frac{l_f}{\mu_f} + \frac{l_g}{\mu_o}} \approx \frac{\mu_o NI}{l_g} (\mu_f >> \mu_o) \quad (5)$$

(B: magnetic flux density, N: number of windings, I: current flowing through transformer, l_f: length of magnetic path of core, l_g: length of magnetic path in gap, μ_f: magnetic permeability of core, μ_o: magnetic permeability of gap)

The magnetic flux density, when the gap does not exist, is expressed by Equation 6,

$$B_f = \frac{\mu_f NI}{l_f} >> B_f \quad (6)$$

The magnetic permeability of the core is considerably larger than that of air, and the size of the gap is relatively larger than that of the core, so that the magnetic flux density in the case where the gap does not exist has a value considerably higher than that in the case where the gap is large. As a result, in the case of a transformer having a large gap, it is difficult for saturation status to occur inside the core, and also local saturation status is not generated easily. Accordingly, with respect to the shape of a core, a narrow section or protrusion is allowed. Furthermore, the magnetic flux density in the core is low, so that core loss due to hysteresis is also low.

Since the gap is large, the magnetic resistance is increased, so that the inductance of the core is decreased. Accordingly, in order to obtain required magnetizing inductance, the number of windings is increased and a wider winding area is required as a result.

The magnetizing inductance L_m may be expressed by Equation 7,

$$L_m = L_M(\frac{N_1}{N_2}) = \frac{N_1}{N_2}(\frac{N_1 N_2}{R_m}) = \frac{N_1^2}{R_m} \quad (7)$$

(R_m: magnetic resistance, N_1: number of primary windings, N_2: number of secondary windings, L_M: mutual inductance)

That is, since the magnetic resistance R_m is large, the number of windings is increased to obtain the required magnetizing inductance L_M. Generally, the difference between the primary- and secondary-side voltages of a non-contact charger is large, so that a difference in the winding ratio is also large. As a result, since the winding areas of the primary and secondary sides are different and the difference between the winding ratios is large, the shapes of the primary- and secondary-side cores are generally asymmetric.

Most leakage magnetic flux is generated in the gap existing between the primary- and secondary-side cores, so that a section area of the cores opposite to each other must be large to increase the coupling coefficient in the transformer. However, in the case of a transformer used in the non-contact charger, the volume and weight of the secondary-side core are limited because the secondary-side core is located inside the battery pack, so that the section area of the cores opposite to each other is also limited. However, in the present invention, a planar pad core, the section area of which is large in considerations of limited volume and weight, is used.

FIGS. 12 to 17 are views showing the operation of the half-bridge serial resonant converter provided to the wireless charging pad of the present invention, according

to modes.

FIGS. 12 to 17 are views showing the operation of the half-bridge serial resonant converter (upper converter), according to modes.

In FIG. 12, when Q_1 is turned on, current i_1 flows to a transformer through the switch Q_1. In FIG. 13, when the switch Q_1 is turned off, the current i_1 flows while discharging the parallel capacitor of a switch Q_2 and charging the parallel capacitor of the switch Q_1. In FIG. 14, when the voltage of the switch Q_2 is zero (the voltage of the switch Q_1 is input voltage), the current i_1 flows through the parallel diode of the switch Q_2, and the voltage of the switch Q_2 remains at zero. Furthermore, if the switch Q^2 is turned on before the direction of the current i_1 is reversed, Zero Voltage Switching (ZVS) is achieved in the switch Q_2. In FIG. 15, when the direction of the current i_1 is reversed, the current i_1 flows through the switch Q^2. In FIG. 16, when the switch Q^2 is turned off, the current i_1 flows while discharging the parallel capacitor of the switch Q^1 and charging the parallel capacitor of the switch Q^2. In FIG. 17, when the voltage of the switch Q^2 is zero (the voltage of the switch Q^2 is the input voltage), the current i_1 flows through the parallel diode of the switch Q^1, and the voltage of the switch Q^1 remains at zero. Furthermore, when the switch Q^1 is turned on before the direction of the current is restored, the ZVS is achieved

in the switch Q^1.

In order to achieve the ZVS of the switch Q^2, the magnitude of the current i_1 at the time of being changed from FIG. 12 to FIG. 13 must be large enough so that the energy of a magnetic circuit depending on the current i_1 can charge or discharge the parallel capacitor, and the gate signal of the switch Q^2 must be provided before the direction of the current i_1 is reversed. The switch Q^1 can achieve the ZVS using the same principle.

In this case, a resonant frequency considerably affects efficiency. The switching frequency is operated at a frequency close to the resonant frequency, so that the core loss and gap loss of the transformer are reduced if the resonant frequency is low. However, the loss may be increased because magnetic current, that is, the primary-side current of the transformer, is increased. Accordingly, the switching loss attributable to the ZVS is reduced by selecting a switching frequency higher than the resonant frequency.

FIG. 18 is a view showing the voltage and current waveforms of the transformer according to the gate signal of the half-bridge series resonant converter provided in the wireless charging pad of the present invention.

Referring to FIG. 18, square wave voltage identical to the input voltage is applied to the transformer by the gate signals of the switches Q^1 and Q^2, and sine wave current

identical to the current i_1 flows to the transformer through the resonant circuit.

FIG. 19 is a view showing the rotating directions of the magnetic field according to the operation of the half-bridge series resonant converter provided in the wireless charging pad of the present invention, according to modes.

FIG. 20 is a view showing the rotating directions of the magnetic field generated according to the operation of the half-bridge series resonant converter according to modes. Accordingly, since the magnetic field rotates by 360 degrees, induced electromotive force can be transmitted to the secondary side regardless of the location and direction of the battery pack 100 when the battery pack 100 equipped with the charging receiver module 110 is placed on the wireless charging pad 200.

FIGS. 20 to 23 are views showing the rectifying circuits of the charging receiver module according to the present invention.

Referring to FIGS. 20 to 23, the secondary-side charging receiver module 110 transmits power through a series-parallel resonant center tap half-bridge rectifying circuit that uses the output of a single center tap rectifying diode and an output filter capacitor, or through a series-parallel resonant full-bridge rectifying circuit that uses the output of a full-bridge rectifying diode and an output filter capacitor.

FIG. 24 is a view showing the construction of a controller provided in the wireless charging pad of the present invention.

The controller 240 provided in the wireless charging pad 200 of the present invention determines whether a battery pack 100 is placed on the wireless charging pad 200, reads wireless identification information, which is stored in the RFID tag 130, from the battery pack 100 if the battery pack 100 is placed, determines whether the battery pack 100 needs to be charged or how many battery packs 100 are placed, and generates a drive control signal and indicates the charged status of each of the battery packs at the same time.

Referring to FIG. 24, the controller 240 provided in the wireless charging pad 200 of the present invention may include an oscillator 241 for generating an oscillation signal of a certain frequency, an antenna driver 242, a demodulator 243 for demodulating RF data received by the antenna driver 242, a filter and amplification unit 244 for filtering wireless identification information and charged status information from the demodulated data and amplifying the filtered information, a data decoder 245 for decoding the wireless identification information and charged status information received by the filter and amplification unit 244, a driver control unit 246 for performing mode conversion according to the charged status based on the

decoded data, a display unit 247 for displaying the data decoded by the data decoder 245, a timer 248, and a reset unit 249.

The antenna driver 242 uses the oscillation signal of the oscillator 241 as a clock, monitors the access of the battery pack 100, and wirelessly receives RF data, which is modulated and includes the wireless identification information and charged status information of the battery pack 100, in response to an RF carrier signal through the reader antenna RA when the battery pack 100 makes access. In this case, a polling method of periodically transmitting the RF carrier signal to the outside through the reader antenna RA and monitoring whether a return signal exists can be applied as a method of the antenna driver 242 monitoring the access of the battery pack 100.

Furthermore, in the case where a plurality of battery packs 100 is placed, the controller 240 reads the wireless identification information and charged status information of each of the battery packs 100 in order in which the battery packs 100 are placed, indicates the charged status of each of the battery packs 100, and switches from an active mode to an energy saving mode when all the battery packs 100 are completely charged, and thereby, the fully charged status is established.

FIG. 25 is a view showing the flow of the RF signal between the wireless charging pad and the battery pack

according to the present invention.

Referring to FIG. 25, when the controller 240 accesses the RFID tag 130 in the battery pack 100 equipped with the charging receiver module 110 to access information on the battery BAT using a carrier frequency in HF (3 to 30 MHz) or UHF (300 to 3000 MHz) bands, the battery information stored in the memory block of the RFID tag 130 is transmitted to the wireless charging pad 200 in a modulated RF signal form.

The present invention may be modified in various forms without departing from the basic concept of the invention according to the demands of those skilled in the art.

CLAIMS

1. A wireless charging pad (200) for charging a battery pack (100) mounted on a portable device in a non-contact manner, to which a radio frequency identification technology is applied, comprising:

a controller (240) for switching to an active mode and controlling drive circuits (220 and 220') while standing by in an energy saving mode when access of the battery pack (100) is detected, for transmitting a Radio Frequency (RF) carrier signal to the battery pack (100) in the active mode, receiving RF data, which is modulated and includes wireless identification information and charged status information of the battery pack (100), through a reader antenna (RA) in response to the RF carrier signal, and indicating the charged status of the battery pack (100), and for switching to the energy saving mode again when charging of the battery pack (100) is completed;

the drive circuits (220 and 220') for switching two primary coils (Pcoil1 and Pcoil2) under control of the controller (240); and

a primary-side transformer formed by constructing a pad core, which is adapted to generate induced electromotive force through switching of the drive circuits (220 and 220') and charge the battery pack (100), and which is formed by connecting a plurality of small cobalt-based

amorphous metallic or ferrite planar cores in a square or rectangular shape, and winding two primary coils (Pcoil1 and Pcoil2) on the pad core in directions perpendicular to each other.

2. The wireless charging pad according to claim 1, wherein the controller (240) reads wireless identification information and charged status information of each of battery packs (100) in order in which battery packs (100) are placed, indicates charged status of each battery pack (100), and switches to the energy saving mode when charging of all the battery packs (100) are completed, and therefore, fully charged status is established.

3. The wireless charging pad according to claim 1 or 2, wherein the controller (240) comprises an oscillator (241) for generating an oscillation signal of a certain frequency; an antenna driver (242) for using the oscillation signal of the oscillator (241) as a clock, monitoring the access of the battery pack (100) by transmitting the RF carrier signal to an outside through the reader antenna (RA) and monitoring whether a return signal exists, and wirelessly receiving RF data, which is modulated and includes the wireless identification information and charged status information of the battery pack (100), in response to the RF carrier signal when the

battery pack (100) makes access; a demodulator (243) for demodulating the RF data received by the antenna driver (242); a filter and amplification unit (244) for filtering the wireless identification information and charged status information from the demodulated data and amplifying the filtered information; a data decoder (245) for decoding the wireless identification information and the charged status information received by the filter and amplification unit (244); and a display unit (247) for displaying the data decoded by the data decoder (245).

4. The wireless charging pad according to claim 1, wherein the drive circuits (220 and 220') include two half-bridge series-parallel resonant converters to control the primary coils (Pcoil1 and Pcoil2) perpendicular to each other, and switch the primary coils (Pcoil1 and Pcoil2) at a frequency higher than a resonant point so that switching patterns of the primary coils (Pcoil1 and Pcoil2) have a phase difference of 90 degrees, thus allowing linkage flux to vary while rotating in a sequence of 180°→ 135°→ 90°→ 45°→ 0°→ -45°→ -90°→ -135°, and thereby, generating a magnetic field that rotates by 360 degrees.

5. The wireless charging pad according to claim 1, further comprising:

an electromagnetic wave filter (250) combined with a

power input terminal to block electromagnetic waves from Alternating Current (AC) power input; an AC/Direct Current (DC) conversion circuit (210) for receiving the AC power, the electromagnetic waves of which are blocked, from the electromagnetic wave filter (250) and rectifying the AC power into DC power; and a flyback converter (210') connected to the AC/DC conversion circuit (210) and the controller (240) to accumulate power while a transistor is turned on and transmit the accumulated power to the controller (240) when the transistor is turned off so as to drive the drive circuits (220 and 220').

6. The wireless charging pad according to claim 1, wherein the wireless charging pad (200) includes input ports that are combined with at least one of an AC adapter, a Universal Serial Bus (USB) port and a cigar lighter jack for a vehicle.

7. The wireless charging pad according to claim 1, wherein the wireless identification information corresponds to one of a product name of the battery (BAT), a serial number of the battery (BAT) and a user identification number that is stored in an Radio Frequency Identification (RFID) tag (130) through communication between a body of a portable device, on which the battery pack (100) is mounted, and the battery pack (100).

8. The wireless charging pad according to claim 1, wherein the RF carrier signal is a signal that accesses an RFID signal stored in the battery pack (100) using a carrier signal in High Frequency (HF) (3 to 30 MHz) or Ultra High Frequency (UHF) (300 to 3000 MHz) bands.

9. A battery pack (B) mounted on a portable device to be charged by a wireless charging pad (A) in a non-contact manner, to which a radio frequency identification technology is applied, comprising:

a charging receiver module (110) formed of an amorphous metallic planar core and two secondary coils (Scoil1 and Scoil2), which are wound on the planar core in vertical and horizontal directions, to induce power through magnetic coupling with the wireless charging pad (200);

a charging protection circuit module (120) combined with the charging receiver module (110) and the battery (BAT) to record charged status information generated by periodically monitoring charged status of the battery (BAT) in an RFID tag (130), and to control whether to charge or discharge the battery (BAT) by selectively supplying or blocking the power induced to the charging receiver module (110) to the battery (BAT);

the RFID tag (130) combined with the charging protection circuit module (120) to store wireless

identification information of the battery (BAT), to periodically record the charged status information, and to generate and modulate RF data including the wireless identification information and charged status information of the battery (BAT) and transmit the modulated RF data to the wireless charging pad (200) when an RF carrier signal is transmitted from the wireless charging pad (200) through a tag antenna (TA); and

the battery (BAT) to be charged under control of the protection circuit (124).

10. The wireless charging pad according to claim 9, further comprising an amorphous metallic electromagnetic protector (140) for minimizing a rise in temperature of the battery (BAT) attributable to frequency interference, which is caused by radio signals or induced electromotive force in a magnetic field, or attributable to inductive heating, by magnetically blocking a gap between the battery (BAT) and the charging receiver module (110).

11. The wireless charging pad according to claim 9 or 10, further comprising a battery casing (150) manufactured using a cool polymer to perform an operation of emitting heat generated due to charging while admitting the induced electromotive force, and to entirely surround a structure that is formed by assembling the components.

12. The wireless charging pad according to claim 9, wherein the charging protection circuit module (120) comprises:

rectifying circuits 121 and 121' for rectifying the power induced to the charging receiver module (110) and supplying the rectified power to a charging control circuit (122); the charging control circuit (122) combined with the rectifying circuits (121 and 121') to supply the power rectified by the rectifying circuits (121 and 121') to a fuel gauge (123) under On/Off control of the RFID tag (130); the fuel gauge (123) for supplying the power supplied from the charging control circuit (122) to the battery (BAT) through a protection circuit (124), and generating the charged status information while monitoring the charged status of the battery (BAT), and periodically recording the charged status information in the RFID tag (130); and the protection circuit (124) combined with the fuel gauge (123) and the battery (BAT) to protect the battery (BAT) by controlling whether to charge or discharge according to the charged status of the battery (BAT).

13. The wireless charging pad according to claim 12, wherein the rectifying circuits (121 and 121') are series-parallel resonant center tap half-bridge rectifying circuits using an output of a single center tap rectifying

diode and an output filter capacitor, or series-parallel resonant full-bridge rectifying circuits using an output of a full-bridge rectifying diode and an output filter capacitor.

14. The wireless charging pad according to claim 9, wherein the RFID tag (130) comprises:

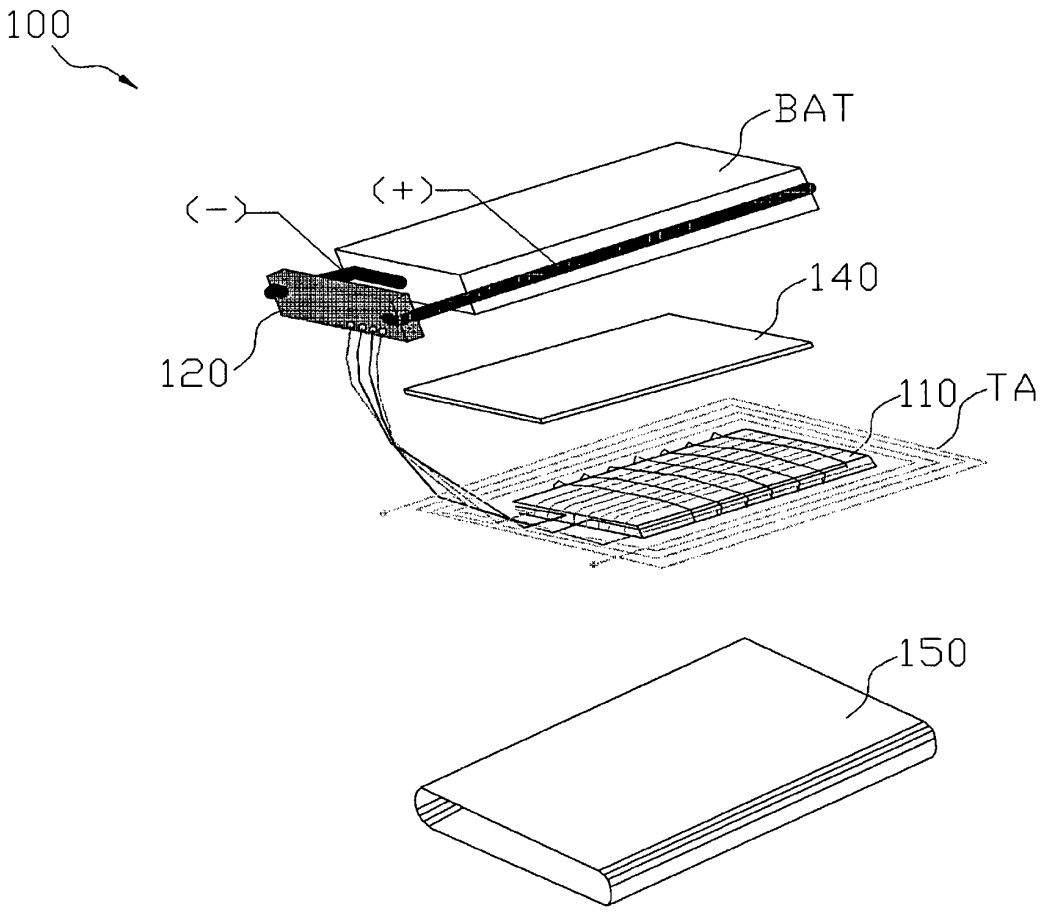
a clock extraction unit (131) for extracting a clock from the RF carrier signal wirelessly received from the wireless charging pad (200); a sequencer (132) for inspecting an sequence of arranged data extracted from the clock extraction unit (131) and transmitting a control signal to a data encoder (133); the data encoder (133) for receiving the wireless identification information and charged status information of the battery (BAT) from a tag (135) when the control signal is transmitted from the sequencer (132), and transmitting the wireless identification information and charged status information to a data modulator (136) after coding the wireless identification information and charged status information; the data modulator (136) for generating RF data generated by modulating the data received from the data encoder (133), and wirelessly transmitting the RF data to the wireless charging pad (200); Read Only Memory (ROM) (134) for recording the wireless identification information and charged status information therein; and the tag (135) for

reading the wireless identification information and charged status information of the battery (BAT) stored in the ROM (134), and transmitting the wireless identification information and charged status information to the data encoder (133).

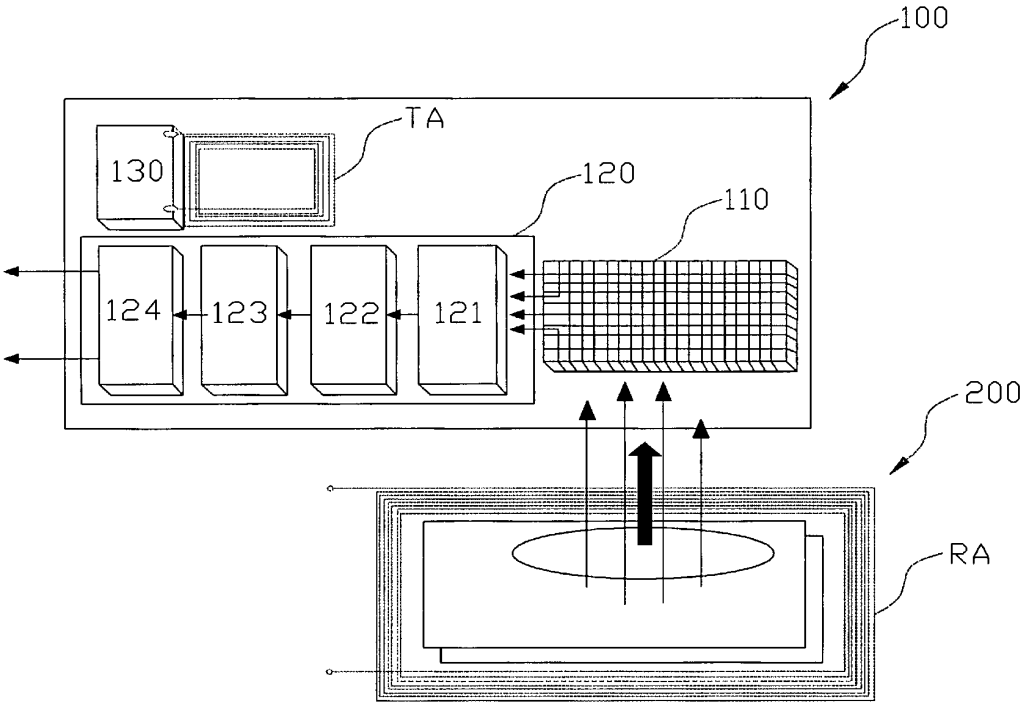
15. The wireless charging pad according to claim 9, wherein the wireless identification information corresponds to one of a product name of the battery (BAT), a serial number of the battery (BAT) and a user identification number that is stored in the RFID tag (130) through communication between a body of a portable device, on which the battery pack (100) is mounted, and the battery pack (100).

16. The wireless charging pad according to claim 9, wherein the RF carrier signal is a signal that accesses an RFID signal stored in the battery pack (100) using a carrier signal in HF (3 to 30 MHz) or UHF (300 to 3000 MHz) bands.

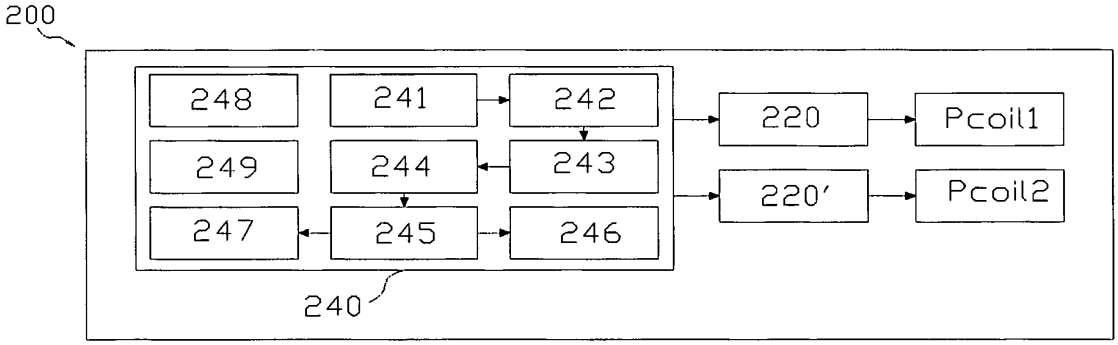
【FIG. 1】



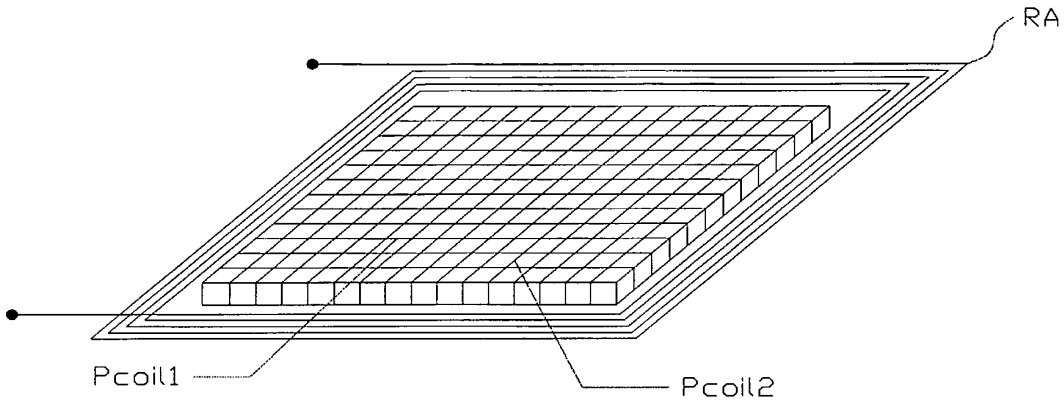
【FIG. 2】


100
TA
130
120
110
124
123
122
121
200
RA

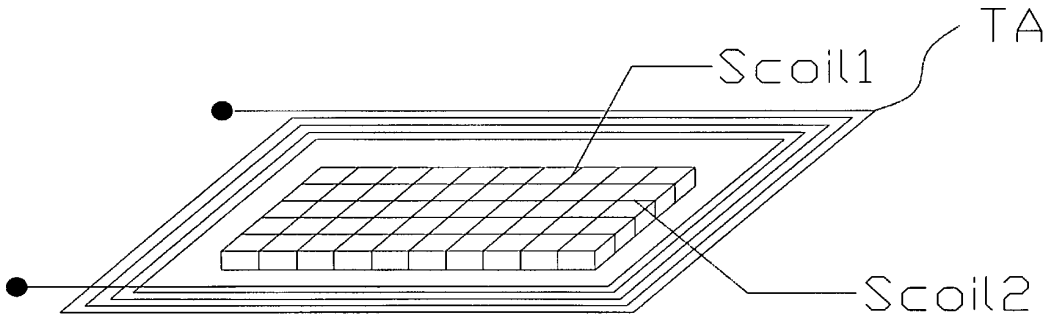
【FIG. 3】


200
248
241
242
220
Pcoil1
249
244
243
220'
Pcoil2
247
245
246
240

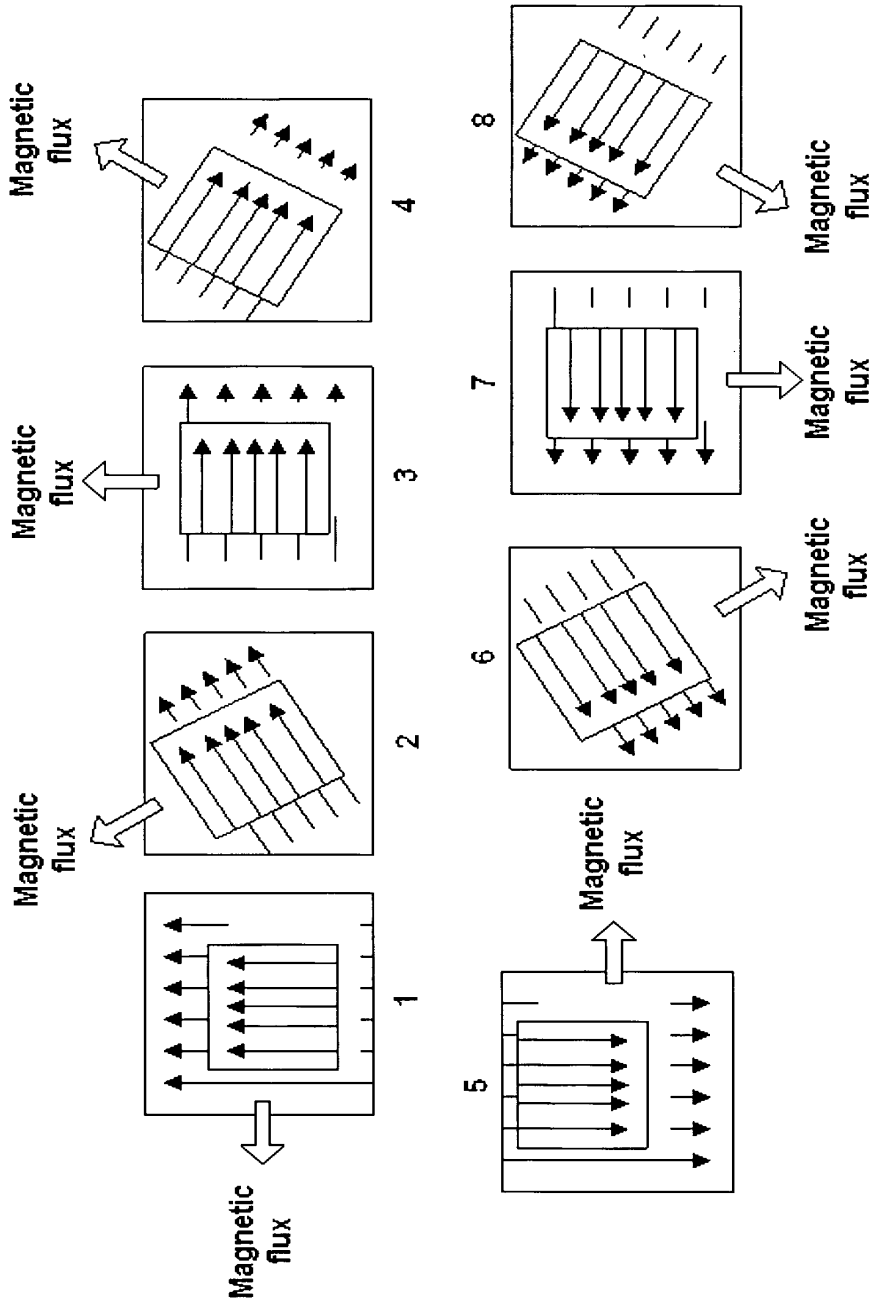
【FIG. 4】



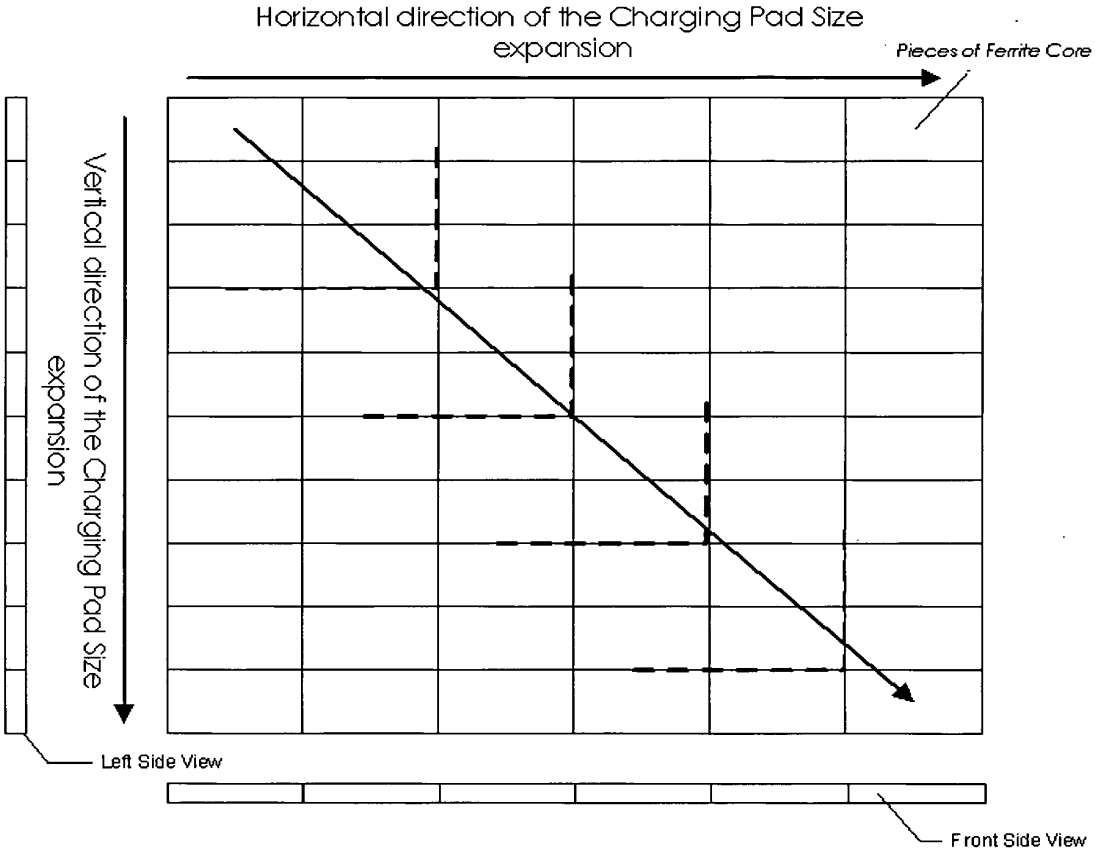
【FIG. 5】



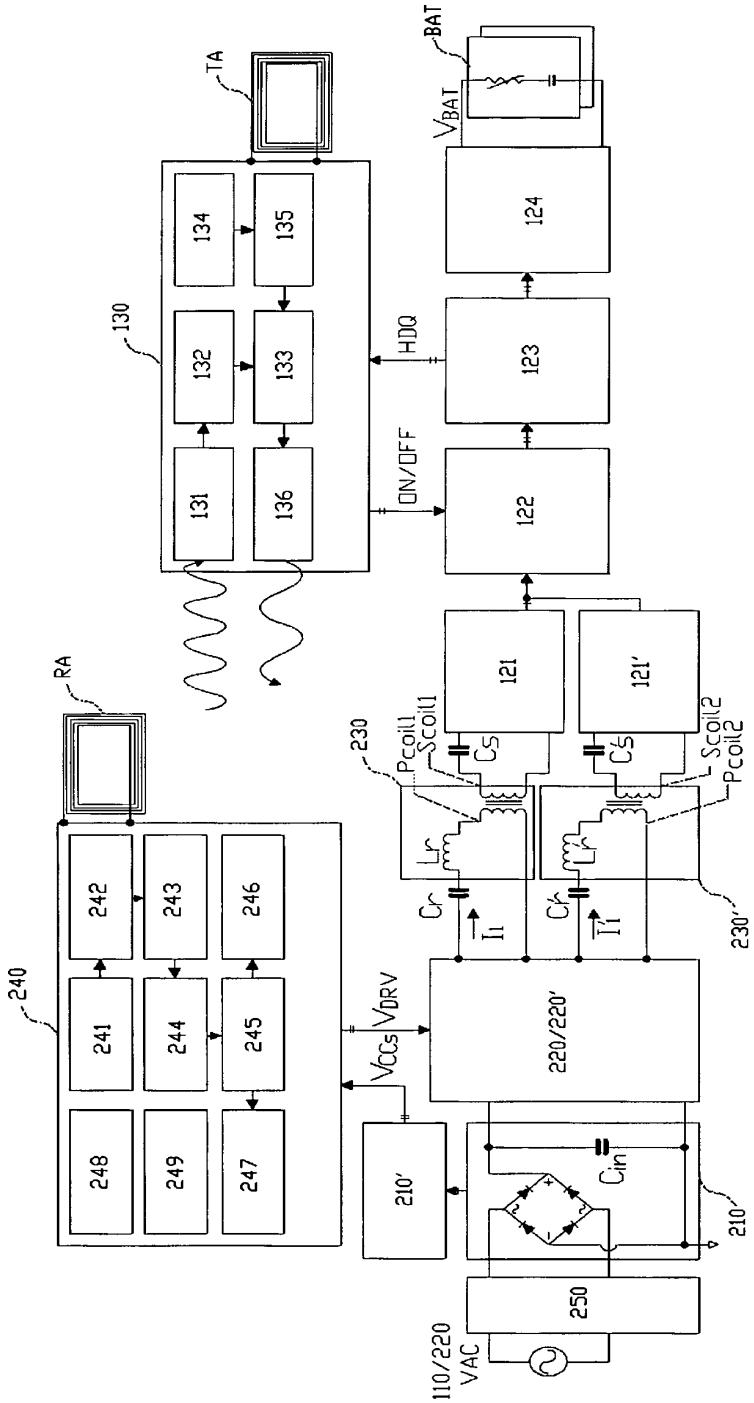
【FIG. 6】


Magnetic flux
1
Magnetic flux
2
Magnetic flux
3
Magnetic flux
4
Magnetic flux
5
Magnetic flux
6
Magnetic flux
7
Magnetic flux
8

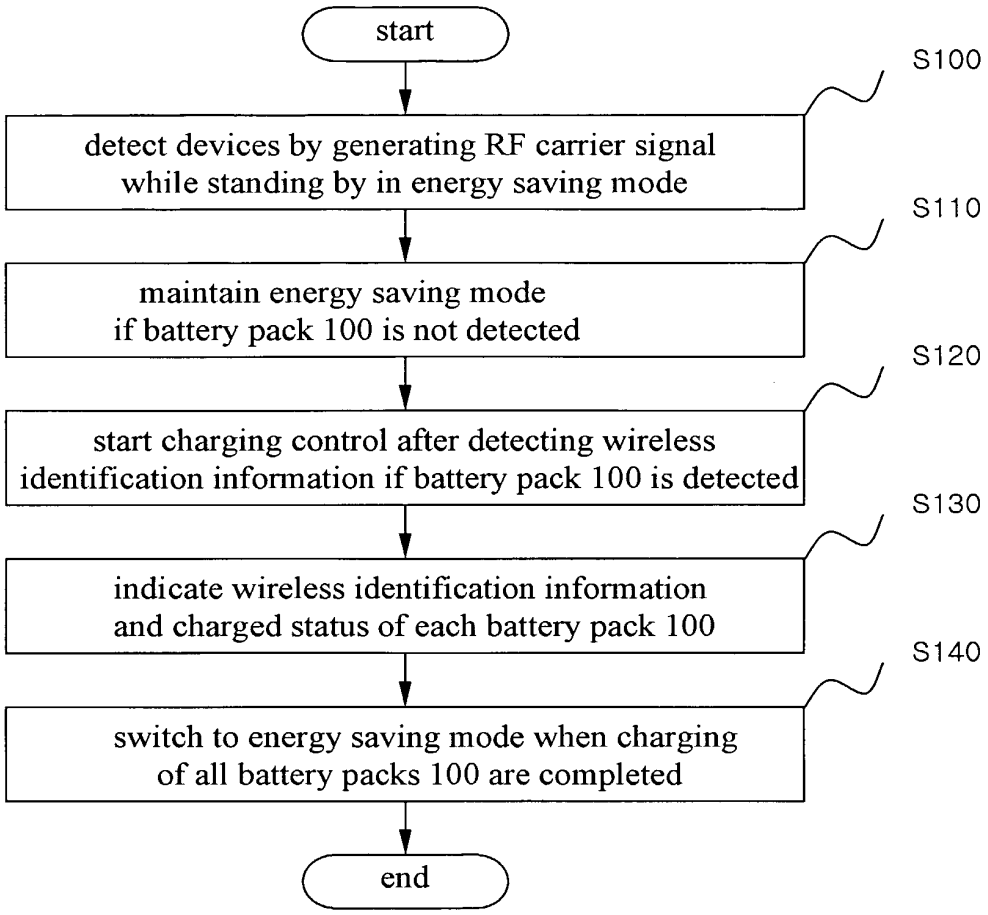
【FIG. 7】


Horizontal direction of the Charging Pad Size expansion
Pieces of Ferrite Core
Vertical direction of the Charging Pad Size expansion
Left Side View
Front Side View

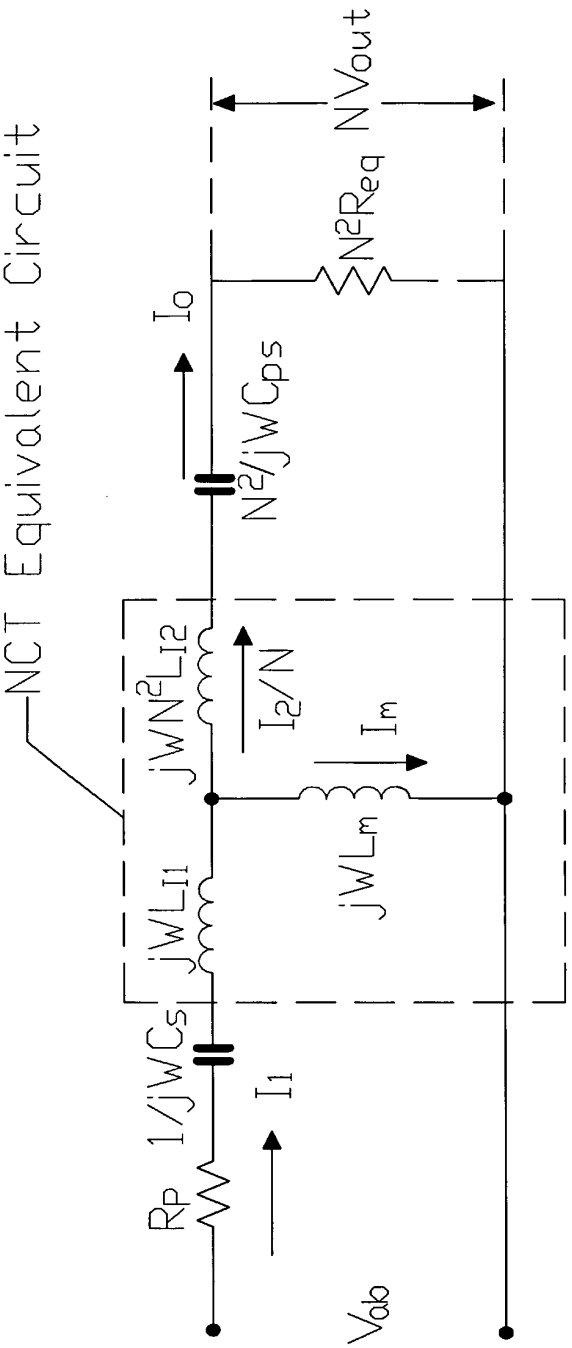
【FIG. 8】


TA
BAT
V_{BAT}
124
123
122
121
121'
130
131
132
133
134
135
136
HDQ
ON/OFF
RA
230
Pcoil1
Scoil1
Scoil2
Pcoil2
Cs
Cs'
Lp
Lp'
Cp
Cp'
I1
I1'
230'
240
241
242
243
244
245
246
247
248
249
V_{DRV}
V_{CCs}
220/220'
210'
Cin
250
110/220
VAC

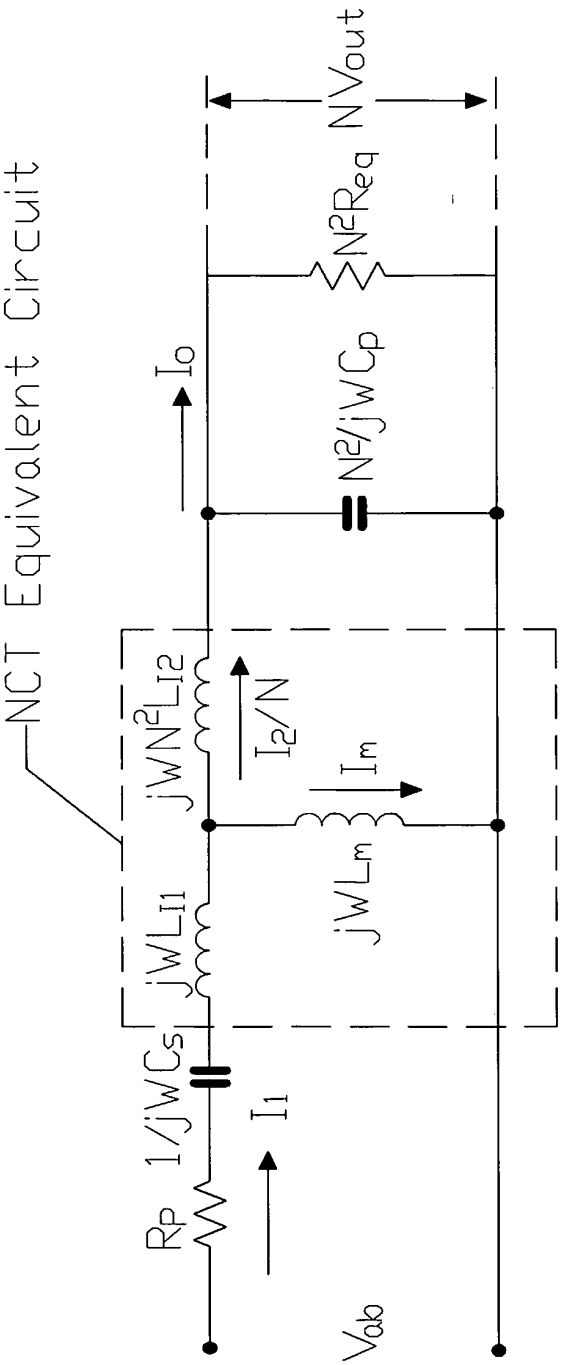
【FIG. 9】


start
S100
detect devices by generating RF carrier signal while standing by in energy saving mode
S110
maintain energy saving mode if battery pack 100 is not detected
S120
start charging control after detecting wireless identification information if battery pack 100 is detected
S130
indicate wireless identification information and charged status of each battery pack 100
S140
switch to energy saving mode when charging of all battery packs 100 are completed
end

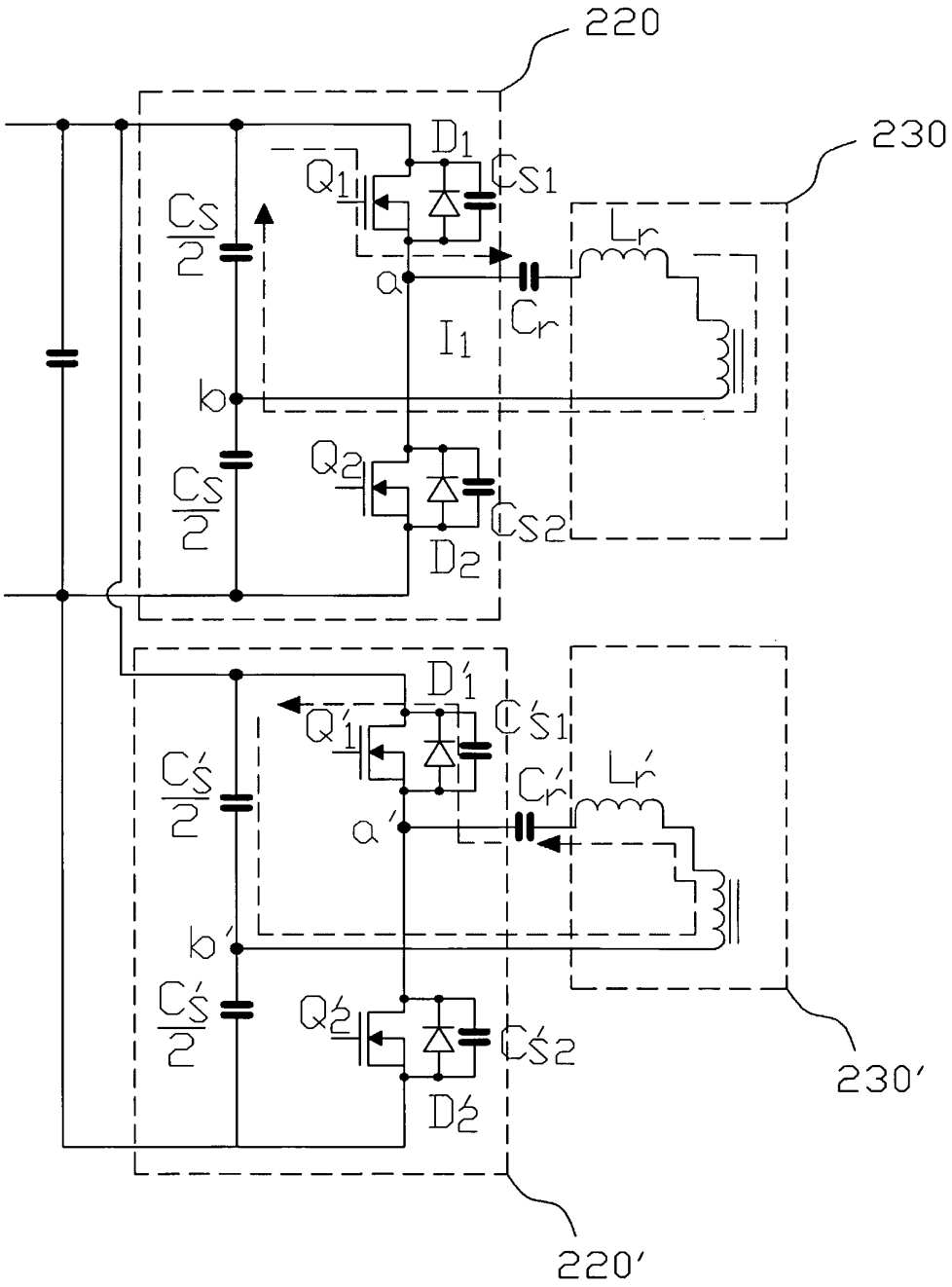
【FIG. 10】


NCT Equivalent Circuit
NVout
N²Req
Io
N²/jWCps
I2/N
jWN²LI2
Im
jWLm
jWLI1
1/jWCs
RP
I1
Vab

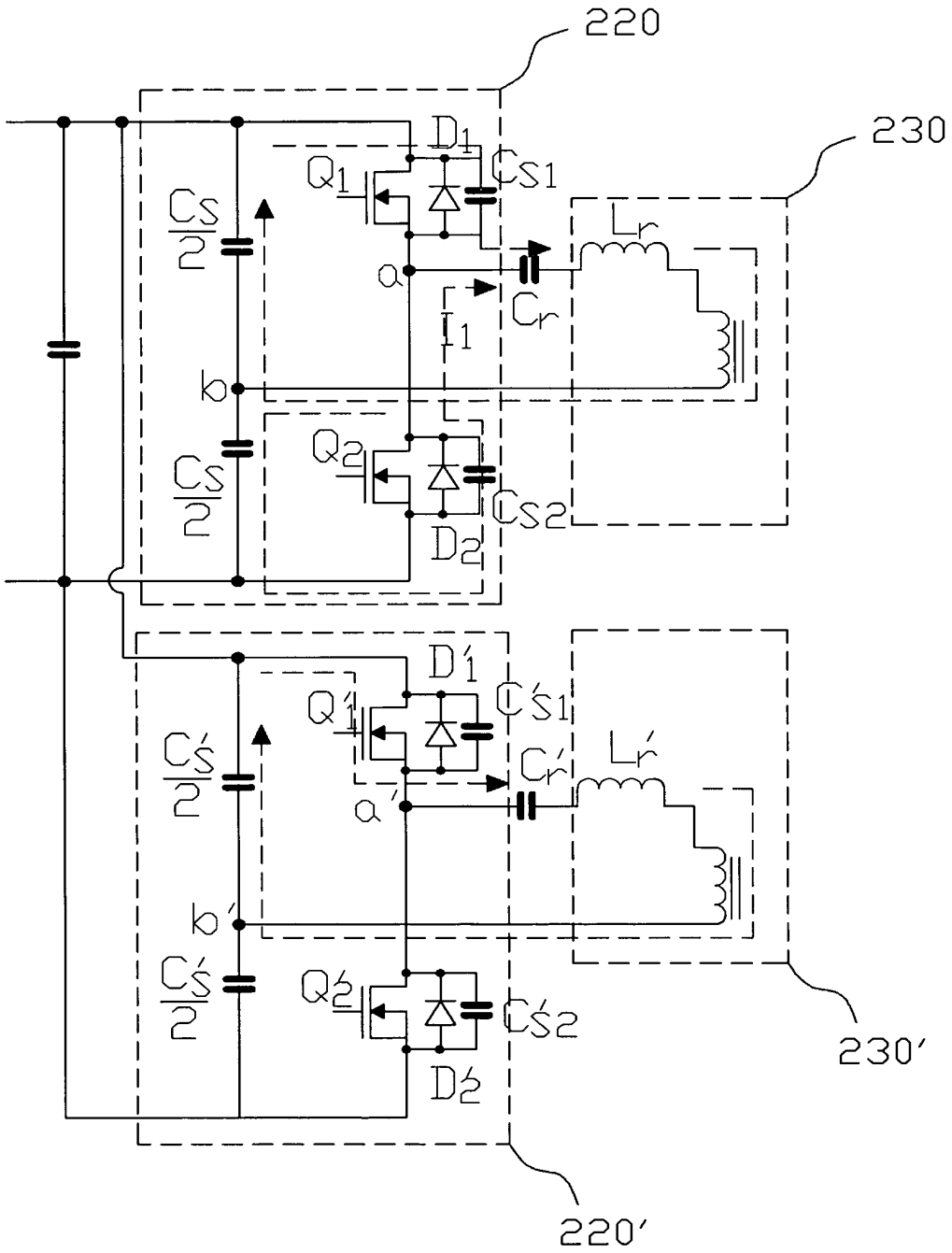
【FIG. 11】


NCT Equivalent Circuit
NVout
N²Req
Io
N²/jwCp
I2/N
Im
jwN²LI2
jwLm
jwLI1
1/jwCs
Rp
I1
Vab

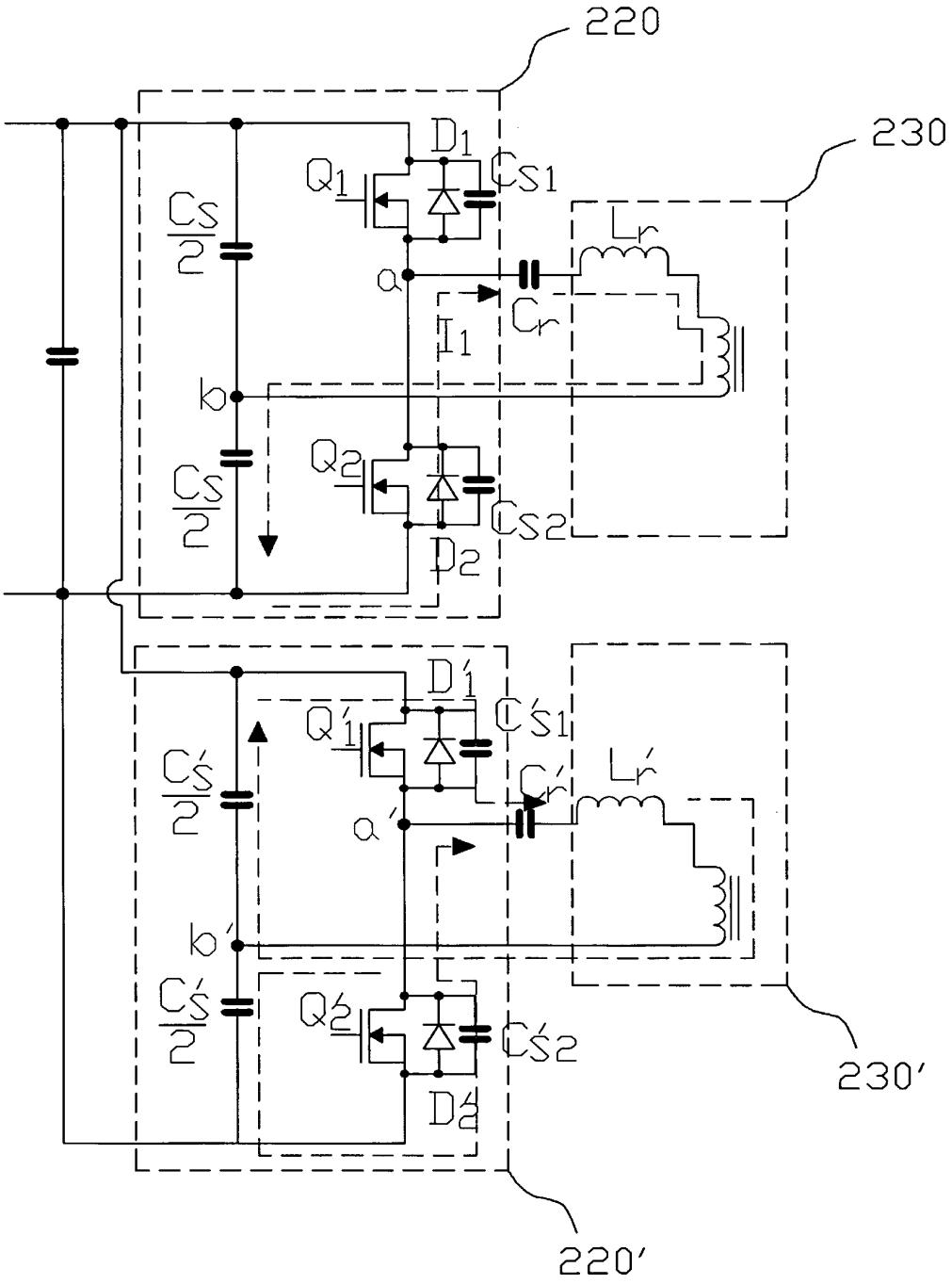
【FIG. 12】


220
230
D1
Q1
CS1
CS/2
Lr
a
Cr
I1
b
Q2
CS/2
CS2
D2
D'1
Q'1
C'S1
C'S/2
C'r
L'r
a'
b'
C'S/2
Q'2
C'S2
D'2
230'
220'

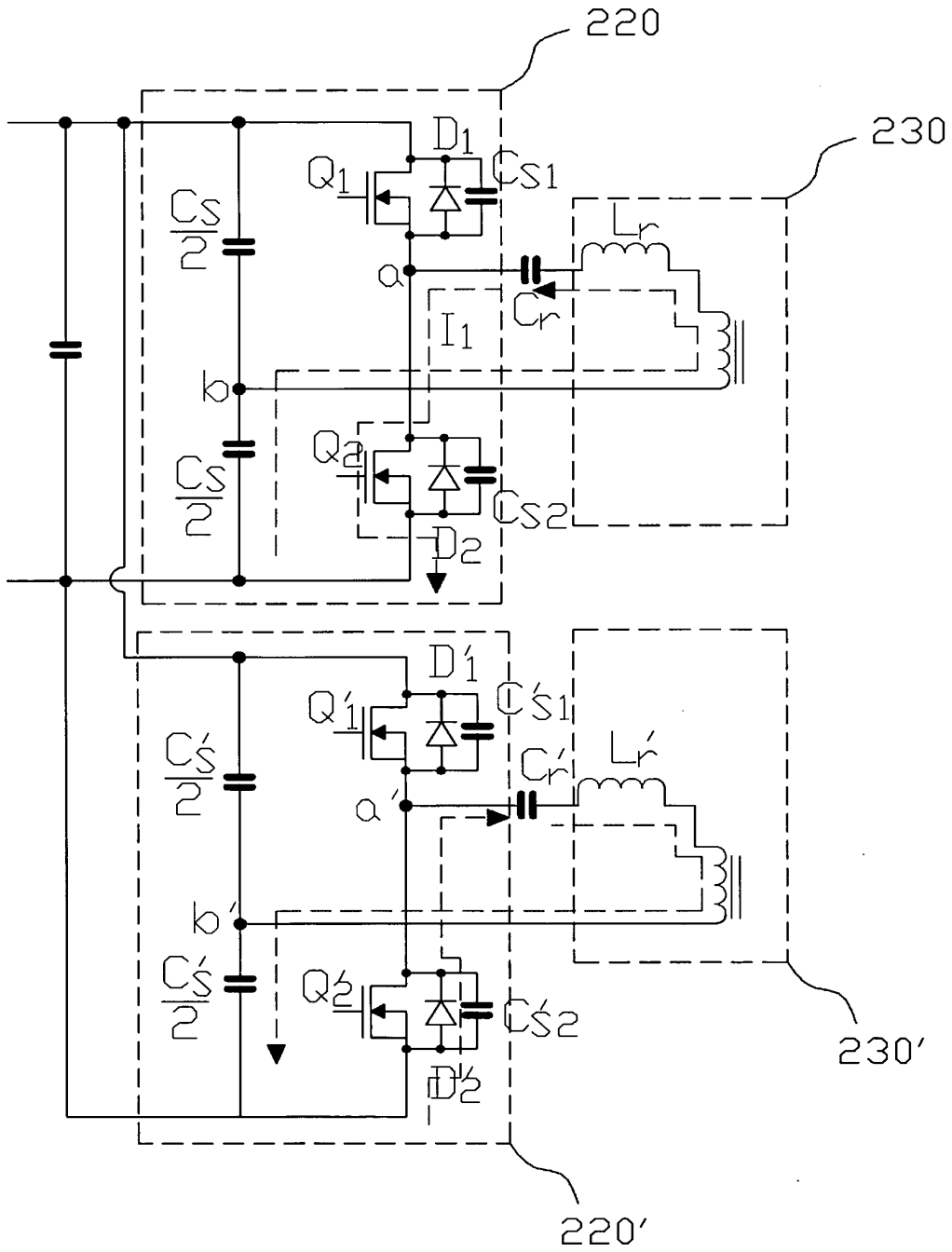
【FIG. 13】


220
230
D1
Q1
Cs1
Cs/2
a
Lr
Cr
I1
b
Q2
Cs/2
Cs2
D2
D'1
Q'1
C's1
C's/2
Cr'
L'r
a'
b'
C's/2
Q'2
C's2
D'2
230'
220'

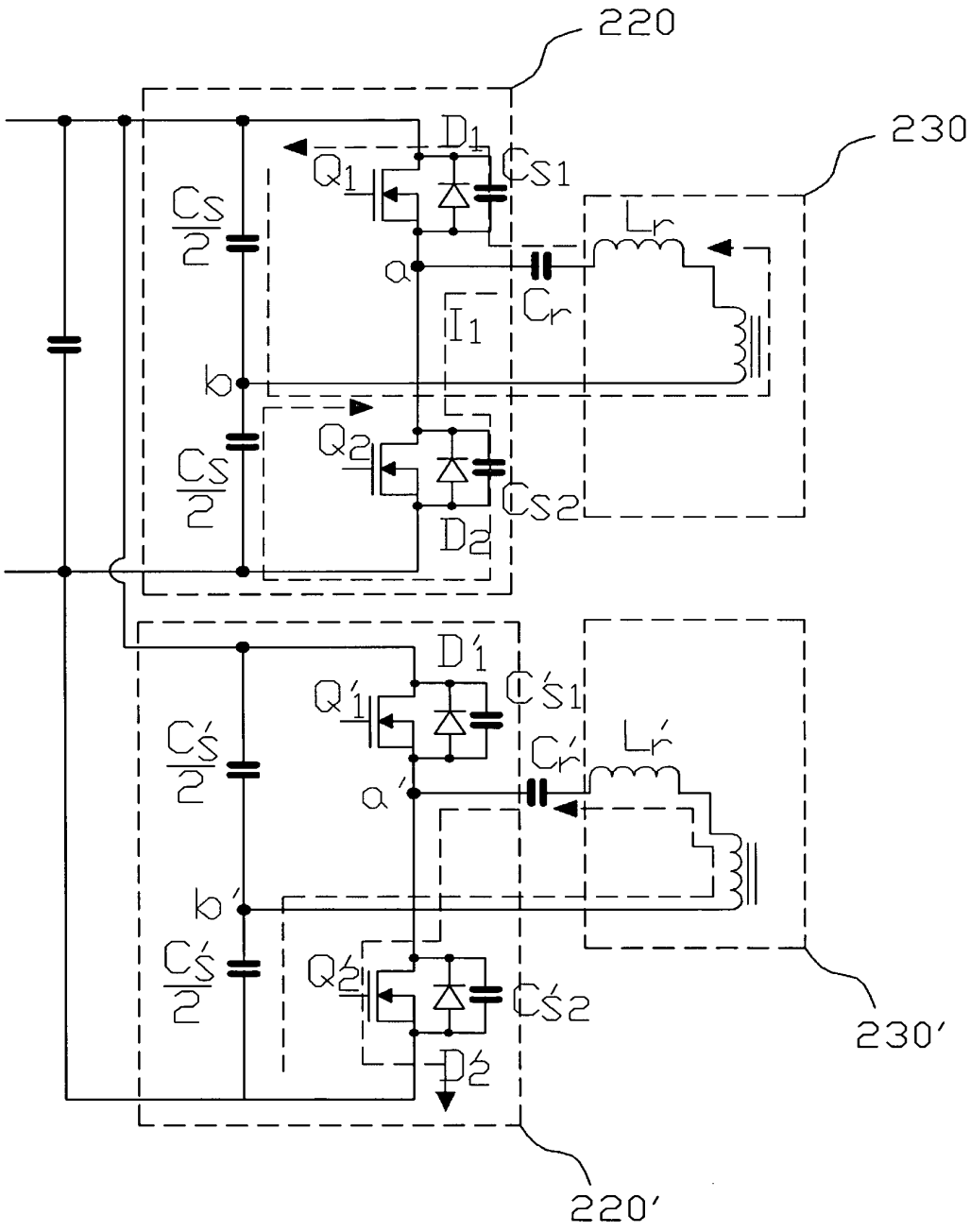
【FIG. 14】


220
230
D1
Q1
CS1
CS/2
Lr
a
Cr
I1
b
Q2
CS/2
CS2
D2
D'1
Q'1
C'S1
C'S/2
C'r
L'r
a'
b'
C'S/2
Q'2
C'S2
D'2
230'
220'

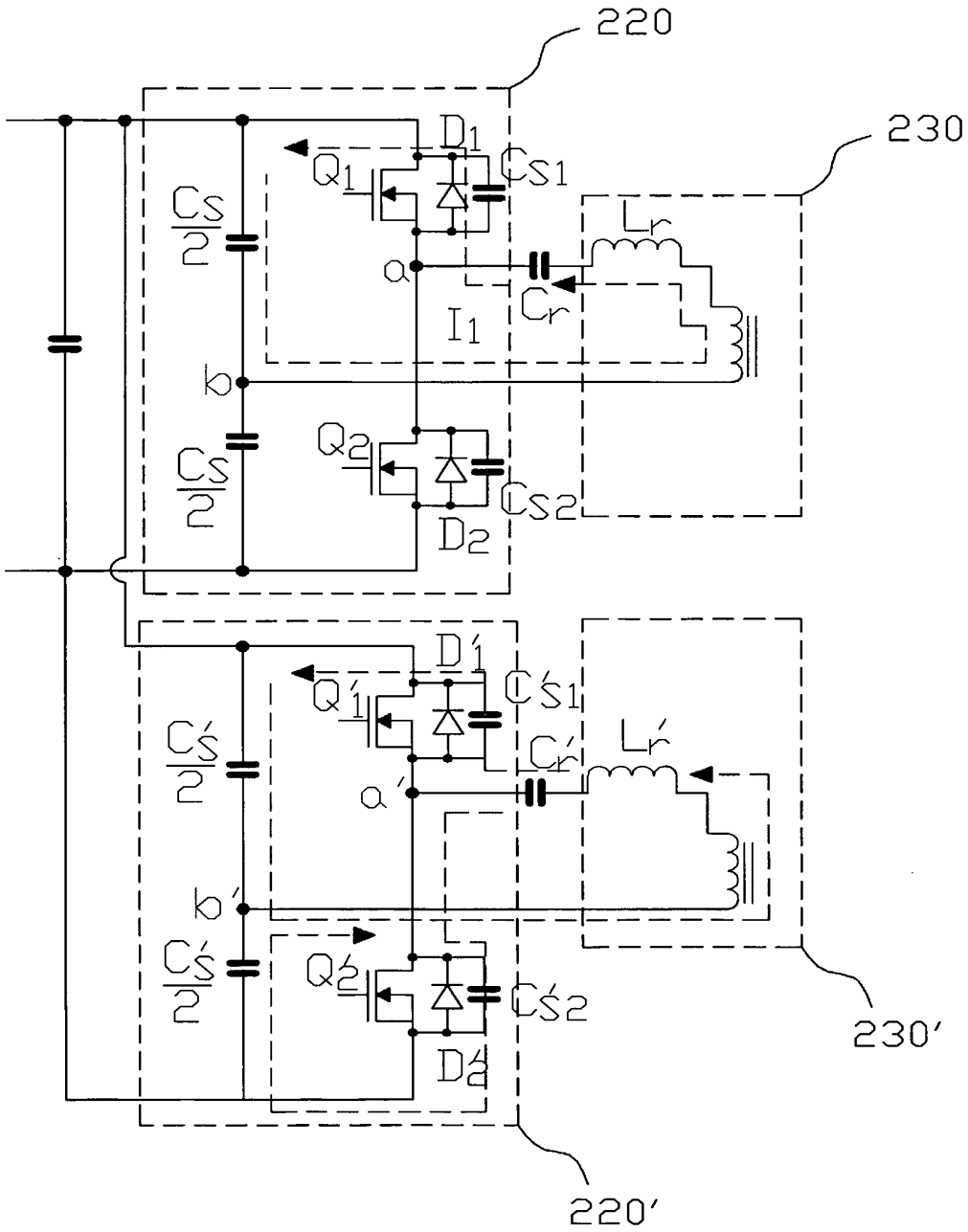
【FIG. 15】


220
230
D1
Q1
CS1
CS/2
Lr
a
Cr
I1
b
Q2
CS/2
CS2
D2
D'1
Q'1
C'S1
C'S/2
C'r
L'r
a'
b'
C'S/2
Q'2
C'S2
D'2
230'
220'

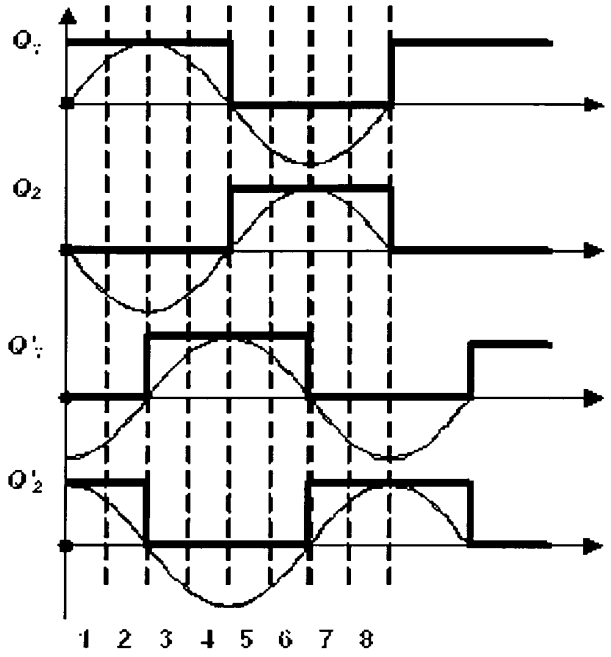
【FIG. 16】


220
230
D1
Q1
Cs1
Cs/2
Lr
a
Cr
I1
b
Q2
Cs/2
Cs2
D2
D'1
Q'1
C's1
C's/2
C'r
L'r
a'
b'
C's/2
Q'2
C's2
D'2
230'
220'

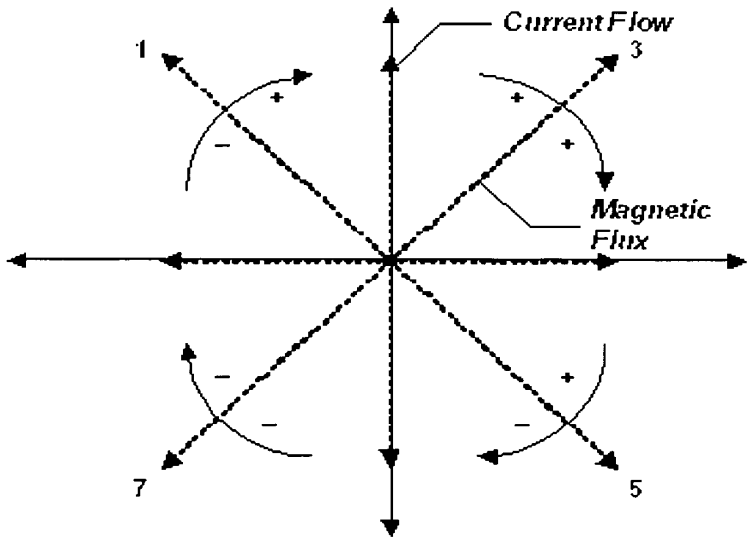
【FIG. 17】


220
230
D1
Q1
CS1
CS/2
Lr
a
Cr
I1
b
Q2
CS/2
CS2
D2
D'1
Q'1
C'S1
C'S/2
C'r
L'r
a'
b'
C'S/2
Q'2
C'S2
D'2
230'
220'

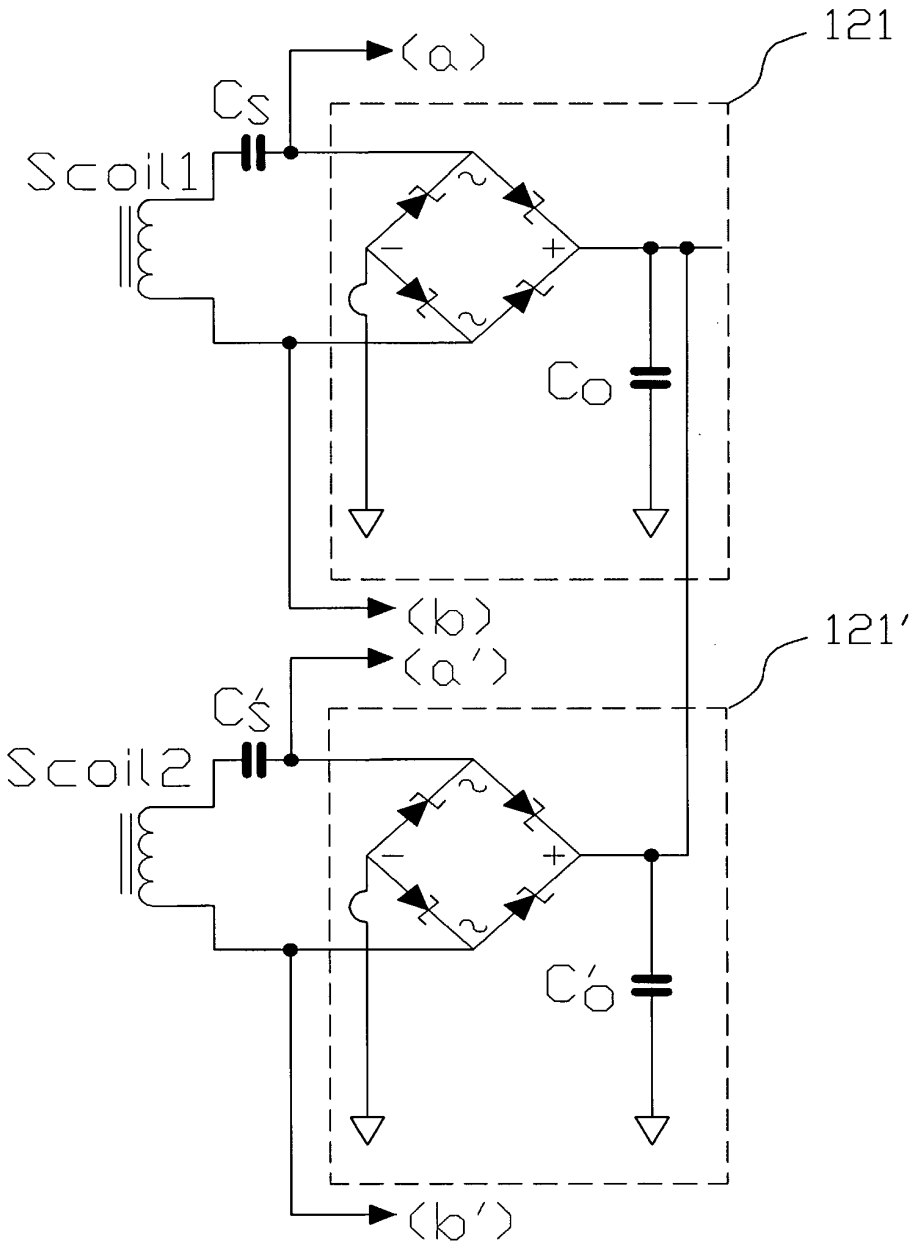
【FIG. 18】



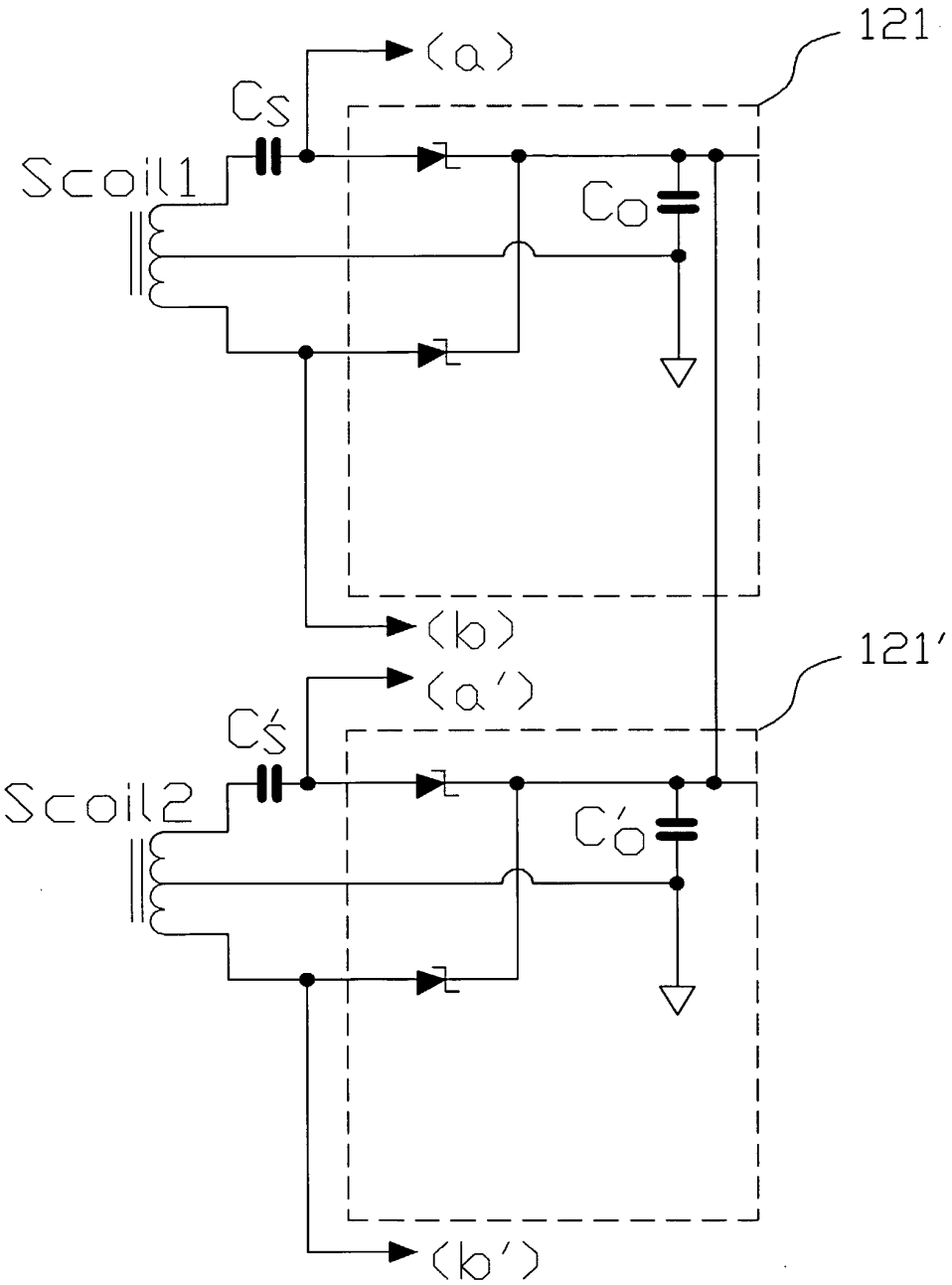
【FIG. 19】



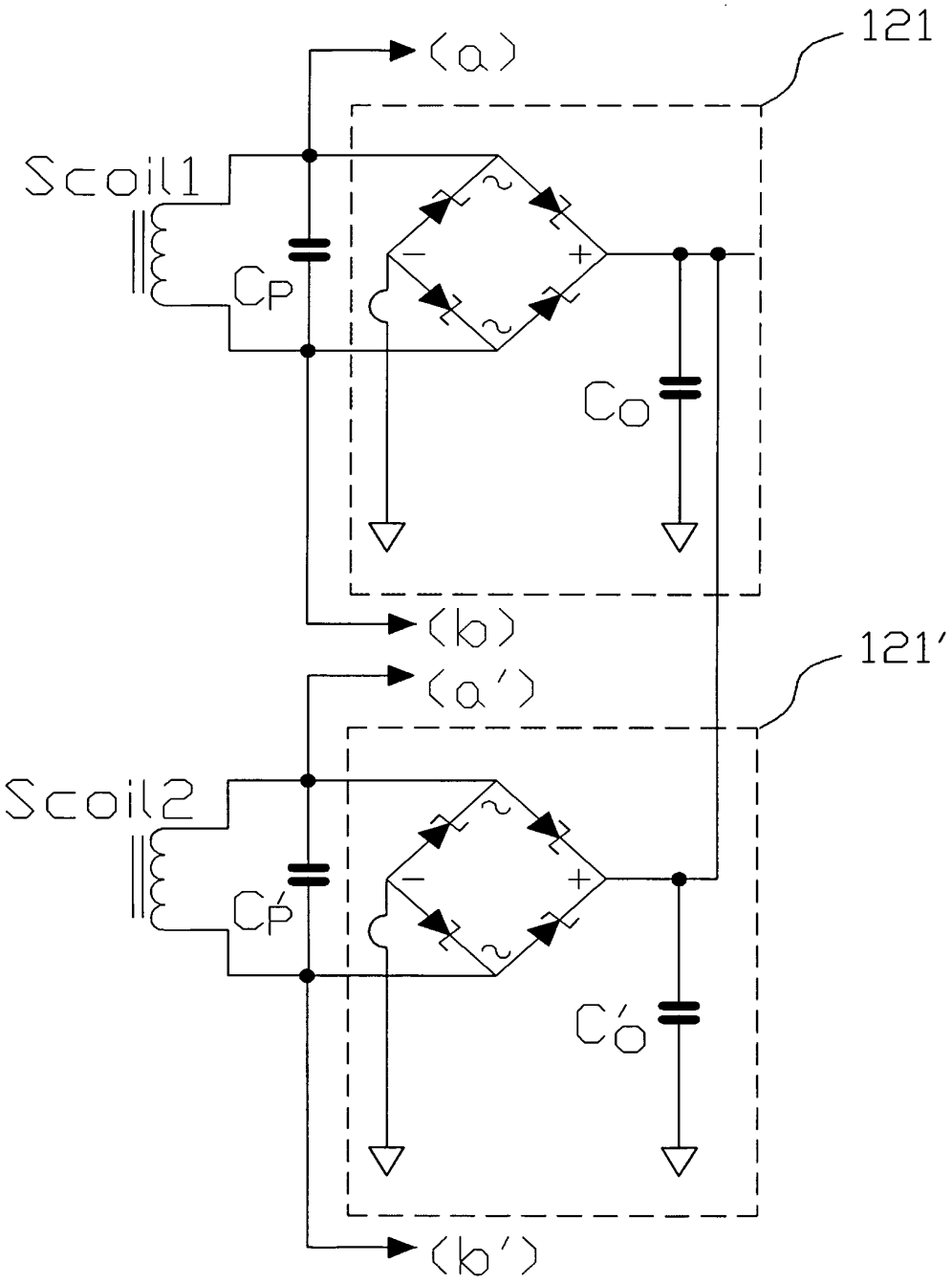
【FIG. 20】



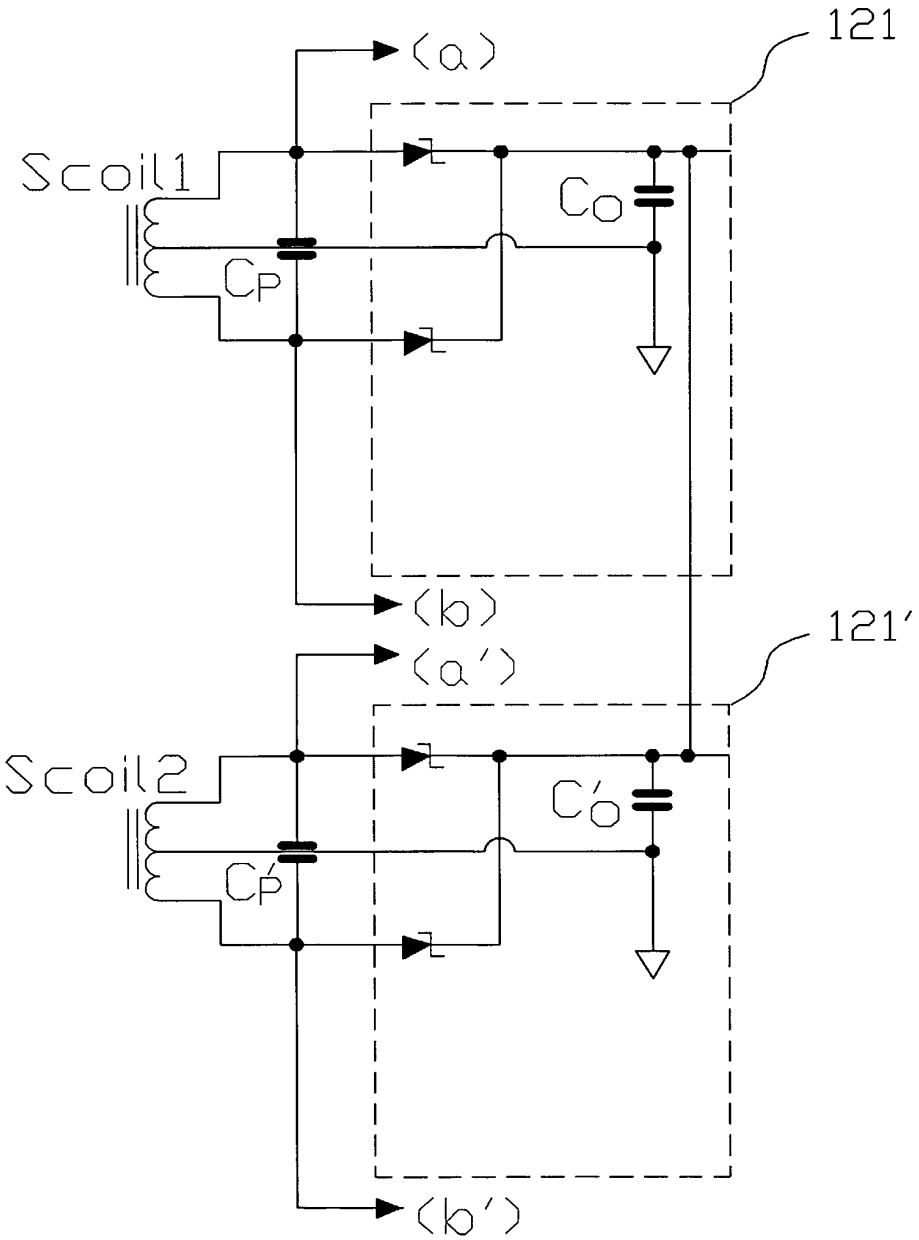
【FIG. 21】



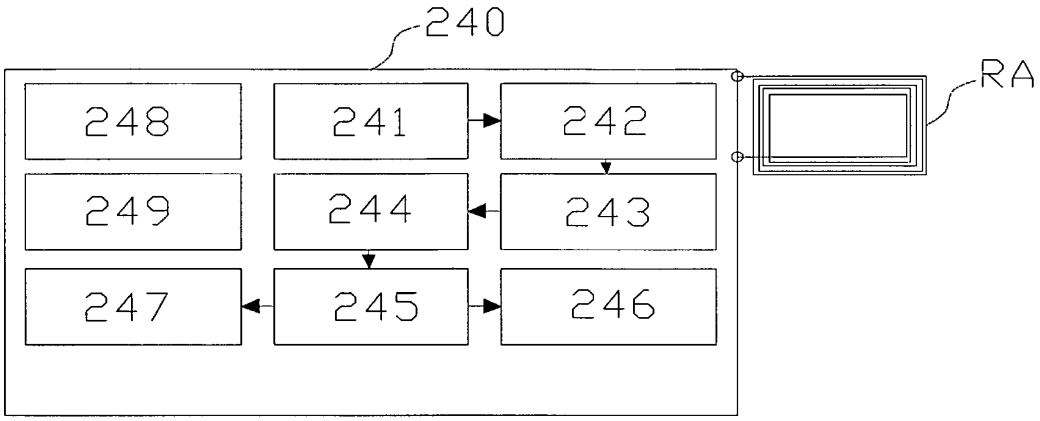
【FIG. 22】



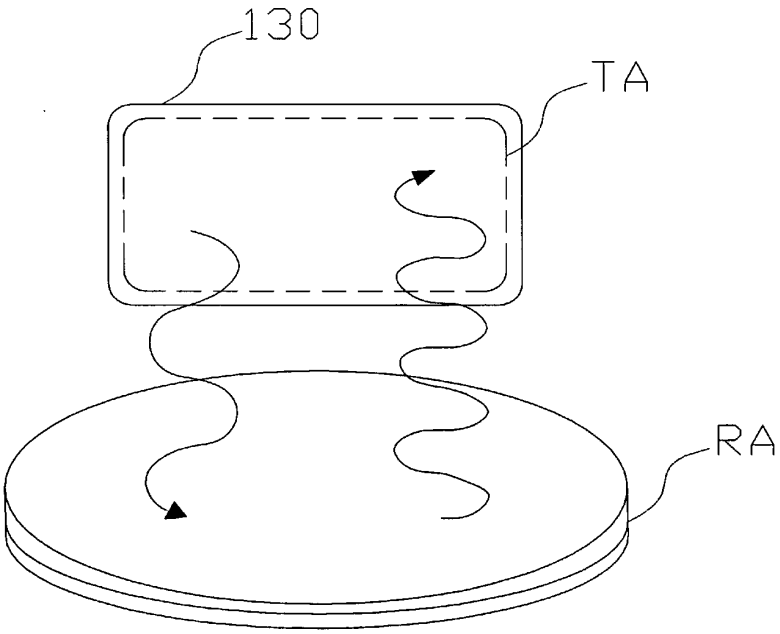
【FIG. 23】



【FIG. 24】



【FIG. 25】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2004/002263

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H02J 7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7: H02J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and application for inventions since 1975
Korean Utility Modles and application for Utility for Utility Models since 1975
Japanese Utility modles and application for Utility for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5600225 A (NEC CO., LTD.) 4 FEB. 1997 Abstract, fig. 2, Claims 1-3	1, 9
A	JP 2003-047178 A (SONY CO., LTD.) 14 FEB. 2003 Abstract, fig. 1, Claims 1-3	1, 9
A	JP 11-178232 A (CANON INC.) 2 JUL. 1999 Fig. 1, Claims 1-3	1, 9
A	JP 2002-272020 A (SONY CO., LTD.) 20 SEP 2002 Abstract, fig. 1, Claims 1-4	1, 9
A	JP 09-233706 A (HITACHI CO., LTD) 5 SEP. 1997 Abstract, fig. 1, Claim 1	1, 9
A	JP 11-68837 A (CASIO COMPUTER CO., LTD) 22 JUN. 1999 See the whole document	1, 9
A	JP 10-201113 A (OKI ELECTRIC INDUSTRIAL CO., LTD.) 31 JUL. 1998 See the whole document	1, 9

☐ Further documents are listed in the continuation of Box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 MARCH 2005 (25.03.2005)	**26 MARCH 2005 (26.03.2005)**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	JEON, Yong Hai Telephone No. 82-42-481-5657

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(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.** [KR/KR]; 416, Maetan-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do 442-742 (KR).

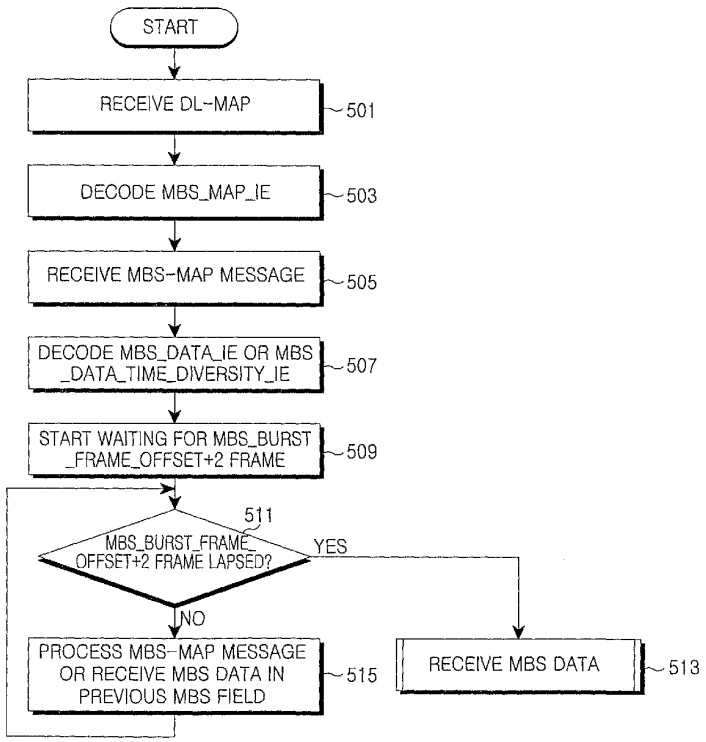
(72) Inventors: **KANG, Hyun-Jeong**; #ga-603, Dongsin Apt., Dogok 1-dong, Gangnam-gu, Seoul 135-271 (KR). **SON, Jung-Je**; #306-901, Mujigaemaeul Sinhan Apt., Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-708 (KR). **LIM, Hyoung-Kyu**; #105-2305, Samhwan Apt., Gaebong 2-dong, Guro-gu, Seoul 152-753 (KR). **SON, Yeong-Moon**; #102, Jeongu Villa, 897-1, Anyang 3-dong, Manan-guAnyang-si, Gyeonggi-do 430-841 (KR). **LEE, Sung-Jin**; #133-1701, Hwanggolmaeul 1-danji Apt., Yeongtong-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-740 (KR). **KOO, Chang-Hoi**; #316-2805, Sibeom-danji Hanyang Apt., Seohyeon-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-776 (KR). **JOO, Pan-Yuh**; #311-402, Sinbanpo Hanshin Apt., Jamwon-dong, Seocho-gu, Seoul 137-950 (KR). **LEE, Geun-Ho**; #109-1503, E-pyeonhansesang Apt., Imun 3-dong Dongdeamun-gu, Seoul 130-083 (KR).

(74) Agent: **LEE, Keon-Joo**; Mihwa Bldg. 110-2, Myon-gryun-dong 4-ga, Chongro-gu, Seoul 110-524 (KR).

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[Continued on next page]

(54) Title: METHOD FOR TRANSMITTING/RECEIVING DATA IN A COMMUNICATION SYSTEM



(57) Abstract: Provided is a method for transmitting/receiving data in a communication system providing Multicast/Broadcast Service (MBS). The method includes, generating transmission data to be transmitted to a receiver; allocating the transmission data to a frame; setting a MAP message that includes information on a frame offset related to the frame; and transmitting to the receiver the MAP message.

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NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD FOR TRANSMITTING/RECEIVING DATA IN A COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a communication system, and in particular, to a method for transmitting/receiving data in a communication system providing Multicast and Broadcast Service (MBS).

2. Description of the Related Art

In the next generation communication system, active research is being conducted to provide users with services varying in Quality-of-Service (QoS) and at a high data rate. Particularly, in the current next generation communication system, studies are being carried out to support high-speed services capable of guaranteeing mobility and QoS in a Broadband Wireless Access (BWA) communication system such as a wireless Local Area Network (LAN) communication system and a wireless Metropolitan Area Network (MAN) communication system. The Institute of Electrical and Electronics Engineers (IEEE) 802.16 communication system is a typical BWA, LAN and MAN communication system.

The IEEE 802.16 communication system employs an Orthogonal Frequency Division Multiplexing (OFDM)/Orthogonal Frequency Division Multiple Access (OFDMA) scheme to support a broadband transmission network for physical channels of the wireless MAN system. The IEEE 802.16 communication system currently takes into account not only fixed elements of a system but also mobile a subscriber stations (SS). An SS having both fixed elements and mobile elements will be referred to as a mobile station (MS).

The BWA communication system provides user with high-speed multimedia communication service, for example, MBS, beyond the voice and packet data communication services provided in the existing communication system. That is, in a communication system providing MBS, a transmitter, for example, a base station (BS), provides broadcast contents to a plurality of

receivers, for example, MSs, using a multicast scheme. The multicast scheme refers to a transmission scheme in which one transmitter transmits transmission data to a plurality of receivers. The communication system providing MBS divides its full broadcast service area into a plurality of service areas, and in each of the divided service areas, one or more transmitters transmit MBS data to all receivers located in their service area using the multicast scheme. The receivers located in each service area simultaneously receive the MBS data from their transmitter(s). In the communication system providing a MBS, one transmitter may manage more than one service areas and simultaneously provide the MBS to receivers located in the multiply service areas.

In the communication system providing the MBS, particularly in the IEEE 802.16 communication system, a transmitter transmits MBS data to receivers at the same frame number and the same MBS symbol position at the same time using the same coding scheme. In order to allow a receiver located in a boundary area of each service area to obtain a macro diversity effect through radio frequency combining, the transmitter should define an MBS field (or MBS zone) in a downlink frame and transmit the MBS data through the MBS field. The receiver receives an MBS-MAP message including information on an MBS field that it should receive in the downlink frame, to detect the MBS field, thereby receiving the MBS data transmitted through the MBS field. Herein, the MAP message transmitting downlink resource allocation information is referred to as a downlink-MAP (DL-MAP) message, and the MAP message transmitting uplink resource allocation information is referred to as an uplink-MAP (UL-MAP) message.

If the transmitter transmits downlink resource allocation information and uplink resource allocation information through the DL-MAP message and the UL-MAP message in this way, the receivers decode the DL-MAP message and UL-MAP message transmitted by the transmitter to detect the allocation position of resources allocated thereto and the control information of the data they should receive. The MSs can transmit/receive data through the downlink and the uplink by detecting the resource allocation position and control information.

FIG. 1 is a diagram illustrating a structure of a downlink frame in a

general communication system providing MBS. In FIG. 1, a downlink frame is represented by subchannels and symbols in a time domain and a frequency domain.

Referring to FIG. 1, a downlink frame includes a preamble field 101, DL-MAP fields 103 and 105, an MBS-MAP message field 109, and a plurality of MBS data burst fields, i.e., an MBS data burst 1 field 113, an MBS data burst 2 field 115, and an MBS data burst 3 field 117. Further, the DL-MAP field 103 includes an MBS_MAP_Information Element (MBS_MAP_IE) field 107, and the MBS-MAP message field 109 includes an MBS_Data_Information Element (MBS_Data_IE) field 111.

The preamble field 101 transmits a synchronization signal, i.e., a preamble sequence, for synchronization acquisition between a transmitter and a receiver. The DL-MAP fields 103 and 105, fields for transmitting DL-MAP information, include the MBS_MAP_IE field 107 to provide MBS, and an MBS_MAP_IE included in the MBS_MAP_IE field 107 provides information for decoding the MBS-MAP message field 109. A format of the MBS_MAP_IE included in the MBS_MAP_IE field 107 is shown in Table 1 below.

Table 1

Syntax	Size (bits)	Notes
MBS_MAP_IE() {		
Extended DIUC	4	MBS_MAP=0x0A
Length	4	
MBS Zone Identifier	7	MBS Zone identifier corresponds to the identifier provided by the BS at connection initiation
Macro diversity enhanced	1	0=Non Macro diversity enhanced zone 1=Macro diversity enhanced zone
If(Macro diversity enhanced=1) {		
Permutation	2	0b00=PUSC permutation 0b01=FUSC permutation 0b10=Optional FUSC permutation 0b11=Adjacent subcarrier permutation

IDcell	6	
}		
OFDMA symbol offset	7	OFDMA symbol offset with respect to start of the MBS region
DIUC change indication	1	Used to indicate DIUC change is included
If(DIUC change indication=1) {		
Reserved	1	
Boosting	3	
DIUC	4	
No. subchannels	6	
No. OFDMA symbols	2	
Repetition coding indication	2	0b00=No repetition coding 0b01=repetition coding of 2 used 0b10=repetition coding of 4 used 0b11=repetition coding of 6 used
} else {		
DIUC	4	
CID	12	12 LSB of CID
OFDMA symbol offset	8	The offset of the OFDMA symbol in which the burst starts, measured in OFDMA symbols from beginning of the downlink frame in which the DL-MAP is transmitted.
Subchannel offset	6	The lowest index OFDMA subchannel used for carrying the burst, starting from subchannel 0.
Boosting	3	
SLC_3_Indication	1	Used to notify sleep mode class 3 is used for single BS MBS service
No. OFDMA symbols	6	
No. subchannels	6	
Repetition coding indication	2	0b00=No repetition coding 0b01=Repetition coding of 2 used 0b10=Repetition coding of 4 used 0b11=Repetition coding of 6 used
If(SLC_3_Indication=0) {		

Next MBS frame offset	8	The Next MBS frame offset value is lower 8bits of the frame number in which the BS shall transmit the next MBS frame.
Next MBS OFDMA symbol offset	8	The offset of the OFDMA symbol in which the next MBS zone starts, measured in OFDMA symbols from the beginning of the downlink frame in which the MBS-MAP is transmitted.
}		
}		
If!(byte boundary) {		
Padding nibble	Variable	Padding to reach byte boundary
}		
}		

Table 1 shows Information Elements (IEs) of the MBS_MAP_IE included in the MBS_MAP_IE field 107. In Table 1, 'Extended Downlink Interval Usage Code (Extended DIUC)' indicates that the MBS_MAP_IE includes MBS-MAP information, and is set to have a value of '0x0A'. 'MBS Zone Identifier' indicates an identifier of the MBS field, 'Macro Diversity Enhanced' indicates whether macro diversity is applied to the MBS field, and 'Permutation' and 'IDcell' indicate information necessary when the macro diversity is applied to the MBS zone. Herein, the MBS field includes the MBS-MAP message field 109 having the MBS_Data_IE field 111, and a plurality of MBS data burst fields 113, 115 and 117.

In addition, 'OFDMA symbol offset' indicates a start offset of an MBS-MAP message in the MBS field, 'DIUC change indication' indicates a change in DIUC to be used for receiving the MBS-MAP message, and 'No. Subchannels' indicates the number of allocated subchannels. Further, 'No. OFDMA Symbols' indicates the number of allocated OFDMA symbols, and 'Repetition coding indication' indicates coding information to be used for decoding the MBS-MAP message. The IEs not mentioned in Table 1 are not directly related to the present invention, so a detailed description thereof will be omitted herein.

As shown in Table 1, the MBS_MAP_IE field 107 includes information on the MBS-MAP message field 109, and receivers receive the MBS-MAP message transmitted with the MBS-MAP message field 109 through the MBS_MAP_IE. With reference to Table 2, a detailed description will now be made of the MBS-MAP message. Table 2 below shows a format of the MBS-MAP message.

Table 2

Syntax	Size(bits)	Notes
MBS-MAP Message format () {		
MAC Generic Header	48	6bytes
Management message type=62	4	
Frame number	4	The frame number is identical to the frame number in the DL-MAP
MBS_DIUC_Change_Count	8	
# MBS_DATA_IE	4	Number of included MBS_DATA_IE
For(i=0;i<n; i++) {		N= #MBS_DATA_IE
MBS_DATA_IE	Variable	
}		
#MBS_DATA_Time_Diversity_IE	4	Number of included MBS_DATA_Time_Diversity_IE
For(i=0;i<m; i++) {		m= #MBS_DATA_ Time_Diversity_IE
MBS_DATA_Time_Diversity_IE	Variable	
}		
If(!byte boundary) {		
Padding nibble	8	
}		
TLV encoding element		
}		

Table 2 shows a format of the MBS-MAP message transmitted through the MBS-MAP message field 109. The MBS-MAP message includes a 6-byte or 48-bit Medium Access Control (MAC) Generic Header, and a plurality of IEs. Of the IEs, 'Management Message Type' indicates a type of a management message,

'Frame number' indicates the same frame number as a frame number of the DL-MAP, and 'MBS DIUC Change Count' indicates whether the MBS data burst profile is identical to a previous MBS data burst profile.

If a value of the 'MBS DIUC Change Count' is changed, the receiver that received the MBS-MAP message should receive downlink burst profile information included as Time/Length/Value (TLV) information of the MBS-MAP message. However, if the downlink burst profile information is not included in the MBS-MAP message, the receiver receives the downlink burst profile information through a next Downlink Channel Descriptor (DCD) message. In addition, 'MBS_Data_IE' and 'MBS_Data_Time_Diversity_Information Element' (MBS_Data_Time_Diversity_IE) indicate field information of MBS data bursts that the receiver will receive. The 'MBS_Data_Time_Diversity_IE' includes information on MBS data bursts allocated when there is only the MBS burst data for a receiver supporting a Hybrid Automatic Repeat reQuest (HARQ) scheme. The IEs not mentioned in Table 2 are not directly related to the present invention, so a detailed description thereof will be omitted herein.

With reference to Table 3, a description will now be made of the MBS_Data_IE including information on the MBS data burst fields 113, 115 and 117 over which MBS data is transmitted.

Table 3

Syntax	Size (bits)	Notes
MBS_DATA_IE {		
MBS_MAP_Type=0	4	MBS_DATA_IE
Next MBS MAP change indication	1	This indicates whether the size of MBS MAP message of next MBS frame for these multicast CIDs included this IE will be different from the size of this MBS MAP message.
No. of Multicast CID	3	
For(i=0;i<No. of Multicast CIDs; i++) {		
Multicast CID	12	12 LSBs of CID for multicast

}		
MBS DIUC	4	
OFDMA symbol offset	8	OFDMA symbol offset with respect to start of the MBS portion
Subchannel offset	6	OFDMA subchannel offset with respect to start of the MBS portion
Boosting	3	
No. OFDMA symbols	7	The size of MBS data
No. subchannels	6	
Repetition coding indication	2	0b00=No repetition coding 0b01=Repetition coding of 2 used 0b10=Repetition coding of 4 used 0b11=Repetition coding of 6 used
Next MBS frame offset	8	The Next MBS frame offset value is lower 8 bits of the frame number in which the BS shall transmit the next MBS frame.
Next MBS OFDMA symbol offset	8	The offset of the OFDMA symbol in which the next MBS portion starts, measured in OFDMA symbols from beginning of the downlink frame in which the MBS-MAP is transmitted.
If(Next MBS MAP change indication=1) {		
Next MBS No. OFDMA symbols	2	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
Next MBS No. OFDMA symbols	6	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
}		
}		

Table 3 shows IEs of the MBS_Data_IE transmitted through the MBS_Data_IE field 111. In Table 3, 'MBS_MAP_Type' indicates that the IEs of Table 3 are MBS_Data_IE, and 'Next MBS MAP change indication' indicates a

change in size of an MBS-MAP message that will come in the next MBS frame, wherein the MBS frame means the frame that includes information of the MBS data or the data burst of the MBS. In addition, 'Multicast Connection Identifier (CID)' indicates multicast identifier information mapped to the MBS_Data_IE, 'OFDMA Symbol Offset' and 'Subchannel Offset' indicate start offsets of the MBS data burst fields 113, 115 and 117, and 'No. Subchannels' indicates the number of subchannels of the MBS data burst fields 113, 115 and 117 allocated to the MBS frame. Further, 'No. OFDMA Symbols' indicates the number of OFDMA symbols of the allocated MBS data burst fields 113, 115 and 117, and 'Repetition coding indication' indicates the number of repetitions (or iterations) needed for decoding the MBS data transmitted through the MBS data burst fields 113, 115 and 117.

In addition, 'Next MBS frame offset' indicates an offset of the next MBS frame, and 'Next MBS OFDMA symbol offset' indicates an offset of a downlink frame OFDMA symbol for receiving the next MBS-MAP message. Herein, if the 'Next MBS MAP change indication' is set to '1', it means that the 'Next MBS OFDMA symbol offset' includes 'Next MBS No. OFDMA symbols' indicating a size of an MBS-MAP message that will come in the next MBS frame, and 'Next MBS No. OFDMA subchannels'. After receiving the 'Next MBS frame offset' and the 'Next MBS OFDMA symbol offset', the receiver can obtain the MBS service information without receiving the MBS_MAP_IE of the DL-MAP. The IEs not mentioned in Table 3 are not directly related to the present invention, so a detailed description thereof will be omitted herein.

The foregoing MBS-MAP message serves as a MAC control message including information so that the receiver can decode the MBS data burst fields and the corresponding MBS data in MBS data transmitted through the fields. As a result, the MBS-MAP message shown in Table 2 provides information on the MBS data burst fields to the receivers, along with 48-bit MAC Generic Header, as described above. If the amount of information on the MBS data burst fields in which the MBS-MAP message is to be included is large, the MBS-MAP message may not include information on many MBS data burst fields that should be included in one MBS frame, because of the 48-bit MAC Generic Header. Accordingly, the MBS-MAP message is not fully transmitted in one MBS frame,

and is transmitted in the next MBS frame, along with the MAC Generic Header.

As the MBS-MAP message is transmitted over two MBS frames together with the MAC Generic Header, the MAC Generic Header becomes an overhead. In addition, the transmitter transmits the MBS-MAP message over two MBS frames due to the 48-bit MAC Generic Header even for the information on the MBS data burst fields that can be transmitted in one MBS frame, thereby causing a waste of frequency bands. In order to prevent the waste of the frequency bands, it is also possible to allocate information on some of the MBS data burst fields to the current MBS frame before transmission, and transmit information on the other MBS data burst fields in the next MBS frame. In this case, there is a need for a scheme for additionally transmitting information indicating to which MBS frame the information on the MBS data burst fields included in the MBS-MAP message transmitted in the current MBS frame is allocated before being transmitted.

FIG. 2 is a diagram schematically illustrating a structure of an MBS frame in a general communication system providing MBS. In FIG. 2, an MBS-MAP message and information on MBS data burst fields included in the MBS-MAP message are transmitted over two frames of a particular frame n and the next frame (n+1). For convenience, FIG. 2 illustrates only the MBS field in the downlink MBS frame of FIG. 1.

Referring to FIG. 2, an MBS frame n 200 includes an MBS-MAP message field 201, and a plurality of MBS data burst fields that include an MBS data burst 1 field 211, an MBS data burst 2 field 213 and an MBS data burst 3 field 215. The MBS-MAP message field 201 includes a plurality of an MBS_Data_IE fields 203, 205, 207 and 209 each including MBS data burst field information. In addition, an MBS frame (n+1) 250, the next frame of the MBS frame n 200, includes an MBS-MAP message field 251, and a plurality of MBS data burst fields that include an MBS data burst 4 field 255 and an MBS data burst 5 field 257. The MBS-MAP message field 251 includes an MBS_Data_IE 253 including the MBS data burst field information. The MBS_Data_IEs transmitted through the MBS_Data_IE fields 203, 205, 207 and 209 included in the MBS-MAP message field 201 of the MBS frame n 200 include information on the MBS data burst fields 211, 213, 215 and 255. In addition, the

MBS_Data_IE transmitted through the MBS_Data_IE field 253 included in the MBS-MAP message field 251 of the MBS frame (n+1) 250 includes information on the MBS data burst fields 257.

Because the MBS data burst fields 211, 213, 215 and 255 mapped to the MBS_Data_IE transmitted through the MBS_Data_IE fields 203, 205, 207 and 209 included in the MBS-MAP message field 201 of the MBS frame n 200 cannot be wholly allocated to one MBS frame, i.e., the MBS frame n 200, the receiver cannot fully receive the MBS data transmitted through the MBS data burst fields 211, 213, 215 and 255. Accordingly, the MBS data burst 1 field 211, the MBS data burst 2 field 213 and the MBS data burst 3 field 215 among the MBS data burst fields 211, 213, 215 and 255 are allocated to the MBS frame n 200, so that the receiver receives MBS data transmitted through the MBS data burst 1 field 211, the MBS data burst 2 field 213 and the MBS data burst 3 field 215 in the MBS frame n 200. In addition, the MBS data burst 4 field 255 among the MBS data burst fields 211, 213, 215 and 255 is allocated to the MBS frame (n+1) 250, so that the receiver receives MBS data transmitted through the MBS data burst 4 field 255 in the MBS frame (n+1) 250.

At this moment, the receiver cannot determine whether the transmitter has allocated the MBS data bursts 211, 213, 215 and 255 mapped to the MBS-MAP message field 201 of the MBS frame n 200 in the current MBS frame, i.e., the MBS frame n 200, or in the next MBS frame, i.e., the MBS frame (n+1) 250. Therefore, upon receiving the MBS frame n 200, the receiver decodes the MBS data of the MBS data burst 1 field 211, MBS data of the MBS data burst 2 field 213, and MBS data of the MBS data burst 3 field 215 received in the MBS frame n 200, using the MBS_Data_IE included in the MBS_Data_IE fields 203, 205 and 207 of the MBS-MAP message field 201. In addition, upon receiving the next MBS frame, i.e., the MBS frame (n+1) 250, the receiver decodes the MBS data of the MBS data burst 5 field 257 received in the MBS frame (n+1) 250 using the MBS_Data_IE included in the MBS_Data_IE field 253 of the MBS-MAP message field 251.

FIG. 2 illustrates operations 221, 223, 255 and 271 of decoding the MBS data transmitted through the MBS data burst fields 211, 213, 215 and 257, using the

MBS_Data_IE in each frame. As described with reference to FIG. 2, in the MBS frame n 200, information on the MBS data burst fields included in the MBS-MAP message field 201 is information on the MBS data burst 1 field 211, the MBS data burst 2 field 213, the MBS data burst 3 field 215 and the MBS data burst 4 field 255. Although the information on the MBS data burst fields 211, 213, 215 and 255 is allocated to the MBS frame n 200 in this manner, the MBS data burst 4 field 255 is actually allocated to the MBS frame (n+1) 250.

However, the receiver receiving the MBS frame n 200 cannot determine that the transmitter has allocated the MBS data burst fields 211, 213, 215 and 255 as described above, using the MBS-MAP message and the MBS_Data_IE having the structures of Table 2 and Table 3, transmitted through the MBS-MAP message field 201 and the MBS_Data_IE fields 203, 205, 207 and 209 of the MBS frame n 200. Therefore, upon receiving the MBS frame n 200, i.e., the current MBS frame, the receiver performs an operation 227 of decoding the MBS data transmitted through the MBS data burst 4 field 255, considering that the MBS data burst 4 field 255 is allocated to the current MBS frame. However, because the MBS data burst 4 field 255 is not allocated to the MBS frame n 200, an error may occur in the receiver.

In addition, the receiver, receiving the MBS-MAP message with the MBS_Data_IE in a particular MBS frame, may not decode the MBS data transmitted through the MBS data burst fields mapped to the MBS_Data_IE in the particular MBS frame in a real time. That is, even though the transmitter has transmitted the MBS data through the MBS_Data_IE and the MBS data burst fields including allocation and decoding information of the MBS data burst fields in the particular MBS frame, the receiver may fail to decode the MBS data transmitted through the MBS data burst fields due to its processing delay.

Therefore, because the MBS data burst fields individually mapped to the MBS data burst fields included in the MBS_Data_IE of the MBS-MAP message should be allocated to the same MBS frame as the MBS-MAP message field through which the MBS-MAP message is transmitted, there is a need for a scheme for reducing a size of the MBS-MAP message. In addition, there is a demand for a scheme for reducing a processing error which may occur when the

receiver recognizes an MBS frame to which the MBS data burst fields are allocated, and decodes the MBS data transmitted through the MBS data burst fields. Further, there is a need for a scheme in which the transmitter provides the receiver with information used for previously decoding the MBS data before a transmission time of the MBS data through the MBS data burst fields, and an allocation time of the MBS data burst fields through which the MBS data is transmitted, i.e., a transmission time of the MBS data, thereby preventing the processing delay of the receiver.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a method for transmitting/receiving data in a communication system.

It is another object of the present invention to provide a data transmission/reception method for preventing processing delay and misoperation of the system by previously transmitting/receiving data transmission information before a data transmission time in a communication system.

It is further another object of the present invention to provide a data transmission/reception method in a communication system providing MBS.

According to one aspect of the present invention, there is provided a method for transmitting data in a communication system. The method includes, generating transmission data to be transmitted to a receiver; allocating the transmission data to a frame; setting a MAP message that includes information on a frame offset related to the frame; and transmitting to the receiver the MAP message.

According to another aspect of the present invention, there is provided a method for transmitting data in a communication system. The method includes, upon generation of data to be transmitted to a receiver, determining a transmission field of the generated data, and allocating the determined transmission field to a frame; setting in transmission field information location information of the transmission field allocated to the frame and frame offset information defining an

offset between the frame to which the transmission field is allocated and a reference frame; and transmitting to the receiver a MAP message including the set transmission field information.

According to another aspect of the present invention, there is provided a method for transmitting data in a communication system. The method includes, upon generation of data to be transmitted to a receiver, determining a transmission field of the generated data; determining offset of frame including the transmission field; setting in data information offset information defining the offset of frame and location information of the transmission field according to the offset information; and transmitting to the receiver a MAP message including the set data information.

According to another aspect of the present invention, there is provided a method for transmitting multicast broadcast service (MBS) data of a base station (BS) in a broadband wireless access (BWA) communication system. The method includes, determining a frame offset of MBS data burst, a frame comprising the MBS data burst is the n-th frame following the current frame comprising the frame offset; determining a position of the MBS data burst within the n-th frame; setting information of the frame offset and the position in a message; and transmitting the message to a mobile station.

According to further another aspect of the present invention, there is provided a method for receiving data in a communication system. The method includesreceiving a MAP message that includes information on a frame offset related to a data burst before receiving the data burst from a transmitter; analyzing the information on the frame offset; and receiving from the transmitter the data burst within the n-th frame flowing a frame comprising the MAP message according to the analysis of the information.

According to yet another aspect of the present invention, there is provided a method for receiving data in a communication system. The method includesupon receiving a MAP message before receiving data from a transmitter, analyzing location information of a data burst included in the MAP message and frame offset information defining an offset between a frame to which the data

burst is allocated and a current frame; and receiving the data burst within the frame according to the analyzed location information and the frame offset information.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagram illustrating a structure of a downlink frame in a general communication system providing MBS;

FIG. 2 is a diagram illustrating a structure of an MBS frame in a general communication system providing MBS;

FIG. 3 is a diagram illustrating a structure of an MBS frame in a communication system providing MBS according to the present invention;

FIG. 4 is a flowchart schematically illustrating an operation of a receiver in a communication system providing MBS according to the present invention;

FIG. 5 is a flowchart illustrating an operation of a receiver in a communication system providing MBS according to another embodiment of the present invention; and

FIG. 6 is a flowchart illustrating an operation of a transmitter in a communication system providing MBS according to the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Preferred embodiments of the present invention will now be described in detail with reference to the annexed drawings. In the following description, a detailed description of known functions and configurations incorporated herein has been omitted for clarity and conciseness.

The present invention proposes a method for transmitting/receiving data in an communication system, for example, Institute of Electrical and Electronics Engineers (IEEE) 802.16 communication system which is a typical Broadband Wireless Access (BWA) communication system. Although the present invention will be described below with reference to an IEEE 802.16 communication system

employing an Orthogonal Frequency Division Multiplexing (OFDM)/Orthogonal Frequency Division Multiple Access (OFDMA) scheme, the data transmission method proposed in the present invention can also be applied to other communication systems.

In addition, the present invention proposes a data transmission/reception method between a transmitter, for example, a base station (BS), for managing a service area and a receiver, for example, a mobile station (MS), for receiving communication service from the transmitter in a communication system, wherein the MS is both fixed and mobile. The present invention proposes a method in which a transmitter transmits Multicast and Broadcast Service (MBS) data to a plurality of receivers located in its coverage area and the receivers receive the transmitted MBS data in a communication system providing MBS.

Further, the present invention proposes a method in which a transmitter previously transmits information related to transmission data to a receiver before a data transmission time before transmitting data in a communication system. Herein, the "information related to transmission data" can include information about a frame in which the data is transmitted, information about a data transmission field allocated for data transmission in the frame, and decoding information for the data. The present invention will be described herein based on the communication system providing the MBS. In the communication system providing the MBS, a downlink MBS frame can be represented with subchannels and symbols in a time domain and a frequency domain as described with reference to FIG. 1, wherein the MBS frame means the frame that includes information of the MBS data or the data burst of the MBS. In addition, the downlink MBS frame includes a preamble field, a DL-MAP field, an MBS-MAP message field, and a plurality of MBS data burst fields. Further, the DL-MAP field includes an MBS_MAP_Information Element (MBS_MAP_IE) field, and the MBS-MAP message field includes an MBS_Data_Information Element (MBS_Data_IE) field.

The preamble field transmits a synchronization signal, i.e., a preamble sequence, for synchronization acquisition between a transmitter and a receiver. The DL-MAP field, a field for transmitting DL-MAP information, includes the

MBS_MAP_IE field to provide MBS, and an MBS_MAP_IE included in the MBS_MAP_IE field provides information for decoding the MBS-MAP message field. A format of the MBS_MAP_IE included in the MBS_MAP_IE field is shown in Table 1. As shown in Table 1, 'Extended Downlink Interval Usage Code (Extended DIUC)' of the MBS_MAP_IE indicates that the MBS_MAP_IE includes MBS-MAP information, and is set to have a value of '0x0A'. 'MBS Zone Identifier' indicates an identifier of the MBS field, 'Macro Diversity Enhanced' indicates whether macro diversity is applied to the MBS field (or MBS zone), and 'Permutation' and 'IDcell' indicate information necessary when the macro diversity is applied to the MBS zone. Herein, the MBS field includes the MBS-MAP message field having the MBS_Data_IE field, and a plurality of MBS data burst fields in FIG. 1.

In addition, 'OFDMA symbol offset' indicates a start offset of an MBS-MAP message in the MBS field, 'DIUC change indication' indicates a change in DIUC to be used for receiving the MBS-MAP message, and 'No. Subchannels' indicates the number of allocated subchannels. Further, 'No. OFDMA Symbols' indicates the number of allocated OFDMA symbols, and 'Repetition coding indication' indicates coding information to be used for decoding the MBS-MAP message.

The present invention reduces an overhead due to the MBS-MAP message that a receiver desiring to receive MBS data from a transmitter receives in a communication system providing MBS, allowing the receiver to transmit the MBS-MAP message within one MBS frame. The present invention proposes a method in which when decoding MBS data using information on MBS data burst fields in which MBS data included in the MBS-MAP message is transmitted, a receiver receives MBS data using either information on the MBS-MAP message transmitted over the current MBS frame, or information on the MBS-MAP message transmitted over a previous MBS frame. In this method, the receiver receives MBS data actually transmitted through the MBS data burst fields, and recognizes a processing time of the MBS data, i.e., a decoding time of the MBS data, using the 'MBS_Burst_Frame_Offset' included in the MBS_Data_IE and the MBS_Data_Time_Diversity_Information Element (MBS_Data_Time_Diversity_IE) of the MBS-MAP message. Herein, the

MBS_Data_IE and the MBS_Data_Time_Diversity_IE indicate field information of the MBS data bursts the receiver will receive. The receiver receives the MBS data transmitted through the MBS data burst fields allocated to the MBS frame at the recognized time according to the recognized information, and processes the received MBS data.

A detailed description will now be made of an MBS-MAP message transmitted through the MBS-MAP message field of the MBS frame and a MBS_Data_IE transmitted through a MBS_Data_IE field included in the MBS-MAP message field in the communication system providing MBS according to the present invention.

Table 4 below shows the format of the MBS-MAP message transmitted through the MBS-MAP message field of the MBS frame in the communication system providing MBS according to the present invention.

Table 4

Syntax	Size(bits)	Notes
MBS-MAP Message format () {		
MBS MAP indicator	5	Shall be set to 11101
Reserved	3	Shall be set to 0
Frame number	4	The frame number is identical to the frame number in the DL-MAP
MBS_DIUC_Change_Count	8	
#MBS_DATA_IE	4	Number of included MBS_DATA_IE
For(i=0;i<n; i++) {		n= #MBS_DATA_IE
MBS_DATA_IE	variable	
}		
#MBS_DATA_Time_Diversity_IE	4	Number of included MBS_DATA_Time_Diversity_IE
For(i=0;i<m; i++) {		m= #MBS_DATA_Time_Diversity_IE
MBS_DATA_Time_Diversity_IE	variable	
}		
If(!byte boundary) {		

Padding nibble	8	
}		
TLV encoding element		
}		

Although Table 4, showing the format of the MBS-MAP message transmitted through the MBS-MAP message field of the MBS frame, provides the information similar to that of the MBS-MAP message of Table 2, the MBS-MAP message of Table 4 does not include the 48-bit Medium Access Control (MAC) Generic Header of Table 2. That is, in the communication system providing MBS according to the present invention, the MBS-MAP message uses a format of an independently provided MAC header without transmitting the 48-bit MAC Generic Header to the receiver.

With reference to Table 4, a detailed description will now be made of the MBS-MAP message in the communication system providing MBS according to the present invention. The MBS-MAP message includes an MBS MAP indicator. The MBS MAP indicator has a value '11101', and two Most Significant Bit (MSB) bits, i.e., first and second MSB bits, of the MBS MAP indicator, indicate information mapped to a Header Type (HT) field and an Encryption (EC) field of the MAC header. A value of the HT field, the first MSB bit of the MBS MAP indicator, indicates whether the MBS-MAP message transmits a general MAC PDU or a bandwidth request message, and the EC field, the second MSB bit of the MBS MAP indicator, indicates whether encryption is applied to the currently transmitted frame. A third MSB bit of the MBS MAP indicator indicates whether the corresponding MAP is a compressed MAP, and the third MSB bit of the MBS MAP indicator being set to '0' indicates a compressed MAP. The last two bits, i.e., fourth and fifth MSB bits, of the MBS MAP indicator indicate that the corresponding MAP is a Sub DownLink UpLink MAP (Sub-DL-UL-MAP). Herein, the fourth and fifth MSB bits of the MBS MAP indicator being set to '00' indicates that the next information is a Sub-DL-UL-MAP, and if the fourth and fifth MSB bits of the MBS MAP indicator are set to '01', it indicates that the next information is a MBS-MAP message. The compressed MAP and the Sub-DL-UL-MAP are not related to the present invention, so a detailed description thereof will

be omitted herein.

That is, a transmitter desiring to transmit the MBS-MAP message to the receiver sets the first and second MSB bits of the MBS MAP indicator to '11', and sets the third MSB bit to '1' to indicate a non-compressed MAP. Further, the transmitter sets the fourth and fifth MSB bits of the MBS MAP indicator to '01' to indicate an MBS-MAP message. As a result, the transmitter sets the MBS MAP indicator of the MBS-MAP message to '11101'. Thereafter, the transmitter transmits the MBS MAP indicator to the receiver through the MBS-MAP message field of the MBS frame, and the receiver, receiving the set MBS MAP indicator of the MBS-MAP message through the MBS-MAP message field of the MBS frame, recognizes that the received information is an MBS-MAP message if the five bits of the MBS MAP indicator are set to '11101'.

Thereafter, the receiver performs decoding on the recognized MBS-MAP message, and decodes MBS data transmitted through MBS data burst fields of the MBS frame using information on the MBS data burst fields included in the MBS-MAP message. In addition, 'Frame number' of the MBS-MAP message indicates the same frame number as a frame number of the DL-MAP, and 'MBS DIUC Change Count' indicates whether the MBS data burst profile is identical to a previous MBS data burst profile.

If a value of the 'MBS DIUC Change Count' is changed, the receiver receiving the MBS-MAP message should receive downlink burst profile information included as Time/Length/Value (TLV) information of the MBS-MAP message. However, if the downlink burst profile information is not included in the MBS-MAP message, the receiver receives the downlink burst profile information through a next Downlink Channel Descriptor (DCD) message. In addition, 'MBS_Data_IE' and 'MBS_Data_Time_Diversity_Information Element' (MBS_Data_Time_Diversity_IE) indicate field information of MBS data bursts the receiver will receive. The MBS_Data_Time_Diversity_IE includes information on MBS data bursts allocated when there is only the MBS burst data for a receiver supporting a Hybrid Automatic Repeat reQuest (HARQ) scheme. The IEs not mentioned in Table 4 are not directly related to the present invention, so a detailed description thereof will be omitted herein.

With reference to Table 5, a description will now be made of the MBS_Data_IE including information on the MBS data burst fields in which MBS data is transmitted.

Table 5

Syntax	Size (bits)	Notes
MBS_DATA_IE {		
MBS_MAP_Type=0	3	MBS_DATA_IE
Next MBS frame indicator	1	0=MBS data burst of the current MBS frame 1=MBS data burst of the next MBS frame
Next MBS MAP change indication	1	This indicates whether the size of MBS MAP message of next MBS frame for these multicast CIDs included this IE will be different from the size of this MBS MAP message.
No. of Multicast CID	3	
For(i=o; i<No. of Multicast CIDs; i++) {		
Multicast CID	12	12 LSBs of CID for multicast
}		
MBS DIUC	4	
OFDMA symbol offset	8	OFDMA symbol offset with respect to start of the MBS portion
Subchannel offset	6	OFDMA subchannel offset with respect to start of the MBS portion
Boosting	3	
No. OFDMA symbols	7	The size of MBS data
No. subchannels	6	
Repetition coding indication	2	0b00=No repetition coding 0b01=Repetition coding of 2 used 0b10=Repetition coding of 4 used 0b11=Repetition coding of 6 used
Next MBS frame offset	8	The Next MBS frame offset value is lower 8 bits of the frame number in which the BS shall transmit the next MBS frame.
Next MBS OFDMA symbol offset	8	The offset of the OFDMA symbol in which the

		next MBS portion starts, measured in OFDMA symbols from the beginning of the downlink frame in which the MBS-MAP is transmitted.
If(Next MBS MAP change indication=1) {		
Next MBS No. OFDMA symbols	2	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
Next MBS No. OFDMA subchannels	6	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
}		
}		

Table 5 shows IEs of the MBS_Data_IE transmitted through the MBS_Data_IE field. The MBS_Data_IE is included in the MBS-MAP message, and includes information on the MBS data transmitted from the transmitter to the receiver through the MBS data burst fields of the MBS frame. 'MBS_MAP_Type' of the MBS_Data_IE indicates that the IEs of Table 5 are MBS_Data_IE, and 'Next MBS MAP change indication' indicates a change in size of an MBS-MAP message that will come in the next MBS frame. In addition, the MBS_Data_IE transmits information indicating whether the MBS data corresponds to the same MBS frame as the MBS frame in which an MBS-MAP message is currently received, or corresponds to an MBS frame in which the next MBS-MAP will be received, using a Next MBS frame indicator.

In other words, if the Next MBS frame indicator of the MBS_Data_IE is set to '0', the receiver processes, or decodes the MBS data transmitted through the MBS data burst fields in the current MBS frame, recognizing that the information included in the MBS_Data_IE transmitted through the current MBS frame is MBS data will be processed in the current MBS frame. However, if the Next MBS frame indicator is set to '1', the receiver processes, or decodes the

MBS data transmitted through the MBS data burst fields in the next MBS frame, recognizing that the information included in the MBS_Data_IE transmitted through the current MBS frame will be processed in the next MBS frame. In this manner, the receiver receives the MBS data. If the Next MBS frame indicator is set to '1', i.e., if the receiver recognizes that the information included in the MBS_Data_IE transmitted through the current MBS frame is MBS data will be processed in the next MBS frame, the receiver buffers the information on the MBS data burst fields included in the MBS_Data_IE using a specific buffer, and then processes the MBS data transmitted through the MBS data burst files in the next MBS frame.

In addition, 'Next MBS MAP change indication' of the MBS_Data_IE indicates a change in size of an MBS-MAP message that will come in the next MBS frame. 'Multicast Connection Identifier (CID)' indicates multicast identifier information mapped to the MBS_Data_IE, 'OFDMA Symbol Offset' and 'Subchannel Offset' indicate start offsets of the MBS data burst fields, and 'No. Subchannels' indicates the number of subchannels of the MBS data burst fields allocated to the MBS frame. 'No. OFDMA Symbols' indicates the number of OFDMA symbols of the allocated MBS data burst fields, and 'Repetition coding indication' indicates the number of repetitions needed for decoding the MBS data transmitted through the MBS data burst fields.

'Next MBS frame offset' indicates an offset of the next MBS frame, and 'Next MBS OFDMA symbol offset' indicates an offset of a downlink frame OFDMA symbol for receiving the next MBS-MAP message. Herein, the 'Next MBS MAP change indication' being set to '1' means that the 'Next MBS OFDMA symbol offset' includes 'Next MBS No. OFDMA symbols' indicating a size of an MBS-MAP message that will come in the next MBS frame, and 'Next MBS No. OFDMA subchannels'. After receiving the 'Next MBS frame offset' and the 'Next MBS OFDMA symbol offset', the receiver can obtain MBS service information without receiving the MBS_MAP_IE of the DL-MAP. The IEs not mentioned in Table 5 are not directly related to the present invention, so a detailed description thereof will be omitted herein.

A description will now be made of a method for transmitting/receiving

data using the MBS-MAP message and information on the MBS_Data_IE included in the MBS-MAP message in the communication system providing MBS according to the present invention.

FIG. 3 is a diagram illustrating a structure of an MBS frame in a communication system providing MBS according to the present invention. For convenience, in FIG. 3, an MBS-MAP message and information on MBS data burst fields included in the MBS-MAP message are transmitted over two frames of a particular frame n and the next frame (n+1). In other words, FIG. 3 illustrates a structure of an MBS frame for the case where the Next MBS frame indicator of the MBS_Data_IE shown in Table 5 is set to '1', wherein the receiver receives MBS data by processing, or decoding the MBS data transmitted through the MBS data burst fields in the next MBS frame, recognizing that the information included in the MBS_Data_IE transmitted through the current MBS frame, i.e., the MBS frame n, is MBS data will be processed in the next MBS frame, i.e., the MBS frame (n+1). The process for the Next MBS frame indicator='1' has been described, so a description thereof will be omitted herein. Similarly, FIG. 3 illustrates only the MBS field in the downlink MBS frame of FIG. 1, for convenience.

Referring to FIG. 3, an MBS frame n 300 includes an MBS-MAP message field 301, and a plurality of MBS data burst fields of an MBS data burst 1 field 311, an MBS data burst 2 field 313 and an MBS data burst 3 field 315. The MBS-MAP message field 301 includes MBS_Data_IE fields 303, 305, 307 and 309 for processing the MBS data burst fields. In addition, an MBS frame (n+1) 350, the next frame of the MBS frame n 300, includes an MBS-MAP message field 351, and a plurality of MBS data burst fields of an MBS data burst 4 field 355 and an MBS data burst 5 field 357. The MBS-MAP message field 351 includes an MBS_Data_IE 353. The MBS_Data_IE transmitted through the MBS_Data_IE fields 303, 305, 307 and 309 included in the MBS-MAP message field 301 of the MBS frame n 300 includes information on the MBS data burst fields 311, 313, 315 and 355. In addition, the MBS_Data_IE transmitted through the MBS_Data_IE field 353 included in the MBS-MAP message field 351 of the MBS frame (n+1) 350 includes information on the MBS data burst fields 357.

Because the MBS data burst fields 311, 313, 315 and 355 mapped to the MBS_Data_IE transmitted through the MBS_Data_IE fields 303, 305, 307 and 309 included in the MBS-MAP message field 301 of the MBS frame n 300 cannot be wholly allocated to one MBS frame, i.e., the MBS frame n 300, the MBS data burst fields 311, 313, 315 and 355 are allocated to the current MBS frame, i.e., MBS frame n 300, and the next frame, i.e., MBS frame (n+1) 350. At this time, the receiver determines whether the MBS data burst fields 311, 313, 315 and 355 are allocated to the MBS frame n 300 and the MBS frame (n+1) 350, using the Next MBS frame indicator of the MBS_Data_IE transmitted through the MBS_Data_IE fields 303, 305, 307 and 309 included in the MBS-MAP message field 301.

That is, upon receiving the MBS frame n 300, the receiver checks the allocation information of the MBS data burst 1 field 311, the MBS data burst 2 field 313, the MBS data burst 3 field 315 received in the current MBS frame, i.e., MBS frame n 300, using the MBS_Data_IE transmitted through the MBS_Data_IE fields 303, 305 and 307 included in the MBS-MAP message field 301 of the MBS frame #n 300, and decodes the MBS data transmitted through each of the allocated MBS data burst fields 311, 313 and 315. In addition, the receiver checks the allocation information of the MBS data burst #4 field 355 in the MBS frame (n+1) 350 using the MBS_Data_IE transmitted through the MBS_Data_IE field 309 included in the MBS-MAP message field 301 of the MBS frame n 300, and decodes MBS data transmitted through the allocated MBS data burst 4 field 355 in the MBS frame (n+1) frame 350.

More specifically, the MBS data burst 4 field 355 is allocated to the MBS frame (n+1) 350, and a value of the Next MBS frame indicator in the MBS_Data_IE 309 of the MBS frame n 300 having information on the MBS data burst 4 field 355 is set to '1'. The receiver receiving the MBS frame n 300 processes, or decodes, the MBS data transmitted through the MBS data burst 4 field 355 allocated to the MBS frame (n+1) 350 upon receipt of the MBS frame (n+1) 350, recognizing that the MBS data burst 4 field 355 is allocated to the next MBS frame, i.e., the MBS frame (n+1) 350.

In addition, the receiver receiving the MBS frame (n+1) 350 checks the

allocation information of the MBS data burst 5 field 357 received in the current MBS frame, i.e., the MBS frame (n+1) 350, using the MBS_Data_IE transmitted through the MBS_Data_IE field 353 included in the MBS-MAP message field 351 of the MBS frame (n+1) 350, and decodes the MBS data transmitted through the allocated MBS data burst 5 field 357. FIG. 3 illustrates operations 321, 323, 325, 327 and 371 of decoding the MBS data transmitted through the MBS data burst fields 311, 313, 315, 355 and 357, using the MBS_Data_IE in each frame.

FIG. 4 is a flowchart illustrating an operation of a receiver in a communication system providing MBS according to the present invention.

Referring to FIG. 4, in step 401, a receiver receives a DL-MAP message transmitted from a transmitter through a DL-MAP message field allocated to an MBS frame. In step 403, if a DIUC value of the received DL-MAP message shown in Table 4 is set to '0x0A', the receiver decodes an MBS_MAP_IE transmitted through an MBS_MAP_IE field included in the DL-MAP message. Thereafter, in step 405, the receiver acquires location information and decoding information of an MBS-MAP message from the received MBS_MAP_IE, and receives an MBS-MAP message transmitted from the transmitter through an MBS-MAP message field allocated to the MBS frame. A format of the received MBS-MAP message is shown in Table 4.

Next, in step 407, the receiver decodes an MBS_Data_IE including the information on the MBS data burst fields in the MBS frame. That is, the receiver receives an MBS_Data_IE transmitted through the MBS_Data_IE field included in the MBS-MAP message field. In step 409, the receiver determines whether a Next MBS frame indicator of the received MBS_Data_IE shown in Table 5 is set to '1'. If it is determined in step 409 that the Next MBS frame indicator is set to '1', the receiver proceeds to step 411. However, if the Next MBS frame indicator is set to '0', the receiver proceeds to step 413.

In step 411, after waiting from an MBS frame, i.e., the current MBS frame, received at the present time until the time that the next MBS frame is received, the receiver processes, or decodes the MBS data transmitted through the MBS data burst fields allocated to the current MBS frame and the next MBS

frame using information included in the MBS_Data_IE transmitted through an MBS_Data_IE field included in each MBS-MAP message of the current MBS frame and the next MBS frame. The method of processing, or decoding, data transmitted through the MBS data burst fields allocated to the two frames has been described above, so a detailed description will be omitted herein.

Meanwhile, in step 413, the receiver processes, or decodes, MBS data transmitted through MBS data burst fields allocated to the current MBS frame using information included in an MBS_Data_IE in the current MBS frame. The method of processing, or decoding data transmitted through the MBS data burst fields allocated to the one frame has also been described above, so a detailed description will be omitted herein. After processing the MBS data transmitted through the MBS data burst fields allocated to each MBS frame in steps 411 and 413, if the receiver continues to receive the MBS provided from the transmitter, the process returns to step 405 and repeats the operation of step 405 and its succeeding steps.

In FIG. 4, the receiver determines whether the information on the MBS data burst fields included in the MBS_Data_IE of the MBS-MAP message corresponds to the current MBS frame or both of the current MBS frame and the next MBS frame, i.e., whether MBS data burst fields are allocated to two consecutive MBS frames, and then processes, or decodes, the MBS data transmitted through the allocated MBS data burst fields according to the determination results. After receiving the MBS-MAP message in the current MBS frame, the receiver receiving MBS provided from the transmitter may receive MBS data transmitted through MBS data burst fields allocated to an MBS frame following more than two MBS frames including the current MBS frame.

That is, the information on the MBS data burst fields included in the MBS_Data_IE of the MBS-MAP message in the current MBS frame may not only be the current MBS frame or both of the current frame and the next frame but also be the information on the MBS data burst fields allocated to the frame transmitted after the next frame. In this case, the receiver should process, or decode, the data transmitted through the MBS data burst fields in real time.

A description will now be made of a method for decoding received MBS data by a receiver in the case where the information on the MBS data burst fields included in the MBS_Data_IE of the MBS-MAP message in the current MBS frame is not only the current MBS frame or both of the current MBS frame and the next frame but also the information on the MBS data burst fields allocated to the frame transmitted after the next frame in the communication system providing MBS according to the present invention.

In the above case, in the communication system according to the present invention, the receiver previously receives information on the MBS data burst fields to be allocated to the frame following at least two frames through the MBS-MAP message transmitted in the current MBS frame. Thereafter, the receiver decodes the MBS data transmitted through the MBS data burst fields allocated to the frame following the at least two frames using the previously received information. Therefore, the MBS-MAP message transmitted through the MBS-MAP message field allocated to the MBS frame includes information indicating how many frames later from the current MBS frame the frame in which MBS data transmitted through the MBS data burst fields is decoded is located. A format of the MBS_Data_IE including such information is shown in Table 6 below.

Table 6

Syntax	Size (bits)	Notes
MBS_DATA_IE {		
MBS-MAP-Type=0	2	MBS_DATA_IE
MBS_Burst_Frame_Offset	2	This indicates the burst indicated by this IE will be shown after MBS_Burst_Frame_offset + 2 frames.
Next MBS MAP change indication	1	This indicates whether the size of MBS MAP message of next MBS frame for these multicast CIDs included this IE will be different from the size of this MBS MAP message.
No. of Multicast CID	3	
For(i=o; i<No. of Multicast CIDs; i++) {		

Multicast CID	12	12 LSBs of CID for multicast
}		
MBS DIUC	4	
OFDMA symbol offset	8	OFDMA symbol offset with respect to start of the next (MBS_Burst_Frame_offset +2)th frame
Subchannel offset	6	OFDMA subchannel offset with respect to start of the next (MBS_Burst_Frame_offset +2)th frame
Boosting	3	
No. OFDMA symbols	7	The size of MBS data
No. subchannels	6	
Repetition coding indication	2	0b00=No repetition coding 0b01=Repetition coding of 2 used 0b10=Repetition coding of 4 used 0b11=Repetition coding of 6 used
Next MBS frame offset	8	The Next MBS frame offset value is lower 8 bits of the frame number in which the BS shall transmit the next MBS frame.
Next MBS OFDMA symbol offset	8	The offset of the OFDMA symbol in which the next MBS portion starts, measured in OFDMA symbols from the beginning of the downlink frame in which the MBS-MAP is transmitted.
If(Next MBS MAP change indication=1) {		
Next MBS No. OFDMA symbols	2	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
Next MBS No. OFDMA subchannels	6	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.

}		
}		

Table 6 shows IEs of the MBS_Data_IE transmitted through the MBS_Data_IE field. The MBS_Data_IE is included in the MBS-MAP message, and includes information on the MBS data transmitted from the transmitter to the receiver through the MBS data burst fields of the MBS frame. Herein, MBS_MAP Type='0' means that the MBS_Data_IE is transmitted through the MBS_Data_IE field, MBS_MAP Type='1' means that MBS_Data_Time_Diversity_IE is transmitted through the MBS_Data_IE field, and MBS_MAP Type='2' means that an Extended MBS_MAP_Information Element (Extended MBS_MAP_IE) is transmitted through the MBS_Data_IE field. For both MBS_MAP Type='0' and '2', because the MBS_Data_IE is transmitted through the MBS_Data_IE field and IEs for both cases are identical to each other, the following description will be given for the MBS_MAP Type='0', for convenience.

A detailed description of the MBS_MAP Type='1' in which the MBS_Data_Time_Diversity_IE is transmitted through the MBS_Data_IE field will be made later with reference to Table 7 below.

The MBS_Data_IE includes MBS_Burst_Frame_Offset indicating how many frames later from the frame where the current MBS-MAP message is received the MBS data burst field is allocated, i.e., indicating how many frames later from the current MBS frame the MBS data the MBS data will be received at the receiver. After decoding the MBS_Data_IE, the receiver recognizes the possibility of processing, or decoding the MBS data transmitted through MBS data burst fields allocated to an frame received more than two frames later from the MBS frame where the MBS_Data_IE is received.

In other words, for MBS_Burst_Frame_Offset='0', the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame received the two frames later, recognizing the possibility of receiving MBS data through MBS data burst fields allocated to an frame following two frames later

from the MBS frame where the MBS_Data_IE is received. For MBS_Burst_Frame_Offset='1', the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame received the three frames later, recognizing the possibility of receiving MBS data through MBS data burst fields allocated to an frame following three frames later from the MBS frame where the MBS_Data_IE is received.

Similarly, for MBS_Burst_Frame_Offset='2' or '3', the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame received four or five frames later.

Table 6 shows an exemplary case where the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame corresponding to each MBS_Burst_Frame_Offset value, wherein the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame following two frames. However, it is also possible to extend the two frames to four frames, six frames, eight frames, and so on. The frame corresponding to the MBS_Burst_Frame_Offset value is a factor that varies according to the system situations or characteristics. The IEs not mentioned in Table 6 have been described in detail with reference to Table 5.

In the case where receivers supporting an HARQ scheme receive MBS service from a transmitter, the transmitter transmits an MBS_Data_Time_Diversity_IE instead of the MBS_Data_IE to the receivers along with the MBS-MAP message. A format of the MBS_Data_Time_Diversity_IE included in the MBS-MAP message is shown in Table 7 below.

Table 7

Syntax	Size (bits)	Notes
MBS_DATA_Time_Diversity_IE() {		
MBS_MAP_Type=1	2	MBS_DATA_Time_Diversity_IE
MBS_Burst_Frame_Offset	2	This indicates the burst indicated by this IE will be shown after MBS_Burst_Frame_Offset +2

		frames.
Multicast CID	12	
OFDMA symbol offset	8	This indicates starting position of the region of MBS Bursts with respect to start of the next (MBS_Burst_Frame_Offset +2)th frame
N_EP code	4	
N_SCH code	4	
AI_SN	1	
SPID	2	
ACID	4	
Next MBS MAP change indication	1	This indicates whether the size of MBS MAP message of next MBS frame for these multicast CIDs included this IE will be different from the size of this MBS MAP message.
Next MBS frame offset	8	
Next MBS OFDMA symbol offset	8	
If(Next MBS MAP change indication=1) {		
Next MBS No. OFDMA symbols	2	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
Nest MBS No. OFDMA subchannels	6	It is to indicate the size of MBS_MAP message in Next MBS portion where the BS shall transmit the next MBS frame for multicast CIDs in this IE.
}		
}		

Table 7 shows IEs of the MBS_Data_Time_Diversity_IE transmitted instead of the MBS_Data_IE transmitted through the MBS_Data_IE field included in the MBS-MAP message field of the MBS frame, and the MBS_Data_Time_Diversity_IE is transmitted through the MBS_Data_IE field included in the MBS-MAP message field in which MBS_Data_IE is transmitted.

In the MBS_Data_Time_Diversity_IE, MBS_MAP_Type indicates that IEs of Table 7 are MBS_Data_Time_Diversity_IE. Further, MBS_Burst_Frame_Offset indicates an MBS_Burst_Frame_Offset indicating how many frames later from the frame where the current MBS-MAP message is received, i.e., from the current MBS frame, the MBS data burst fields will be allocated. 'Multicast CID' indicates information on a multicast identifier mapped to the MBS_Data_Time_Diversity_IE, and 'OFDMA symbol offset' indicates a start offset of MBS data burst fields allocated to the frame.

'N_EP code', 'N_SCH code', 'ARQ Identifier_Sequence Number (AI_SN)', 'Sub_Packet IDentifier (SPID)' and 'Hybrid ARQ Channel IDentifier (ACID)' indicate information used for decoding the HARQ data. 'Next MBS MAP change indication' indicates any change in MBS-MAP message to be transmitted through an MBS-MAP message field in the next MBS frame, and 'Next MBS frame offset' indicates an offset of the next MBS frame. 'Next MBS OFDMA symbol offset' indicates an offset of a downlink frame OFDMA symbol for receiving an MBS-MAP message transmitted through the next MBS frame. Next MBS MAP change indication='1' indicates that it includes 'Next MBS No. OFDMA symbols' indicating a size of an MBS-MAP message that will be transmitted through the next MBS frame, and 'Next MBS No. OFDMA subchannels'.

Moreover, after receiving the Next MBS frame offset and the Next MBS OFDMA symbol offset, the receiver can obtain MBS information without receiving the MBS_MAP_IE of the DL-MAP message. Further, after decoding the MBS_Data_Time_Diversity_IE, the receiver recognizes the possibility of receiving MBS data transmitted through MBS data burst fields allocated to an frame received more than two frames later from the MBS frame where the MBS_Data_Time_Diversity_IE is received.

In other words, for MBS_Burst_Frame_Offset='0', the receiver processes, or decodes MBS data transmitted through MBS data burst fields allocated to an frame received the two frames later, recognizing the possibility of receiving the MBS data transmitted through MBS data burst frames allocated to an frame following two frames. For MBS_Burst_Frame_Offset='1', the receiver processes,

or decodes, MBS data transmitted through MBS data burst fields allocated to an frame received the three frames later, recognizing the possibility of receiving the MBS data transmitted through MBS data burst frames allocated to an frame following three frames.

Similarly, for MBS_Burst_Frame_Offset='2' or '3', the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame received four or five frames later. As mentioned above, Table 6 shows an exemplary case where the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame corresponding to each MBS_Burst_Frame_Offset value, wherein the receiver receives the MBS data transmitted through MBS data burst fields allocated to an frame following two frames. However, it is also possible to extend the two frames to four frames, six frames, eight frames, and so on. The frame corresponding to the MBS_Burst_Frame_Offset value is a factor that varies according to the system situations or characteristics. The IEs not mentioned in Table 6 have been described in detail with reference to Table 5.

FIG. 5 is a flowchart illustrating an operation of a receiver in a communication system providing MBS according to the present invention.

Referring to FIG. 5, in step 501, a receiver receives a DL-MAP message transmitted from a transmitter through a DL-MAP message field allocated to an MBS frame. In step 503, if a DIUC value of the received DL-MAP message shown in Table 4, Table 5 and Table 6 is set to '0x0A', the receiver decodes an MBS_MAP_IE transmitted through an MBS_MAP_IE field included in the DL-MAP message. Thereafter, in step 505, the receiver acquires location information and decoding information of an MBS-MAP message from the received MBS_MAP_IE, and receives an MBS-MAP message transmitted from the transmitter through an MBS-MAP message field allocated to the MBS frame. A format of the received MBS-MAP message is shown in Table 2, Table 4.

Next, in step 507, the receiver decodes an MBS_Data_IE or an MBS_Data_Time_Diversity_IE that include information on MBS data burst fields in the MBS frame. That is, the receiver receives the MBS_Data_IE or the MBS_Data_Time_Diversity_IE transmitted through an MBS_Data_IE field

included in an MBS-MAP message field. A format of the MBS_Data_IE is shown in Table 6, and a format of the MBS_Data_Time_Diversity_IE is shown in Table 7.

Thereafter, in step 509, the receiver recognizes an expected reception time of MBS data transmitted through the MBS data burst fields allocated to the frame using MBS_Burst_Frame_Offset information included in the MBS_Data_IE or the MBS_Data_Time_Diversity_IE received in step 507. That is, the receiver recognizes the possibility of receiving the MBS data transmitted through MBS data burst fields allocated to an frame following MBS_Burst_Frame_Offset+2 frames, for example, an frame following two or three frames, and waits for the frame where the MBS data is transmitted through MBS data burst fields actually allocated to the corresponding frame.

In step 511, the receiver determines whether the MBS_Burst_Frame_Offset+2 frames have elapsed. If it is determined in step 511 that MBS_Burst_Frame_Offset+2 frames have elapsed, the receiver proceeds to step 513. In step 513, the receiver processes, or decodes, MBS data transmitted through MBS data burst fields actually allocated to an frame following the MBS_Burst_Frame_Offset+2 frames. However, if it is determined in step 511 that the MBS_Burst_Frame_Offset+2 frames have not elapsed, the receiver proceeds to step 515.

In step 515, the receiver processes an MBS-MAP message transmitted through the next MBS frame, or processes MBS data transmitted through MBS data burst fields of the previous frame, i.e., MBS data transmitted through MBS data burst fields allocated in the current frame corresponding to the information on the MBS data burst fields previously received before the current frame is transmitted. As a result, the receiver can perform an operation in the next MBS frame according to a Next MBS Frame offset included in the MBS_Data_IE or the MBS_Data_Time_Diversity_IE decoded in step 507. This corresponds to the case where a value of the MBS Burst Frame Offset+2 frames is greater than the Next MBS Frame offset.

Alternatively, in step 515, if MBS data burst fields where MBS data is

transmitted are allocated within MBS Burst Frame Offset+2 frames from the current MBS frame based on the MBS Burst Frame Offset provided from the MBS_Data_IE or the MBS_Data_Time_Diversity_IE included in the MBS-MAP message of the previous MBS frame, the receiver receives MBS data transmitted through the MBS data burst fields. As a result, the receiver receives MBS data transmitted through MBS data burst fields allocated to an frame following a predetermined frame using the MBS_Burst_Frame_Offset in the MBS_Data_IE and the MBS_Data_Time_Diversity_IE shown in Table 6 and Table 7.

FIG. 6 is a flowchart illustrating an operation of a transmitter in a communication system providing MBS according to the present invention.

Referring to FIG. 6, in step 601, a transmitter determines an MBS Burst Frame Offset value according to the MBS data to be transmitted to a receiver, in order to allocate the MBS data burst fields, in which the MBS data is transmitted, to an frame. Thereafter, in step 603, the transmitter generates an MBS_Data_IE or an MBS_Data_Time_Diversity_IE of an MBS-MAP message including the determined MBS Burst Frame Offset value as shown in Table 6 or Table 7.

In step 605, the transmitter transmits a DL-MAP message including location information of an MBS-MAP message with the generated MBS_Data_IE or MBS_Data_Time_Diversity_IE. Herein, the location information of the MBS-MAP message includes location information of an MBS-MAP message field and an MBS_Data_IE field included the MBS-MAP message field in the downlink MBS frame, and a plurality of MBS data burst fields. That is, in step 605, the transmitter transmits all information for the MBS data transmission/reception to the receiver so that the receiver may process, or decode, the MBS data that the transmitter itself provides to the receiver. Thereafter, in step 607, the transmitter transmits MBS data to the receiver through the corresponding MBS data burst fields in MBS Burst Frame Offset+2 frames according to the MBS_Data_IE or the MBS_Data_Time_Diversity_IE included in the MBS-MAP message.

As can be understood from the foregoing description, the present invention newly defines a service MAP message and a service data information element according to the service data to be transmitted to a receiver receiving

communication service in a communication system. This contributes to an increase in resource efficiency during the transmission of the service MAP message and a reduction in overhead due to the service MAP message. The receiver recognizes the frame where the service data is transmitted by receiving the newly defined service MAP message and service data information elements. As a result, the receiver can decode the service data without error. In addition, a transmitter transmits the newly defined service MAP message and service data information elements to the receiver, to inform the receiver of a decoding time of the service data, thereby enabling real-time service data processing between the transmitter and the receiver and thus reducing the required transmission/reception load.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method for transmitting data in a communication system, comprising the steps of:

generating transmission data to be transmitted to a receiver;

allocating the transmission data to a frame;

setting a MAP message that includes information on a frame offset related to the frame; and

transmitting to the receiver the MAP message.

2. The method of claim 1, wherein the frame offset indicates that the frame will be shown after a plurality of frames from the current frame comprising the frame offset.

3. The method of claim 2, wherein a number of the plurality of frames is equal to the sum of the frame offset and a predetermined number of frames.

4. The method of claim 1, wherein the MAP message includes information on a position of the transmission data within the frame.

5. The method of claim 4, wherein the information on the position includes information relating to a symbol offset within the frame.

6. The method of claim 4, wherein the information on the position includes information relating to a subchannel offset within the frame.

7. The method of claim 1, wherein the MAP message includes data time diversity information when the receiver supports a hybrid automatic repeat request scheme.

8. The method of claim 1, wherein the MAP message includes a MAP indicator of a number of bits indicating a MAP message, and the MAP indicator includes type information of a medium access control header, encryption field information, compressed MAP information, and sub downlink-uplink MAP information.

9. The method of claim 1, further comprising the step of:

buffering the allocated transmission data for a plurality of frames and transmitting the buffered transmission data within the frame to the receiver.

10. A method for receiving data in a communication system, comprising the steps of:

receiving a MAP message that includes information on a frame offset related to a data burst before receiving the data burst from a transmitter;

analyzing the information on the frame offset; and

receiving from the transmitter the data burst within the n-th frame flowing a frame comprising the MAP message according to the analysis of the information.

11. The method of claim 10, wherein the n is equal to the sum of the frame offset and a predetermined minimum frame offset.

12. The method of claim 10, wherein the MAP message includes information on a position of the data burst within the n-th frame.

13. The method of claim 12, wherein the information on the position includes information relating to a symbol offset of the data burst within the n-th frame.

14. The method of claim 12, wherein the information on the position includes information relating to a subchannel offset of the data burst within the n-th frame.

15. The method of claim 10, wherein the MAP message includes data time diversity information when the receiver supports a hybrid automatic repeat request scheme.

16. The method of claim 10, wherein the MAP message includes a MAP indicator of a number of bits indicating a MAP message, and the MAP indicator includes type information of a medium access control header, encryption

field information, compressed MAP information, and sub downlink-uplink MAP information.

17. A method for transmitting data in a communication system, comprising the steps of:

upon generation of data to be transmitted to a receiver, determining a transmission field of the generated data, and allocating the determined transmission field to a frame;

setting in transmission field information location information of the transmission field allocated to the frame and frame offset information defining an offset between the frame to which the transmission field is allocated and a reference frame; and

transmitting to the receiver a MAP message including the set transmission field information.

18. The method of claim 17, wherein the reference frame includes the MAP message.

19. The method of claim 17, wherein the offset between the frame to which the transmission field is allocated and the reference frame is equal to the sum of the frame offset information and a predetermined number of frames.

20. The method of claim 17, wherein the location information includes information on a position of the transmission data within the frame to which the transmission field is allocated.

21. The method of claim 20, wherein the information on the position includes information relating to a symbol offset and a subchannel offset within the frame.

22. The method of claim 17, wherein the MAP message includes data time diversity information when the receiver supports a hybrid automatic repeat request scheme.

23. The method of claim 17, further comprising the step of:

buffering the generated data for the offset and transmitting the buffered data within the frame to the receiver.

24. The method of claim 17, wherein the MAP message includes a MAP indicator of a number of bits indicating a MAP message, and the MAP indicator includes type information of a medium access control header, encryption field information, compressed MAP information, and sub downlink-uplink MAP information.

25. A method for receiving data in a communication system, comprising the steps of:

upon receiving a MAP message before receiving data from a transmitter, analyzing location information of a data burst included in the MAP message and frame offset information defining an offset between a frame to which the data burst is allocated and a current frame; and

receiving the data burst within the frame according to the analyzed location information and the frame offset information.

26. The method of claim 25, wherein the current frame includes the MAP message.

27. The method of claim 25, wherein the offset between the frame to which the data burst is allocated and the current frame is equal to the sum of the frame offset information and a predetermined number of frames.

28. The method of claim 25, wherein the location information includes symbol offset information and subchannel offset information of the data burst within the frame to which the data burst is allocated.

29. The method of claim 25, wherein the MAP message includes data time diversity information when the receiver supports a hybrid automatic repeat request scheme, and the data time diversity information includes the location information and the offset information.

30. The method of claim 25, wherein the MAP message includes a MAP indicator of a number of bits indicating a MAP message, and the MAP

indicator includes type information of a medium access control header, encryption field information, compressed MAP information, and sub downlink-uplink MAP information.

31. A method for transmitting data in a communication system, comprising the steps of:

upon generation of data to be transmitted to a receiver, determining a transmission field of the generated data;

determining offset of frame including the transmission field;

setting in data information offset information defining the offset of frame and location information of the transmission field according to the offset information; and

transmitting to the receiver a MAP message including the set data information.

32. The method of claim 31, wherein the offset information is used to inform the receiver that the data will be transmitted through a transmission field included to a frame following a number of frames from the frame including the MAP message.

33. The method of claim 31, wherein the location information includes symbol offset information and subchannel offset information which indicate start offset of the transmission field included to the frame.

34. The method of claim 31, wherein the MAP message includes data time diversity information when the receiver supports a hybrid automatic repeat request scheme, and the data time diversity information includes the information on the transmission field.

35. The method of claim 34, wherein the generated data is transmitted to the receiver through a transmission field for the frame according to the transmission field information.

36. The method of claim 31, wherein the MAP message includes a MAP indicator of a number of bits indicating a MAP message, and the MAP

indicator includes type information of a medium access control header, encryption field information, compressed MAP information, and sub downlink-uplink MAP information.

37. A method for transmitting multicast broadcast service (MBS) data of a base station (BS) in a broadband wireless access (BWA) communication system, the method comprising the steps of:

determining a frame offset of MBS data burst, a frame comprising the MBS data burst is the n-th frame following the current frame comprising the frame offset;

determining a position of the MBS data burst within the n-th frame;

setting information of the frame offset and the position in a message; and

transmitting the message to a mobile station.

38. The method of claim 37, wherein the 'n' is equal to the sum of the frame offset and a predetermined minimum frame offset value.

39. The method of claim 37, wherein the information of the frame offset and the position comprises information relating to a symbol offset within the n-th frame.

40. The method of claim 37, wherein the information of the frame offset and the position comprises information relating to a subchannel offset within the n-th frame.

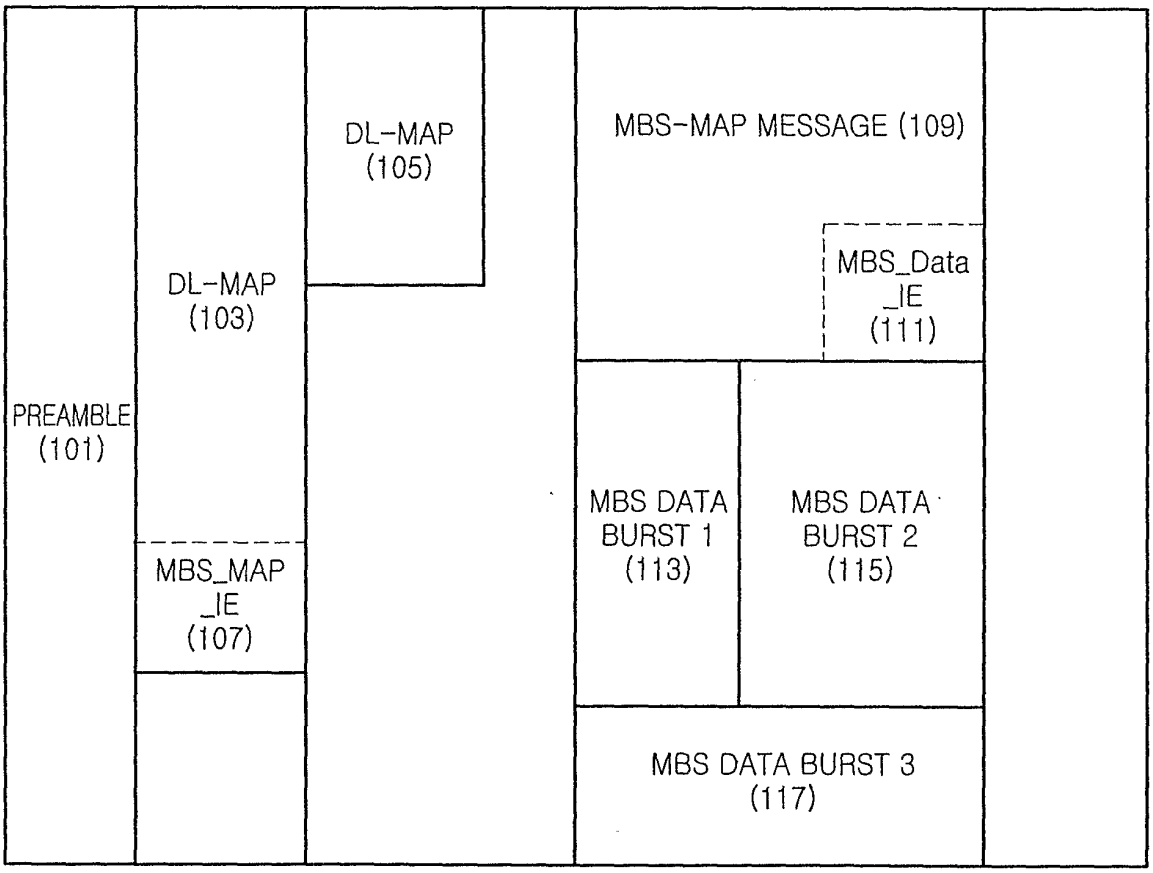

PREAMBLE
(101)
DL-MAP
(103)
MBS_MAP
_IE
(107)
DL-MAP
(105)
MBS-MAP MESSAGE (109)
MBS_Data
_IE
(111)
MBS DATA
BURST 1
(113)
MBS DATA
BURST 2
(115)
MBS DATA BURST 3
(117)

FIG.1

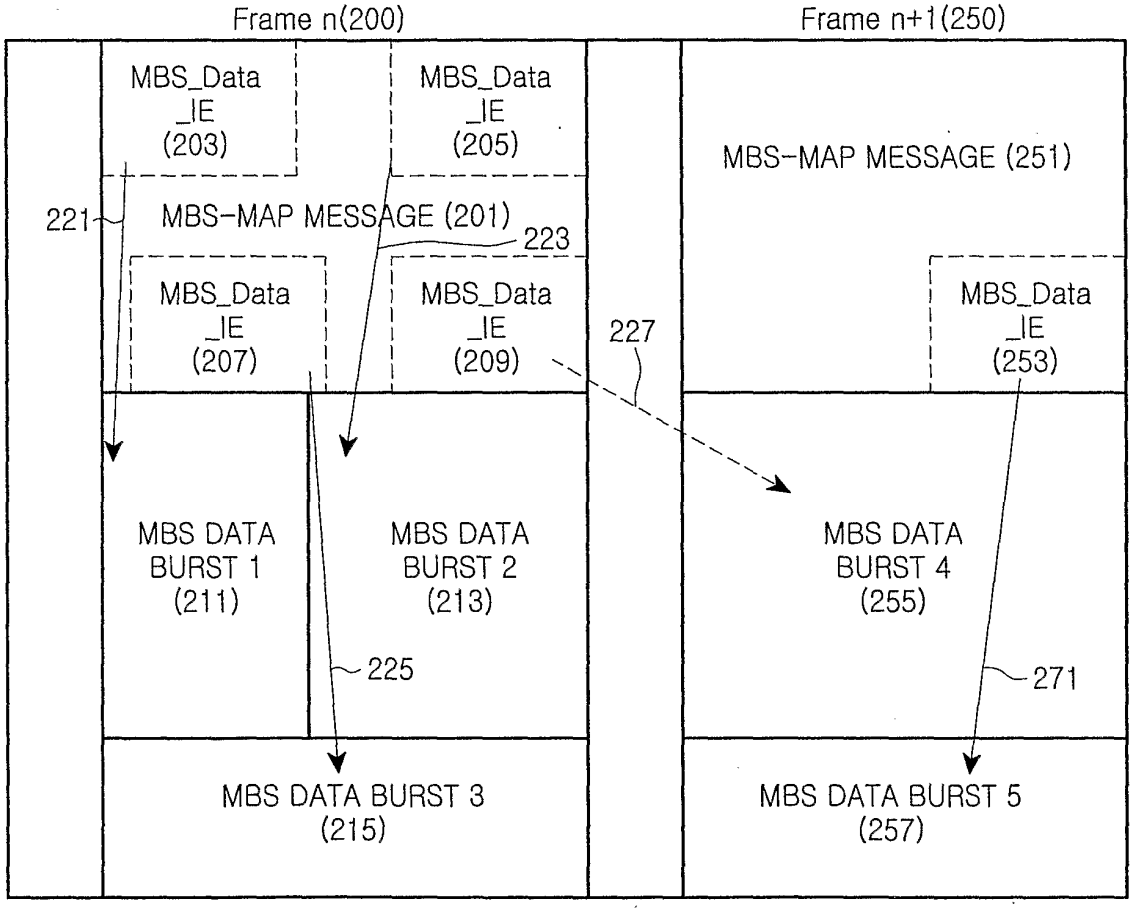

Frame n(200)
Frame n+1(250)
MBS_Data _IE (203)
MBS_Data _IE (205)
MBS-MAP MESSAGE (251)
221
MBS-MAP MESSAGE (201)
223
MBS_Data _IE (207)
MBS_Data _IE (209)
227
MBS_Data _IE (253)
MBS DATA BURST 1 (211)
MBS DATA BURST 2 (213)
MBS DATA BURST 4 (255)
225
271
MBS DATA BURST 3 (215)
MBS DATA BURST 5 (257)

FIG.2

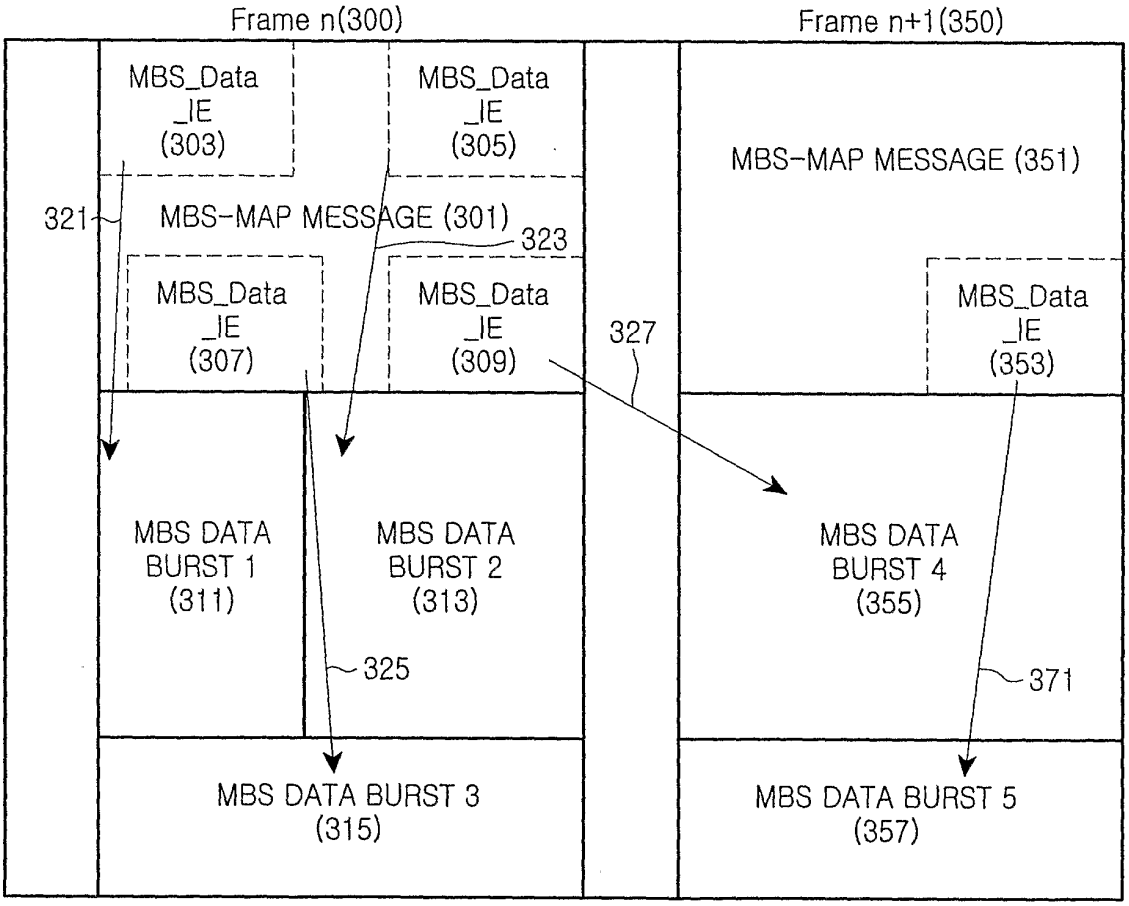

Frame n(300)
Frame n+1(350)
MBS_Data _IE (303)
MBS_Data _IE (305)
MBS-MAP MESSAGE (351)
321
MBS-MAP MESSAGE (301)
323
MBS_Data _IE (307)
MBS_Data _IE (309)
327
MBS_Data _IE (353)
MBS DATA BURST 1 (311)
MBS DATA BURST 2 (313)
MBS DATA BURST 4 (355)
325
371
MBS DATA BURST 3 (315)
MBS DATA BURST 5 (357)

FIG.3

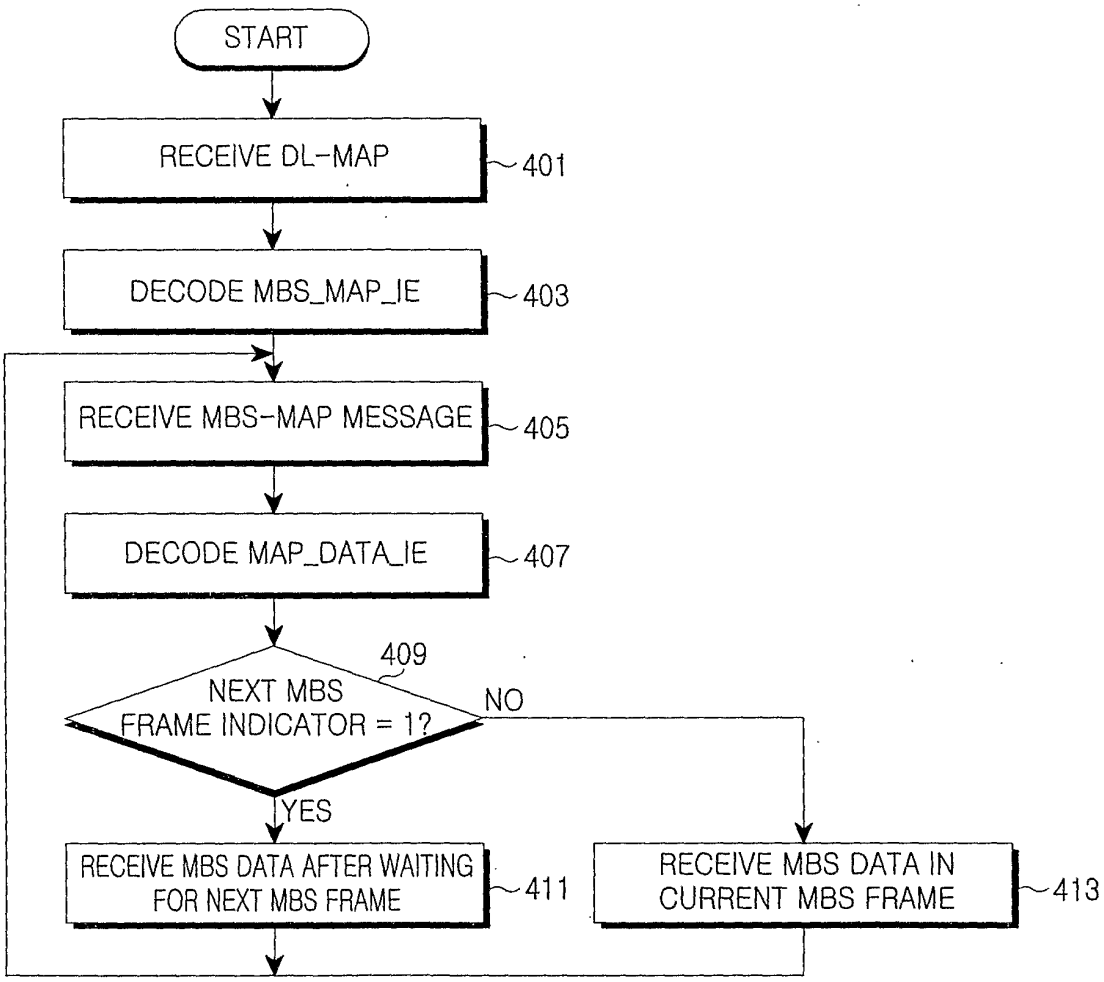

START
RECEIVE DL-MAP
401
DECODE MBS_MAP_IE
403
RECEIVE MBS-MAP MESSAGE
405
DECODE MAP_DATA_IE
407
409
NEXT MBS FRAME INDICATOR = 1?
NO
YES
RECEIVE MBS DATA AFTER WAITING FOR NEXT MBS FRAME
411
RECEIVE MBS DATA IN CURRENT MBS FRAME
413

FIG.4

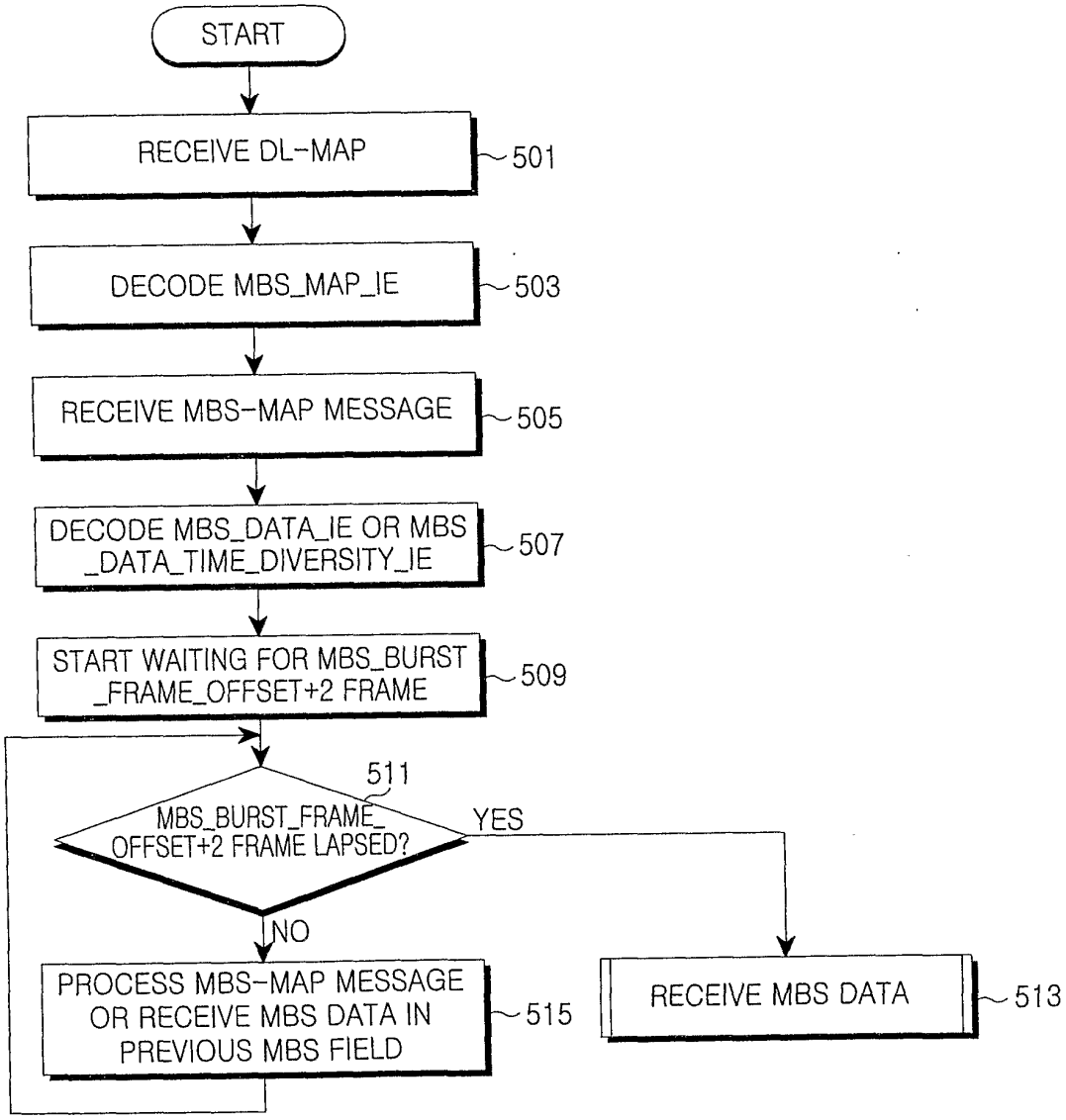

START
RECEIVE DL-MAP
501
DECODE MBS_MAP_IE
503
RECEIVE MBS-MAP MESSAGE
505
DECODE MBS_DATA_IE OR MBS _DATA_TIME_DIVERSITY_IE
507
START WAITING FOR MBS_BURST _FRAME_OFFSET+2 FRAME
509
511
MBS_BURST_FRAME_ OFFSET+2 FRAME LAPSED?
YES
NO
PROCESS MBS-MAP MESSAGE OR RECEIVE MBS DATA IN PREVIOUS MBS FIELD
515
RECEIVE MBS DATA
513

FIG.5

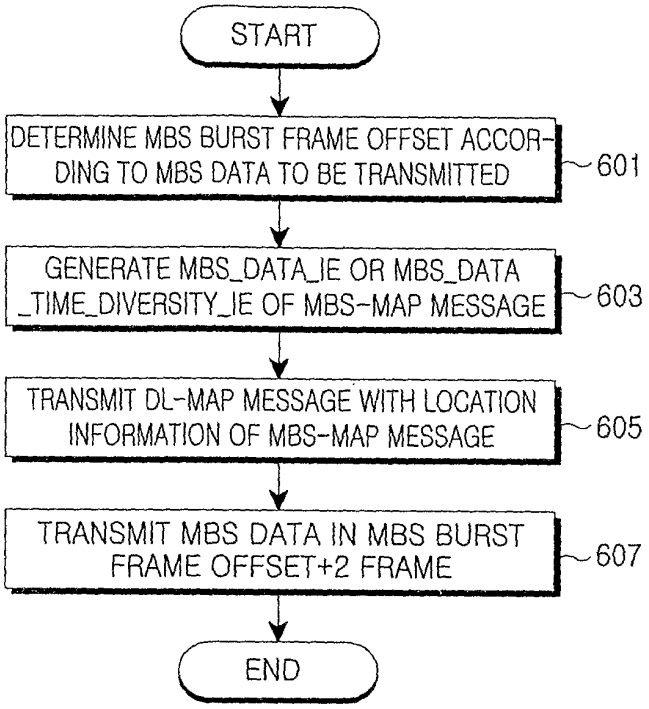

START
DETERMINE MBS BURST FRAME OFFSET ACCORDING TO MBS DATA TO BE TRANSMITTED
601
GENERATE MBS_DATA_IE OR MBS_DATA _TIME_DIVERSITY_IE OF MBS-MAP MESSAGE
603
TRANSMIT DL-MAP MESSAGE WITH LOCATION INFORMATION OF MBS-MAP MESSAGE
605
TRANSMIT MBS DATA IN MBS BURST FRAME OFFSET+2 FRAME
607
END

FIG.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/001557

A. CLASSIFICATION OF SUBJECT MATTER

H04H 1/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8: H04J H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KOREAN PATENTS AND APPLICATIONS FOR INVENTIONS SINCE 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
PAJ, FPD, USPAT, eKIPASS, IEEE "MULTICAST""MBS""MAP""NEXT""OFDM"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	IEEE C802/16e-05/111 (SAMSUNG ELECTRONICS) 09 MARCH 2005 see the whole document	1-40
Y	IEEE C802.16e-04/444r2 (SAMSUNG ELECTRONICS) 15 NOVEMBER 2004 see the whole document	1-40

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 JUNE 2006 (29.06.2006)	**29 JUNE 2006 (29.06.2006)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea
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CHEKAL Hyun
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(72) Inventor; and
(71) Applicant : **STEELE, Daniel, W.** [US/US]; 3 Sherwood Circle, Clay, NY 13041 (US).

(74) Agents: **NOCILLY, David, L.** et al.; Bond, Schoeneck & King, PLLC, One Lincoln Center, Syracuse, NY 13202 (US).

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Published:

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(54) **Title**: WIRELESS AUTOMATED VEHICLE ENERGIZING SYSTEM

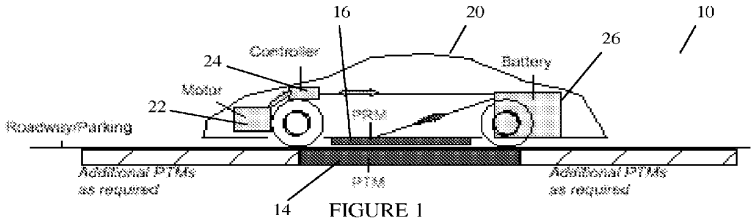


FIGURE 1

(57) **Abstract**: A wireless recharging system for battery or hybrid vehicles having an in-road magnetic power transmission assembly that interconnects to a magnetic power reception assembly onboard the vehicle. As the vehicle stops or passes over the in-road magnetic power transmission assembly, magnetic coupling transfers power to the magnetic power reception assembly which, in turn, is used to recharge the vehicle battery. The in-road magnetic power transmission assembly may be powered from the electrical grid or designated electrical generators and is preferably designed to build the powering magnetic field in response to the detection of an authorized vehicle in proximity to the transmission assembly.

WO 2012/116054 A2

TITLE

Wireless Automated Vehicle Energizing System

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a non-provisional of U.S. Provisional Application No. 61/463,717, filed on February 22, 2011 and U.S. Provisional No. 61/573,750, filed on September 12, 2011, both of which are hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0002] The present invention relates to electric and hybrid electric vehicles and, more particularly, a system and method for wirelessly charging vehicle batteries while stationary or in motion.

2. DESCRIPTION OF THE RELATED ART

[0003] The rapid development of a new electric vehicle fleet is being fueled by a "perfect storm" of pressures – to cut foreign oil consumption, reduce greenhouse gas pollution and revive USA based manufacturing. However a major impediment to the rapid growth of an electric vehicle fleet is the high cost, low reliability and performance limitations associated with vehicular energy storage - the battery. Other major components required to produce a low cost, high performance electric vehicle are currently ready for mass production - strong lightweight body, electric motor and associated electronic controller. Accordingly, there is a need in the art for utility-based power generation capacity that is capable of adapting to the electrical consumption posed by any reasonable growth in electrically powered transportation.

[0004] The U.S. Department of Energy is faced with the very difficult task of driving development that will transition the energy infrastructure of our nation from one primarily based upon early 20th century technologies to an infrastructure based upon early 21st century technologies. The key being that the required 21st century technology is only partially developed, with many missing pieces and not integrated. Transitioning the transportation sector to 21st century technology is one very important component that U.S. Department of Energy must address if it is to successfully drive this difficult transition.

[0005] Vehicle fleet electrification is a fundamental way for the U.S. Department of Energy to drive fuel efficient and low pollution electrical energy generation to ubiquitously change the present inefficient nature of fossil fuel consumption. The primary impediment to widespread adoption of electric bus, truck and automobile electrification is the disconnect between electric power generation and vehicle motors, currently bridged by battery

technology that is costly, easily damaged and performance limiting. The U.S. Department of Energy is of course one of the important drivers of battery technology improvement, however this appears to be a long term developmental process. The U.S. Department of Energy thus needs an adjunct that can enable both current and longer term battery technologies to seamlessly transition into all modes of land transport. The focus upon higher and higher battery energy storage density at proportionately lower cost, volume and weight still ignores the difficulties associated with peak charging energy demands that grow larger with each improvement.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention provides.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0007] The present invention will be more fully understood and appreciated by reading the following Detailed Description in conjunction with the accompanying drawings, in which:

[0008] Figure 1 is a schematic of the wireless energizing system according to the present invention;

[0009] Figure 2 is a schematic of an in-road embodiment of a wireless power transmission system according to the present invention;

[0010] Figure 3 is a schematic of an intersection provided with a wireless power transmission system according to the present invention;

[0011] Figure 4 is a schematic of a parking lot provided with a wireless power transmission system according to the present invention;

[0012] Figure 5 is a schematic of an in-home embodiment of a wireless power transmission system according to the present invention;

[0013] Figure 6 is a schematic of a grid power multiphase interface according to the present invention;

[0014] Figure 7 is a schematic of a grid power multiphase interface according to the present invention;

[0015] Figure 8 is a schematic of a grid power multiphase interface according to the present invention;

[0016] Figure 9 is a schematic of the coil electronics subassembly of a power transmission module according to the present invention;

[0017] Figure 10 is a graph of the power transmission module primary waveform according to the present invention;

[0018] Figure 11 is a schematic of the coil electronics subassembly of a power transmission module according to the present invention;

[0019] Figure 12 is a schematic of a roadway installation of a wireless power transmission system according to the present invention;

[0020] Figure 13 is a schematic of a power transmission cable according to the present invention;

[0021] Figure 14 is a schematic of a power transmission cable interface according to the present invention;

[0022] Figure 15 is a detailed schematic of a parking lot provided with a wireless power transmission system according to the present invention;

[0023] Figure 16 is a schematic of a roadway power transmission cable and magnetic interface according to the present invention;

[0024] Figure 17 is a schematic of a power transmission module truss support assembly according to the present invention;

[0025] Figure 18 is a schematic of a power transmission module assembly according to the present invention;

[0026] Figure 19 is a schematic of a power transmission module end cap according to the present invention;

[0027] Figure 20 is a schematic of the integrated tank and link coils of the coil electronics subassembly of a power transmission module according to the present invention;

[0028] Figure 21 is a schematic of tank coil of the coil electronics subassembly of a power transmission module according to the present invention;

[0029] Figure 22 is a schematic of the integrated tank capacitor of the coil electronics subassembly of a power transmission module according to the present invention;

[0030] Figure 23 is a schematic of the design of the tank capacitor of the coil electronics subassembly of a power transmission module according to the present invention;

[0031] Figure 24A is an electrical diagram of the circuitry of the power transmission module power amplifier according to the present invention;

[0032] Figure 24B is a schematic of the power amplifier output current sampling of a power transmission module according to the present invention;

[0033] Figure 25 is a schematic of the laminate construction of the coil electronics subassembly of a power transmission module according to the present invention;

[0034] Figure 26 is a schematic of the heat sink via designs of the coil electronics subassembly of a power transmission module according to the present invention;

[0035] Figure 27 is a schematic of the magnetic fields produced by a power transmission module according to the present invention'

[0036] Figure 28 is a schematic of the selective energization of power transmission modules in a roadway according to the present invention;

[0037] Figure 29 is an electrical schematic of an embodiment of the H-bridge power amplifier according to the present invention;

[0038] Figure 30 is a schematic of a power receive module according to the present invention;

[0039] Figure 31 is flowchart of the logic of a power transmit module according to the present invention;

[0040] Figure 32 is a schematic of the vehicle interfaces of a power transmit module according to the present invention;

[0041] Figure 33 is a schematic of an integrated power receive module coil assembly according to the present invention;

[0042] Figure 34 is a schematic of a dual mode embodiment of the wireless power transmission system according to the present invention;

[0043] Figure 35 is a schematic of an intersection provided with a wireless power transmission system according to the present invention;

[0044] Figure 36 is a schematic of a steering correct display according to the present invention;

[0045] Figure 37 is a schematic of a power receive module configuration for use with a steering correct display according to the present invention;

[0046] Figure 38 is an electrical schematic of an example of a power transmit module according to the present invention;

[0047] Figure 39 is an electrical schematic of an example of the electronic subassemblies of a power transmit module according to the present invention;

[0048] Figure 40 is an electrical schematic of an H-bridge amplifier of an example of a power transmit module according to the present invention;

[0049] Figure 41 is an electrical schematic of a tank coil of an example of a power transmit module according to the present invention;

[0050] Figure 42 is a schematic of a power amplifier tank cap of an example of a power transmit module according to the present invention;

[0051] Figure 43 is a schematic of a pickup coil of an example of a power transmit module according to the present invention;

[0052] Figure 44 is a schematic of a pickup coil resonating cap of an example of a power transmit module according to the present invention;

[0053] Figure 45 is an electrical schematic of the carrier logic and power amplifier gate drive electronics for an example of a power transmit module according to the present invention;

[0054] Figure 46 is a schematic of the gate drive and coil polarity relationships for an example of a power transmit module according to the present invention;

[0055] Figure 47 is a schematic of the variable frequency oscillator subassembly of an example of a power transmit module according to the present invention;

[0056] Figure 48 is a schematic of the chassis layout for an example of a power transmit module according to the present invention;

[0057] Figure 49 is a schematic of the load bank layout for an example of a power receive module according to the present invention;

[0058] Figure 50 is a schematic of the foil and conductive surfaces for an example of a power transmit module according to the present invention;

[0059] Figure 51 is a schematic of the electronics of an example power receive module according to the present invention; and

[0060] Figure 52 is a schematic of a strapping system for present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0061] Referring now to the drawings, wherein like reference numerals refer to like parts throughout, the present invention comprises a wireless automated vehicle energizing system, referred to hereinafter as WAVES. WAVES complements the current development of an electric vehicle fleet and provides a primary means for achieving national “energy security” for U.S. vehicular transportation. The present invention presents a clear path towards the near-and long term elimination of battery technology limitations regarding range, charging time and associated lifetime cost and real-time performance trades. The present invention also provides the U.S. with a way to leapfrog over potentially severe investments in conventional mass transit, by providing similar gains in efficiency and carbon reductions as it complements our currently flexible roadway transportation based infrastructure. WAVES can be a very large factor towards achieving U.S. international commitments regarding greenhouse gas reductions.

[0062] In general, the present invention provides a wireless means of charging "all electric" and "hybrid electric" vehicle batteries and is applicable to stationary and moving vehicles (in parking spaces and within the roadway). The present invention is also scalable

for both new production vehicles and as an add-on to existing vehicles. Intra-city use is an initial target, with inter-city and inter-state follow-on. Consistent with the needs of both private and public transportation vehicles, the present invention also includes a fee-based system whereby charges are automatically levied in proportion to energy use.

[0063] Figure 1 depicts a means for seamlessly charging batteries of all-electric or plug-in hybrid electric vehicles under a variety of conditions, both statically while a vehicle is parked or otherwise stationary and dynamically while a vehicle is in motion, using WAVES 10. A distributed network 12 of parking/road imbedded Power Transmit Modules (PTMs) 14 are connected to a power grid 18 for primary power and wirelessly linked to a Power Receiver Modules (PRMs) 16 located in a vehicle 20 that is within proximity to PTM 14 for magnetic power transfer. Vehicle 20 generally comprises an electric motor 22, controller 24, and battery supply 26. Vehicle mounted PRMs 16 are interconnected to battery 26 to recharge battery 26 while vehicle 20 is stationary or in motion via magnetic coupling with PTMs 14.

[0064] The charging operation is automatic when enabled by the driver of vehicle 20, employing a wireless data communication links between PRMs 16 and each/any PTM 14 supplying power. PTMs 14 are in turn LAN (Local Area Network) and subsequently internet connected for energy billing. The intent of the static infrastructure of WAVES 10 is to provide energy "hot spots" whereby WAVES equipped vehicles can partially or completely recharge using individual parking area located PTMs 14. Dynamic charging is accomplished by the concatenation of additional PTMs as necessary to provide continuous wireless charging.

[0065] When dynamically charging, vehicle 20 is both recharged and energized on a continuous basis while in transit, providing a power transfer capability greater than that required by electric motor 22. The result being that subsequent to a long range trip, requiring perhaps many times the energy nominally available from battery 26, vehicle 20 leaves the highway with a battery in a high state of charge.

[0066] In either stationary or mobile mode, the driver can be automatically charged for energy use (and tolls as they may apply), such as in a manner directly analogous to the current EZ Pass system where a credit card account is periodically charged for usage fees.

[0067] It should be recognized by those of skill in the art that safety standards must be adopted for the effective implementation of WAVES 10 so that the various components of the present invention, including PTMs 14, PRMs 16, and associated grid power and internet interfaces, are designed for safe operation, meeting transportation, fire, electrical and

magnetic field standards. For example, the Department of Transportation and National Traffic Safety Administration are pivotal sources of safety and compatibility standards that all U.S. based WAVES components must meet to insure roadway safety. Regarding magnetic field health standards, the present invention is designed to meet IEEE P1140 (a VDT standard) in the VLF band from 2 KHz to 400 KHz, with magnetic field strengths within the passenger compartment below 0.25 mG. Regarding electric field intensity health standards, WAVES meets IEEE P1140 with VLF band field strengths within the passenger compartment less than 2.5 Volts/Meter.

[0068] In a preferred embodiment, WAVES magnetic coupling fields alternate at a frequency at the upper portion of the VLF band. PTM 14 magnetic fields emanate through a Faraday shielded assembly with electrical fields of the power amplifier waveform and its harmonics attenuated to meet FCC radiated emissions limits. It is intended that all WAVES modules are U. L. approved as a first insurance of electrical safety. This implies that the design has been verified to prevent catastrophic fire and shock exposure under normal, worst case and failed modes of operation. Conservatively rated components, temperature control, rigorous power fusing, automatic shutdowns and fault detection and location are important design attributes in meeting overall electrical safety and reliability.

[0069] Reliable wireless data interlocking between PTM 14 and PRM 16 modules prevents power generation until a vehicle PRM 16 is in the immediate proximity of a given PTM 14. When immediate proximity is achieved, efficient power transfer is possible given that the vehicle has established a valid ID via two independent communications paths, i.e., a first proximity link 28 between the PRM 16 and PTM 14 and an internet or data link 30, as well as an additional and independent real-time check on vehicle presence via a valid second proximity link 32.

[0070] The inherently rapid attenuation of magnetic fields at distances beyond the 3 inch nominal roadway clearance between PTM 14 and PRM 16 means that the magnetic field strength is normally very weak at the floor level of vehicle 20. Free space magnetic attenuation can be expressed as proportional to $1/(\text{distance ratio})^3$. Additionally, if the floor of vehicle 20 contains a suitably magnetically permeable material, such as iron or ferrite, this already weak magnetic field will be significantly further weakened by being shunted away from the passenger compartment. Furthermore, when PRM 16 is effectively coupling power from PTM 14, the majority of the magnetic field is shunted through the vehicle's PRM 16 with a significantly weakened field left to propagate across the remaining distance to the floor of the vehicle 20 (again at an attenuation factor equal to $1/(\text{distance ratio})^3$). If desired, in-

vehicle magnetic field sensing can be employed to alarm and otherwise inhibit a valid ID from being sent via the first proximity link, thus disabling PTM 14 power generation such as in cases of an accident.

[0071] Power transfer can only be enabled by the condition of two valid ID requests, one in relatively non-real-time via the Wi-Fi (radio) Data Link 30 and the other in real-time via the first proximity link (magnetic) 28. Note that first proximity link 28 operates through the same PTM coil 42 of PTM 14 utilized for magnetic power transfer to insure correlation with the power transfer footprint. The second proximity link 32 verification is an additional condition that must be met for power transfer. It operates independently from both the first proximity link 28 and the Internet access link 30 by utilizing a radio sensing subsystem. This 3-way enabling function in combination with Exciter Control criteria insure that no magnetic radiation occurs from any Power Transmit Module - Coil Electronics Subassembly (PTM-CES) 34 whenever there is not a PRM 16 directly above (or within adequate coupling range) of a PTM-CES 34. The requirement that all three conditions be met makes certain that there will be a valid vehicle PRM 16 ready to absorb energy and the presence of highly attenuated magnetic fringe fields due to the large range, vehicle PRM 16 absorption and chassis between PTM fields and vehicle passengers.

[0072] From the broader standpoint of traffic safety, WAVES 10 provides a basis for real-time comprehensive traffic density and speed data that are vital to an efficient traffic management system. This can include active feedback to individual vehicles or to traffic signals as well as to law enforcement.

[0073] WAVES Energy Requirements

[0074] The energy required by electric vehicles 20 traveling on a highway is dependent upon many factors including size, weight, speed, acceleration demands. At city traffic speeds below 50 mph the energy requirements are dominated by mass acceleration and tire/rolling losses. The average of these energy requirements, with dynamic braking significantly normalizing acceleration demands is, on average, less than the energy required at constant upper-end highway speeds. Therefore, WAVES 10 energy requirements are set by the more demanding high speed conditions. At approximately 40 to 50 MPH wind losses begin to dominate vehicle energy demands and wind losses increase disproportionately with increases in speed. Maximum highway speed as defined for WAVES 10 energy transfer purposes is set at 70 MPH, which is at or above most maximum legal speed limits within the continental US.

[0075] Electric vehicle miles per gallon equivalent is often expressed in electrical energy per mile or kilowatt hours per mile. The continuous required power for a vehicle 20 is then kilowatt hours per mile divided by hours per mile or "watts". This continuous power requirement can be distributed equally across the number of coils within the vehicle's PRM 16 since its design efficiently combines individual coil powers to produce a single source of DC for vehicle battery 26 charging and motor energizing power. The vehicle PRM 16 insures that all of its pickup coils are energized (continuously) by sequentially enabling magnetic coupling from respective roadway PTM 14 transmitting coils as they pass under the PRM 16 pickup coils. It is then the net continuous power per PRM 16 coil that is at the core of the roadway electrical design requirement. The energy requirements for various scenarios may be seen in Table 1 below:

Table 1

Medium Sized Car	50 mph	60 mph	70 mph
Kilowatt hours / mile	0.2	0.25	0.433
Continuous Power - kilowatts	10	15	26
Total energy for 20 miles - kilowatt hours	4	5	8.66
Continuous Power Kilowatts per PRM Coil (coil PRM)	0.71	1.07	1.86
PHEV Bus or Truck	50 mph	60 mph	70 mph
Kilowatt hours / mile	0.8	1	1.73
Continuous Power - kilowatts	40	50	86.6
Total energy for 20 miles - kilowatt hours	16	20	34.64
Continuous Power Kilowatts per PRM Coil (42 coil PRM)	0.95	1.19	2.06

[0076] It should be emphasized that WAVES 10 provides significant utility in offsetting the normally high 26 to 86 kilowatt rates of discharge from vehicle batteries 20 during normal operation. Repeated high discharge rates can be especially problematic, leading to lack of capacity and early failure, as batteries age and as battery temperatures are lowered during winter. By continuously offsetting the need for long periods of high rates of discharge, WAVES 10 provides the ability to dramatically extend battery life as well as range. From the above chart it can be understood that the maximum continuous power per

PRM 16 coil, a core requirement, is 2 kilowatts. This is for practical purposes identical to the peak PTM-CES 34 magnetic field power requirement. Average PTM-CES 34 magnetic field power is less, dependent upon the traffic density induced energization duty cycle.

[0077] WAVES Roadway and Parking Lot Installation

[0078] Roadway 36 installations for the present invention may range from entire highway systems such as interstates to all or portions of local or intrastate highways to parking lots. Smaller scale installations can include segments of highways such as at traffic signals, waiting lines and other cueing areas where traffic densities are high and vehicle dwell times are sufficient to allow significant, although transient, battery charging intervals.

[0079] In the overwhelming majority of installations, roadways and parking areas already exist. Therefore an emphasis is placed upon existing roadway installations in a way that makes such installations cost-effective and as minimally intrusive as possible. This implies a set of national standards, an automated means of implanting PTM 14 modules and reasonable access to grid 18 and internet connection points. New roadway installations can however engineer required interfaces in a rigorous manner, thus avoiding retrofits and other perhaps more indirect methods to accomplish interconnectivity.

[0080] In either existing or new cases, subsequent to a WAVES 10 installation, the roadway 36 must provide a seamless transition across PTMs 14, with no effects upon drivability and safety. This implies that PTMs 14 have an ability to support worst case traffic loads, present a skid-free surface and be resistant to sun, oil, fuel, water, ice, salt, sand and temperature extremes. During roadway 36 installation, PTMs 14 are preferably imbedded within a V-shaped channel 38 cut along the centerline of each driving lane to form a PTM lane 40. The walls of roadway channel 38 are lined with salt resistant concrete, coated with asphalt or tar. The corresponding V-shaped bottom of PTM 14 is designed to fully seat into the roadway channel 38, continuously sealed along both side-walls, with the top surface of the PTM 14 matching the level of the roadway 36. Vertical traffic loads are thus translated to forces perpendicular to the side-walls of the V-Channel as downward pressure is exerted upon PTM 14, thus securing it within the roadway channel. This triangular implementation provides a robust installation, given that the trussed triangular cross section throughout the length of each PTM 14 translates load forces with minimal deflection.

[0081] As seen in Figure 2, a typical WAVES 10 system for roadway 36 is composed of continuous chains of PTMs 14 forming PTM lanes 40, with each PTM 14 containing many individual PTM coils and their associated PTM-CES units 34. PTM-CES units 34 provide the alternating magnetic fields that are the source of power coupled to vehicle mounted PRMs

16 as well as providing control and critical communications links. PTMs 14 thus create PTM Lanes 40 that are centered within vehicle driving lanes. A multi-phase primary power line 44 is routed within each PTM Lane 40, powering in parallel all PTMs 14 within a given PTM Lane 40. PTM Lanes 40 may in turn be paralleled for a given roadway to form segments 46 of WAVES 10. The boundary of each WAVES segment 46 becomes a potential grid interface point, implemented by grid power converters that bridge between the grid 18 and roadway segment 46. Due to the multi-phase nature of PTM 14 primary power interface provided by grid power converters, they are referred to as Grid Multi Phase Interfaces (GPMIs) 48.

[0082] The number of highway lanes and/or highway traffic density and type will determine the segmentation distance and the corresponding number of GPMIs 48 present. Combined Heat and Power (CHP) units 50 may be employed at GPMIs 48 to provide power backup to grid 18, peak power shaving for grid 18 during periods of intense overall usage (e.g. during rush hours and at noontime), or on grid 18 continuously, given favorable net metering contracting with the utility. It is not necessary to provide CHP 50 capability at each GPMI 48 to provide a significantly large margin of robustness to WAVES 10.

[0083] As seen in Figure 3, power transfer at intersections 52 is a critical first step in the process of establishing a WAVES 10 roadway infrastructure. Given priorities of traffic density and grid interface proximity, such installations provide a relatively low cost and compact roadway installation format with a significant return on investment. The approach is to install PTMs 14 that fully "energize" the normal lane lengths associated with cueing and acceleration through and surrounding intersection 52. This arrangement allows stationary electric vehicles 20 to receive maximum battery charging while waiting for an intersection light to change, and full charging energy plus acceleration energy transfer when vehicles 20 leave intersection 52. The energy demands of accelerating vehicles 20 represent a significantly disproportionate battery energy drain that can be nearly eliminated via a WAVES 10 energized intersection 52. Furthermore, electric vehicles 20 that are simply passing through intersection 52 on a green light also benefit by a relatively short period of full charge rate and full electromotive energization. Since the cruising energy demands for EVs are modest at urban speeds, a network of such WAVES intersections 52 within a city environment can nearly fully provide the energy needs traffic without having to electrify gaps between intersections 52 such as would be the case in a full WAVES roadway 36 installation.

[0084] Parking lots 54 can be served by single or multiple GPMIs 48. The power demands of vehicles 20 associated with parking lots 54 can be on the same order as the per

vehicle power demands of a highway, since battery charging alone can readily be in the kilowatt level. CHP units 50 may also be employed at parking lot systems, as seen in Figure 5, for the same reasons as for highway installations. Additional loads such as from vehicle air conditioning or heating could also be significant power additions. As seen in Figure 4, there is flexibility in PTM 14 and GPMI 48 configurations for parking lots 54.

[0085] As noted within Table 2 below, parking lot individual car charging rates are conservatively limited to 15 KW while larger vehicles 20 are limited to 45 KW such that the continuous per PTM coil power is limited to approximately half of a coil's peak power rating. Note also that a 1 to 10 ratio of Plug-in Hybrid Electric Vehicle (PHEV) or all electric (EV) trucks & buses to cars has been maintained for the purpose of this analysis.

[0086] Given approximately a 70%-30% split between battery charging power and auxiliary power (e.g. air conditioning and heating) there remains significant power to provide upwards of 10 KW or 10 KWh/hour of battery energy recovery. This would be sufficient for approximately 20 miles of travel in a car traveling at 70 mph, or correspondingly, 160 miles of travel for an 8 hour work day charge. The ratio of battery charging to auxiliary power for trucks and buses may be different depending upon refrigeration and other demands.

Table 2

Parking Medium Sized Car	100 Spaces	200 Spaces	400 Spaces
Per Vehicle Charging + Aux. Power - kilowatts	15	15	15
Continuous Total Power - kilowatts	1500	3000	6000
Total energy for 8 hours - kilowatt hours	12000	24000	48000
Continuous Power - kilowatts per PRM Coil (14 coil PRM)	1.07	1.07	1.07
Parking PHEV or EV Bus/Truck	10 Spaces	20 Spaces	40 Spaces
Per Vehicle Charging + Aux. Power - kilowatts	45	45	45
Continuous Total Power - kilowatts	450	900	1800
Total energy for 8 hours - kilowatt hours	3600	7200	14400
Continuous Power - kilowatts per PRM Coil (42 coil PRM)	1.07	1.07	1.07

[0087] It is useful to consider the case of retrofitting an average interstate highway system such as the New York State Thruway (I-90) as an example of the implementation of a WAVES 10 according to the present invention. The typical peak vehicle density for this particular highway under normal driving conditions is approximately 160 vehicles 20 per mile across a total of 4 lanes, 2 lanes running in each direction. With an average traffic mix of 90% cars and 10% buses or trucks traveling at 70 mph it is estimated that the instantaneous peak power demands of a one mile interval would be 5 megawatts. This 5 megawatt primary power demand is satisfied by a single power converter station or GPMI 48 that is grid interconnected at its input side and outputs multiphase power as primary power input to connected PTMs 14. Thus, a 6 phase GPMI 48 would produce 6 PTM primary power lines at 5 MW / 4 Lanes / 6 phases for approximately 200 KW per lane phase, as seen in Table 3 below:

Table 3

Vehicle Traffic @ 70 MPH 90% Cars 10% Trucks and Buses	Light	Medium	Heavy
Vehicles / mile (4 Lanes)	40	80	160
Avrg Vehicle Spacing within Lane - Feet	528	264	132
Average PTM-CES Duty Cycle - %	10.18	20.36	40.73
Kilowatt Hours per Mile	22.508	45.016	90.032
Continuous Power - Kilowatts	1280	2560	5120
Lane Power per Phase - Kilowatts	53.33	106.67	213.33
Current per Phase @ 4KV - Amperes	13.33	26.67	53.33
DC Ohmic Loss of #10 Gauge Wire per Mile - %	0.88	1.77	3.53

[0088] Four kilovolts (4 kVAC) has been chosen as the PTM primary power distribution voltage as a reasonable compromise between the need for low (I^2)*R losses and requirements for high voltage safety and reliability. At 4 kilovolt per phase, the maximum current drawn by each lane phase would be 50 amperes which is sufficiently low to ensure low losses with modest gauge conductors. Note that the #10 gauge conductor reference in Table 3 is an "equivalent" reference and will be made up of individually insulated metal foils with sufficient area to achieve bulk resistance and skin effect losses equal to the DC resistance associated with a #10 gauge solid round copper conductor. Skin effect begins to be

a significant loss factor for power transmission frequencies that are within the VLF band as detailed in Table 4 below.

Table 4

Aluminum Foil	Estimated Resistivity Incr.	Resistivity Increase	Combined Area	#10 gauge Area	Area required	Al Foil Width @1 skin depth thick
1 skin depth thick	due to skin effect	Ratio to Cu	increase factor	(inch^2)	for Al Foil eqv	t@ 60 kHz eqv DC Resistivity to #10 gauge Cu
0.0106	1.2	1.64	1.968	0.00817	0.01607856	1.51684528301887

[0089] A GPMI 48, spaced nominally at an interval of 1 mile along a highway, such as I-90, forms a 4 lane PTM segment 46. In cases where peak power demands of a particular segment might exceed the capability of a given GPMI 48, the connectivity between GPMIs 48 along the multi-phase PTM primary supply lines provides a means for borrowing energy from adjacent segments when available. The multiphase wiring of the PTM primary supply line provides an additional degree of redundancy since individual phase failures gracefully degrade the power transmission capability of any affected PTMs 14.

[0090] From a backup power perspective, natural gas/fossil fueled micro-turbine electrical power generation may be used and spaced strategically, at perhaps 20 mile intervals, in conjunction with a GPMI 48 located perhaps at service/rest stop areas. For example, a micro turbine generator capable of 1 MW available from Capstone Turbine Corporation of Chatsworth, California can be readily grid inter-tied to produce efficient (28% natural gas to electrical efficiency) and continuous grid power in parallel with an operating grid or as the case may be, emergency backup power for both a roadway segment and an associated service area. A 1 MW micro-turbine generator can also be configured as CHP unit 50, supplying the heating and air conditioning loads of the service area itself. A quantity of six such CHP units 50 can continuously provide 6 MW of electrical power (grid tied or backup) while also producing 100 million BTU per hour (@580 deg. F) of thermal energy. Given the availability of natural gas or another suitable fuel, such CHP units 50 can pay for themselves during normal operating periods, while insuring the availability of vehicle charging power under grid failure conditions. During grid outages the availability of backup lane segments spaced every 20 miles gives vehicles 20 an opportunity to acquire a full charge at an associated rest stop parking area or, if sufficient energy exists within the vehicle's

battery 26, continue on with the original journey with some assurance of periodic future boosts in charge.

[0091] From a renewable energy perspective, photo-voltaic (PV) powered grid inter-tied inverters, co-located along the highway, may be used to mitigate greenhouse gas generation as well as shave some of the peak grid loads during daytime periods. Shaving one half, or 2.5 MW of the GPMI's worst case vehicle traffic load, using PV power generation, would require an array (@ 20% efficiency) that is 1 mile long by 20 feet high (the entire segment length). This is not a totally unreasonable requirement for many areas along a typical interstate highway system and could readily pay for itself in energy savings alone over a 20 year period.

[0092] WAVES Household Installation

[0093] Referring to Figure 5, household WAVES installations 56 differ from roadway and parking lot installations by the need for lower cost and a more simplified PTM 14 installation. PTM 14 for household garage or driveway may be constructed as a raised mat-like assembly 58 that can be simply laid down upon a flat surface, over which the vehicle's PRM 16 is centered. The raised midsection houses a row of PTM-CES units 34 in a sealed, waterproof housing 60.

[0094] Transmitting coils are located at the top-most portion of the rib-like midsection 62 of PTM 14 such that it reaches within 3" of the vehicle's PRM 16 (while retracted). Rib 62 has a triangular cross-section pointed upward forming an easily cleaned top surface that prevents debris or animals from resting thereon. PTM 14 is designed to interface directly to 220 VAC 60 Hz power mains, and is capable of continuous vehicle charging at a rate of 6.6 kW. The design of household installation 56 could be similar to the electrical design of the current 3 coil demonstration prototype described below, with additional power amplifiers & Tank Coils, as also described below.

[0095] WAVES Light Rail and Electric Transit Bus Installation

[0096] WAVES technology according to the present invention provides a means for supporting light rail and electric bus systems by minimizing electrical and control infrastructure while enhancing efficiency. The use of PTMs 14 embedded within trackways or bus lanes facilitates the use of electric motor drives fed wirelessly, without overhead wires, hot rails or associated moving mechanical contacts. Control system automation uses the existing PTM data link 30 allowing spacing and other vehicle data to be managed in a way to provide real-time feedback for collision avoidance, scheduling and integration with other roadway traffic. Positional, velocity and vehicle ID data is particularly effective in

maintaining safety in cases where light rail or bus traffic is interspersed with normal traffic. In such traffic, vehicles 20 of all types share a common PTM 14, however may have individual PRMs 16 optimized for particular applications. Batteries 26 on board light rail and bus vehicles 20 provide a means for storing braking energy and otherwise limit peak energy demands. Distributing PRMs 16, motors and energy storage within each "car" of a transit vehicle 20, inherently scales its ability to meet transport propulsion needs. In this way, long trains of many cars are possible with minimal added integration.

[0097] WAVES Return on Investment

[0098] It is important to consider how investments in WAVES infrastructure will be paid for, and the fairness doctrine that can be employed to insure long term acceptance. Grid energy has a cost that varies with the type and location of power sources which in turn can vary throughout the day and days of the week. The instantaneous cost of energy to the driver can and should be adjusted both to provide fair price to the grid but also as a way to provide adaptive choices that drivers can use to minimize their driving expenses while at the same time providing the power grid with greater capacity margins. Thus at peak driving times such as early morning, noontime and early evening, the cost per kilowatt-hour passed to the driver may be substantially greater than at other times of the day. The driver may in turn choose other commute times or avoid engagement the PRM during these times.

[0099] The cost of the grid supplied energy is however only one factor in determining the final cost per kilowatt-hour passed along to the driver. A toll can be assessed in addition, that reflects the long term investment infrastructure required to put WAVES in place on a given highway as well as shorter term maintenance costs.

[00100] A third factor added to the final cost per kilowatt hour is that of the peak power utilized by vehicle 20 such as to achieve optimum utilization of WAVES power supplying equipments. The objective of the peak power utilization surcharge is to reduce the probability of having to increase existing capacity or of over-stressing existing power generation and distribution equipments. Such a surcharge can be dynamic in that the charge is traffic density based with a utilization cost assessed as a factor of the energy used at any one interval of time and associated with traffic density or instantaneous electrical load on the system. Thus, higher energy users such as trucks and busses end up with higher costs for the energy that they use during times and locations of intense overall energy use.

[00101] On-board vehicle computer controller 24 can be programmed to consider all of these cost factors in deciding what route to take or when to activate the vehicle's PRM 16, which of course would include the vehicle's battery and its state of charge.

[00102] Parking lot located WAVES 10 offer some additional billing considerations. Parking lots associated directly with businesses may wish to incentivize use based to attract customers. The cost of delivered energy could be made artificially lower to accomplish greater visitation and/or be based upon a customer's purchases or history. Other factors that may be additionally attractive or simply deemed parking services, is that of supplying energy for vehicle air conditioning or heating while the vehicle is left unattended. This promotes safety and comfort while at the same time reduces the amount of energy required to overcome the accumulated environmentally induced loads once the vehicle leaves the parking area. WAVES 10 provides opportunities to employers wishing to pass along perks or incentivize certain employee habits by providing smart parking lots.

[00103] And finally, it must be stated that as with highway GPMI grid power backup, CHP micro-turbine generation can be used at businesses local to parking lots. This grid parallel inter-tie form of connection not only provides emergency backup electrical power for both business and WAVES during grid failure events, but also increases the level of overall net efficiency of heating, cooling and electrical power to nearly 90% for CHP GPMI associated businesses and highway vehicles 20.

[00104] It is also viable to consider the addition of renewable energy sources as a way to reduce environmental impacts associated with fossil fueled power generation and shave daytime load peaks from the grid. Specifically, regarding the use of PV renewable sources, it can be noted that typical parking areas represent extremely large areas of real estate, capable of receiving PV arrays with minimal impacts upon vehicle 20 use. Thus such a large amount of renewable energy, in direct proximity to point of use represents an efficient power source while at the same time offering an additional source of revenue and payback.

[00105] WAVES Grid Power Interface

[00106] Referring to Figure 6, grid power 18 is interfaced nominally at mile lane intervals using high efficiency multi-phase solid state inverter units (GPMIs 48) that transform 60 Hz grid power to kV level high frequency multi-phase AC for PTMs 14. Normally a single GPMI 48 supports 4 lanes of PTMs 14 over a mile interval, providing up to 300 KW of high voltage & high frequency multiphase power to a nominal string of 5000 PTM-CES 34. GPMIs 48 also bridge fiber data to and from the internet for billing, status, control and other purposes. GPMIs 48 can be connected in parallel for added robustness and reliability within a given PTM interval or segment. This can be done at each GPMI by bussing one PTM string to the following one, simultaneous with each GPMI interface.

GPMIs have capabilities to disconnect from the power grid and from each other during failure conditions.

[00107] Normal grid power is in the form of high voltage and current 3 phase 60 Hz grid power to a set of lower voltage 480 VAC, 3-phase power, using 6 transformers 64 (or a single 3-phase transformer). A subsequent tie circuit 66 associated with each of the 480 VAC Phase Inverter 68 feeds allows for the decoupling of a given 60 Hz phase from the grid under failure or maintenance conditions, or the introduction of alternate sources of power. Such alternate sources can be an external CHP 50 whereby grid power 18 is supplanted entirely (grid failure mode) or simply "or-tied" for purposes of peak load sharing and net metering. Additionally, since the phase inverters 68 are insensitive to 60 Hz phase relationships (each having internal AC-DC rectification), there is the capability to simply bring in another source of 60 Hz power as a backup. The following set of 6 Phase Inverters 68 (A through F) are phase synchronized to produce properly phased relationships on their outputs that directly feed PTM 14 segments.

[00108] The design of the Phase Inverters 68 may be based on a "transformerless" IGBT approach. In a concatenated roadway segment implementation, each Phase Inverter 68 will be phase-locked to its respective incoming phase from the adjacent segment, thus allowing for a direct inter-tie between segments. This is not a firm requirement because segments can be operated independently; however, by inter-tying segments, power can be passed between segments or otherwise directly shared, thereby enhancing overall robustness of the roadway energizing system. Furthermore, such an inter-tie prevents an open transmission line effect which may require active termination (variable load via multi-phase AC to DC to grid (or other) inter-tie inverter(s)) to reduce reflections back through the segment.

[00109] Alternative GPMI 48 designs can be configured that do not employ transformers. This promotes reductions in GPMI 48 cost, weight and size. Figure 7 depicts a series of 6 half H-Bridges 70, one for each phase being generated. A common return is established by a split capacitor 72 on the 60 Hz primary feed. Figure 8 depicts a full H-Bridge configuration wherein separate returns are available from each phase bridge. In both configurations resulting high-frequency power carrier phases from each phase pass through respective output filters that reduce harmonics associated with the square-wave switched waveform. The full H-Bridge configuration is particularly attractive and fits nicely with proposed RTC magnetic connector based step-down transformers feeding PTM loads.

[00110] Power Transmit Module (PTM) Primary Power Distribution

[00111] Referring to Figure 9, high frequency multiphase (6 phase) PTM primary power is magnetically coupled to each PTM-CES 34 in a phase parallel configuration throughout a given energized roadway lane or parking area. Transformer/magnetic links for each phase at each PTM subassembly efficiently step down the multiphase 4 kVAC primary distribution voltages to the order of 400 VAC per phase at each PTM-CES 34. This same transformer mechanism provides a conductor-less connector for routing primary power to the input of each PTM-CES 34. The multiphase primary power frequency is preferably an exact division by 6 of the PTM carrier frequency to thus provide a rectified ripple waveform which is in exact synchronism with the switching waveform that generates the PTM coil magnetic power field. A way to guarantee such a relationship is to individually "phase lock" each PTM-CES 34 High Power Amplifier drive signal to the rectifier ripple frequency or incoming AC phase power waveform. In this way DC filtering requirements are significantly reduced by the matching coincidence between power amplifier peak power demands at each 1/2 cycle to the peak of the rectifier ripple/each of the rectifier conduction peaks. Subsequent DC filtering thus can be limited to that of the much higher frequency switching transients while at the same time the lack of significant mismatch between voltage and current demands maintains a unity power factor load on the 6 phase Primary Power. Unity power factor is particularly important in minimizing PTM primary power distribution losses associated with non-unity induced reactive currents. The multiphase nature of this power distribution also allows the AC transmission frequency to be lowered by a factor equal to the number of phases, thus reducing AC transmission losses including both dielectric and skin effect losses by using this lowered frequency. This intermediate 6 phase power remains significantly high to allow the manufacture of relatively small, efficient and low cost step down transformers within the RTC. Thus, the important factors leading to an efficient PTM lane based primary power distribution system that are addressed by the present invention are: KV level distribution voltages and associated PTM-CES local step-down transformation to reduce IR transmission loss; Sufficiently high phase frequencies to minimize step-down transformer size and loss but not too high (essentially providing a sweet spot in cost/performance); Multiphase rectification synchronous with magnetic field generation to achieve unity power factor with minimized filtering and conditioning electronics to prevent reactive current circulation; and Multiple phases to lower distribution frequency thus reducing AC skin effect, dielectric and radiated field losses.

[00112] Ripple in Full Wave Rectified Waveforms for Multiple Phases

[00113] Each phase of a multiple phase system is full wave rectified and the outputs combined to provide a DC power source. When all six rectified phases are combined the resulting DC waveform has a ripple as shown in the subsequent waveform of Figure 10. In high power applications it is especially difficult to effectively filter out such ripple.

[00114] Historically, all high power multiphase generation was achieved with rotating machinery. Under these conditions, mechanical constraints on coil winding and placement in the alternator forced generated phases to be uniformly spaced over 360 degrees. That is, the phase increment between adjacent phases was $2\ \pi/N_\varphi$ degrees, where N_φ is the number of phases. Thus a 3 phase system had 120 degrees between phases, a 4 phase system had 90 degrees between phases, etc.

[00115] With modern high-power solid state inverters, the interval between phases can have any desired value. This phase is no longer constrained as it was in the past with machinery based multiphase alternators. This flexibility is used within WAVES 10 to synchronize ripple peaks in the rectified dc output voltage with demands for maximum power transfer at the coil amplifier. This insures that maximum power transfer is achievable without energy storage or costly filtering requirements. In particular, in WAVES 10 it is desirable to have a phase increment equal half of what it would have been for rotating machinery. Table 5 below summarizes ripple peaks for electronic and rotating machinery generation, where N_φ = Number of Phases.

Table 5

Increment Between Adjacent Phases	Number of Ripple Peaks per Cycle of Power Input	
	Odd Number of Phases	Even Number of Phases
$2\ \pi/N_\varphi$	$2\ N_\varphi$	N_φ
π/N_φ	$2\ N_\varphi$	$2\ N_\varphi$

Thus, the number of ripple peaks per cycle is $2\ N_\varphi$ for all combinations of phase intervals and even or odd number of phases, except for the larger phase interval combined with an even number of phases (where it is reduced to N_φ).

[00116] Power Transmit Module (PTM) Magnetic Power Transmission Control

[00117] Vehicle mounted PRMs 16 contain a first proximity wireless link 28 that is used to enable power transmission at each roadway PTM 14 as PRM 16 passes over them. This power enabling signal is demodulated at each PTM 14 subassembly to reveal the vehicle's ID that is used in conjunction with a valid vehicle ID obtained from a fiber cable

based Data Link (routed internally within each PTM) to enable power transmission to vehicle 20.

[00118] The degree of power coupled to a given vehicle 20 is limited by the maximum power capability of each PTM 14, aggregated by the number of simultaneously enabled coils and their respective instantaneous magnetic coupling coefficient (as expressed between PTM 14 and PRM 16). Furthermore, due to the parallel resonant transformer primary formed at each PTM-CES Tank Coil 74, the power required by each coil driving amplifier within the associated PTN-CES 74 subassembly is directly equal (minus relatively minor losses) to the power coupled to the vehicle. The amount of energy (power x time) provided by each PTM 14 is thereby measured for each vehicle passage and reported over the internet for billing purposes, along with other status information that has been acquired both organic to PTM 14 and from wireless data link 30 derived data. It should be noted that PTM 14 segment power demands can be capped at a power limit, as for example during above normal traffic loading, by purposely inhibiting individual or groups of PTM-CES units.

[00119] There is seen in Figure 11 PTM-CES 34, including data links 28, 30, and 32, power control 76 and reporting 78 (note a Phase to Phase Input Power cable format is shown as an option, and other options include common ground and individual paired phases with respective grounds). PTM 14 coils "light up" in rapid sequence as a vehicle PRM 16 passes over, only to just as rapidly power down again after a given vehicle's passage, ready for the next vehicle. This forms "waves" of power transfer that travel with and under each vehicle.

[00120] A high bandwidth WiFi wireless Data Link 30 is maintained between vehicle PRM 16 and roadway PTMs 14 (providing 2-way internet access, using PTM 14 contained fiber optic cables) for purposes of supplying required vehicle validation, billing and Performance Monitoring and Fault Location (PMFL). Data Link 30 has sufficient additional capacity to provide vehicle occupants with direct access to the internet while en-route. The WiFi nature of Data Link 30 communications allows for continuous access while a vehicle is on a WAVES 10 equipped highway, even while crossing lanes or otherwise not in direct magnetic power coupling range of a PTM 14. It should be noted that all highway vehicles preferably need access to this wireless Data Link 30 , whether WAVES 10 equipped, fossil fueled or otherwise. Universal Data Link 30 connectivity enables features associated with traffic control, law enforcement and general communications to be available from to and from all vehicles 20 on the highway. Traffic safety, efficiency and related labor cost reductions strongly drive for the universal adoption of a generic WAVES wireless Data Link 30 standard.

[00121] Control signals are also sent via PTM 14 contained fiber optic cables to enable or disable individual or multiple PTM-CES 34 within a lane as may be required for maintenance or other purposes. Control and monitoring functions can be highly automated, centralized and remotely located from WAVES 10 equipped highways. Performance monitoring at each PTM-CES 34 is used to insure safe power generation under worst case loading and transmitted power levels as well as to report failures for future maintenance. PMFL includes thermal, over current and over voltage sensing to insure safe amplifier operating conditions at each PYM 14 coil subassembly.

[00122] Power Transmit Module (PTM) Spectrum

[00123] In a preferred embodiment of the present invention, PTM-CES 34 coils are nominally operating at 360 kHz. This is roughly in the middle of the U.S. FCC VLF sub-band from 305 kHz to 405 kHz allocated for the dual purpose of both Aeronautical Communications (radio beacons) and Aeronautical Mobile (communications). WAVES 10 will be treated by the FCC under radiated and conducted emissions regulations/standards similar to that of other electrical appliances, as in electric vehicles, computers, TVs, inverters etc. that have internal high power electronics operating within this radio spectrum. WAVES 10 wireless power is coupled as a magnetic field, through a magnetic window, with electromagnetic shielding and filtering designed to avoid unintended emissions from both PTM and PRM. The power carrier itself is narrowband with PTM-CES tank coil 74 Q's greater than 10 during full power coupling. Standard EMI verification can be conducted (similar to tests that are routinely performed on military electronics) to insure that all demonstration tests will comply with FCC regulations for both fundamental and harmonics of the power carrier.

[00124] Primary Power Distribution (6 phase) Spectrum

[00125] Direct division of six of the PTM 14 operational frequency, thus nominally 60 kHz each phase. Due to National Time Code usage of the 60 kHz channel, the suggested operational frequency should most likely be just below or above the time code spectrum. Thus, PTM 14 operating frequency would be above and below 360 kHz by a factor of 6 times the difference in primary power frequency respectfully above and below 60 kHz. The cable shielding and multiple phase nature of the primary power distribution should greatly attenuate any unintended RF radiation at 60 kHz.

[00126] Power Transmit Module (PTM) Roadway Interface

[00127] PTMs 14 are sealed and ruggedly built triangular "conduit-like" modules 80 containing 50 individual PTM 14 coils and their associated PTM-CES 34. Each PTM 14

contains a concatenated line of pre-installed PTM-CES 34 units along with associated internal power and data cables. Weather-tight electrical and fiber optic feedthroughs at each end of a PTM 14 provide the means to rapidly chain PTMs 14 in series as they are installed within a roadway.

[00128] Referring to Figure 12, installation involves preparing a V channel 38 into which PTMs 14 are laid. This operation may be performed by a trenching vehicle 82. Bulk delivered unconnected PTM modules are robotically offloaded from a bulk hauling vehicle 84 directly on to an Assembly and Laying Vehicle 86. The Assembly and Laying Vehicle 86 lays a primary electrical power cable (RTC) 88 followed by successive PTMs 14. PTMs 14 are nested end to end to form a continuous assembly within roadway 36. Joined PTMs 14 are then pressure and electrically tested prior to and after the last operation which lays the PTM 14 assembly into the previously prepared PTM Trench, sealing it against the trench walls and rolling it flush to the roadway surface. This process produces a contiguous, operational PTM lane from the rear of the Assembly and Laying Vehicle as it progresses down the highway.

[00129] Note that PTM-CES 34, pre-installed within each PTM 14, are designed to be separately removable/replaceable for in-field servicing of roadway installed PTMs 14. The multi-phase primary input power to PTM-CES 34 units utilize magnetically coupled transformer links and blind-mated electrical and fiber connections to promote ease and reliability of this process. Table 6 below details the preferred specifications for PTMs 14:

Table 6

PTM Physical Specifications	
Length - Feet	40
Width - Feet	1.3
Depth - Feet	1.5
Basic Shape - Cross Section	Triangular
Weight - Pounds	500
Volume - Cubic Feet	46.8
Pounds per Cubic Foot	10.68
Power Leads - #	7
Power Lead - Connections at Each End	Pigtails - Weldable
Data Leads - #	2
Data Leads - Connections at Each End	Pigtail - Fusable
Mechanical Connection at Each End	Flange - Weldable

Number of PTM-CES Units per PTM - #	50

[00130] Power Transmit Module (PTM) Interface to Roadway Transformer Cable (RTC)

[00131] PTM 14 electrical components include multi-phase power wiring that supports not only the entire electrical power demands of a given PTM but also carries significantly higher levels of power required to sustain an entire lane segment. Utilizing high voltage AC power distribution minimizes currents and respective I^2R and skin effect losses associated with powering PTM 14 segments. Each PTM-CES 34 is connected to the multi-phase distribution running through a given PTM 14 by a set of six magnetically coupled transformer links 90 that serve to provide a safe, weather resistant, contact-less and reliable connector. Thus, this multi-phase power wiring is referred to as a Roadway Transformer Cable (RTC) 92. Magnetically coupled RTC transformer power connectors 94 are located below each PTM-CES 34 of a PTM 14. Each individual phase link forms a transformer with a physically separable core that enables a tight magnetic flux connection from primary to secondary when the core halves are brought together as PTM-CES 34 units are seated within the roadway. The primary side of each transformer link 90 is connected between one of the six multi-phase power lines to a neutral or paired ground conductors and performs a voltage step-down function (current step-up), in addition to the connection function, as a result of the ratio of turns between primary and secondary halves of the transformer.

[00132] To facilitate the manufacture of the RTC 92, individual transformer primary windings contain programmable taps 96 that are welded to respective phase conductors within the RTC 92. Each primary within a 6-phase sequence will select a unique ground/phase pair via programmable bonds thus allowing for a common transformer primary and associated cable construction. The use of multiple ground in parallel, paired with an appropriate phase allows for further reliability in these phase connections. Final molding of a surrounding insulating weatherproof outer jacket during manufacture encapsulates bonds, conductors and transformer primaries, as see in Figure 13.

[00133] Multiple PTM-CES 34 sets of magnetically coupled transformer links 90 are thus molded directly into the primary power phase lines during RTC 92 manufacture. They form repeating sequences of qty 6 phase transformer primary links that align with above secondaries respectively located within each PTM-CES 34 unit, as seen in Figure 14. Mechanical fixturing associated with each 6 phase transformer link sequence allows PTM-CES 34 units to be guided into position as a blind-mate connection. This produces a Zero

Insertion Force (ZIF) connection to each PRM-CES 34 module while also facilitating individual module replacement for maintenance. Moisture at transformer link core physical interfaces have no effect upon the magnetic coupling and all electrical connections, both on the cable side and within the PTM-CES 34, since the cores of each transformer windings are highly insulated and electrically isolated from both primary or secondary voltages. Similarly, the manufacturing installed and mated blind-mated fiber optic data line connectors at each PTM-CES 34, co-located with the transformer connector, are also isolated from the effects of moisture due to high degrees of electrical and environmental isolation common to such connectors.

[00134] The employment of 6 multi-phase power lines allows the power frequency to be 1/6th that of a single phase power line while achieving the same rectified ripple percentage for an equivalent rectifier on each phase. This lowered power frequency in turn reduces skin effect losses on the power distribution cable and allows the Multiphase Power Interface Unit (MPIU) 96 to be designed using more readily available and lower cost components operating at higher operational efficiencies due to lowered switching transition losses at correspondingly lower phase frequencies. The relatively high operational power frequencies as compared to 60 Hz drive RTC phase conductors 94 to be able to compensate for the increased skin effect conduction loss. Phase conductors implemented as metal (e.g. aluminum) foil or thin film conductors can satisfy this requirement while simplifying cable manufacture and lowering costs. Such implementations include depositing a film conductor on insulating (e.g. plastic) ribbons, that can be sandwiched for lower cost and higher reliability. Large scale RTC 92 to PTM-CES 34 power interface connectors 94 can employ transformers at each phase to ensure safe, reliable voltage isolation combined with efficient voltage step-down within this power interface, such as that seen in Figure 14.

[00135] Some variants (e.g., a parking lot) of PTM-CES 34 can employ a more conventional direct wired connection to each PTM-CES 34 for smaller scale installations and lower cost alternatives, especially within initial prototypes and demonstrations, as seen Figure 15. In such installations, one can employ a 220 VAC 60Hz power distribution cable with suitable environmentally sealable connections to the PTM-CES 34. In either MPIU 96 or 60Hz configurations, a ground fault circuit interrupter can be utilized that provides immediate power shutdown and safety protection in the circumstance that an environmental breech has occurred either along/within the power distribution cable or PTM-CES 34.

[00136] Figure 16 depicts the cross-section of a triangular RTC 92 married to a PTM 14 in a configuration that fits directly into the apex at the bottom of the PTM trench 38.

Closely fitting the trench as such, this cable format reduces the overall volume involved in the total PTM 14 installation. It facilitates pre-connection of RTC 92 to PTM 14 prior to trench installation, particularly when PTM 14 is to be used as a "self-form" during installation, while still enabling separate RTC removal if so desired during maintenance.

[00137] Power Transmit Module (PTM) Design Trades

[00138] A fundamental trade space surrounding PTM 14 design is that of design center gap distance between roadway/parking lot PTM 14 and vehicle mounted PRM 16 coils. This gap distance drives many design factors and related reliability and costs. The size of the coils within PRM 16 and PTM 14 can be relatively equal for wide ranges of gap distance however there exists a relatively linear relationship between coil size and gap distance for a fixed amount of power transfer/coupled power. The cost of roadway or parking lot installation is at least directly related to PTM 14 coil size in that a doubling of the width or cross-lane dimension of the PTM 14 coil doubles the amount of material that must be removed and doubles the physical volume of the PRM 16 assembly. Coil size also impacts the upper resonant frequency limitation of the associated Tank Coil 74 perhaps lowering this by a factor of 2 for each doubling of coil aperture area. Higher resonant frequencies reduce power supply ripple filtering requirements and allow efficient and small sized power transformers on the primary power side of PTM 14 ensuring the availability of magnetic connectors.

[00139] On the other hand over four times the reactive PTM 14 transmit power is required if the power transfer between PTM 14 and PRM 16 is to be maintained over a doubled gap distance. This increased reactive power is in turn a primary stressor for PTM 14 electronics reliability and raises component costs perhaps by a factor of 8. The chosen design center for PTM 14 to PRM 16 coil gap within the current design is 6 inches which is sufficient to allow a net roadway clearance of approximately 5 inches. Clearances greater that this will result in a rapidly decreasing falloff of power transfer. Clearances less than 5 inches will cause a disproportionately greater coupling factor between PTM 14 and PRM 16 coils resulting in the need to regulate or "fold back" the reactive power within the PTM 14 coil to maintain a fixed power. Therefore the 6 inch gap specification really determines the maximum gap at which a specified maximum power can be transferred. Initial experimentation has been with PTM 14 (Tank) coil dimensions of approximately 12 inches long (along lane) by 16 inches wide (across-lane) allowing a nominal 16 inch wide trench requirement for roadway or parking lot installation. It is possible to gain some design margin or reduction in reactive power (a main cost driver for PTM 14 implementation) by increasing the PTM 14 coil aperture, to perhaps a 16 inch by 16 inch dimension without significantly

impacting the ability to operate at currently high magnetic power frequencies, specified maximum power transfer or roadway installation costs. This could result in an estimated 25% reduction in reactive power for the same gap specification. Table 7 below depicts an attempt to rationalize a set of basic ratios of PTM 14 size and power to cost.

Table 7

Gap coil-coil inches	Reactive power per coil	PTM coil width	PTM coil length	PTM coil area, square	Gap coil-coil inches (normalized	Reactive power per coil	PTM Coil width (normalized	PTM coil area, square	PTM Electronics cost basis
6	2	16	12	192	1	1	1	1	10.1
6	2	16	16	256	1	0.75	1	1.333333333	8.13333333
6	2	16	24	384	1	0.5	1	2	6.2
5	1.666666666	16	16	256	0.8333333	0.625	1	1.333333333	7.13333333
5	1.666666666	16	24	384	0.8333333	0.4166666667	1	2	5.53333333

[00140] PTM Assembly

[00141] PTM 14 is comprised of included PTM-CES 34 units which are themselves individually environmentally sealed. In the preferred embodiment, separately manufactured and individually tested PTM-CES 34 units are attached to one another, in numbers that establish the modularity desired (e.g. 14 for parking lots and 50 for roadway installations). Note that certain PTM-CES 14 end-caps contain a locking mechanism which both draws the entire PTM 14 down into trench and while also securing it into position, as described in further detail herein. While a minimum of 2 locking mechanisms at each end of a PTM 14 may be adequate for the short parking lot PTM 14 configuration, this may be too few to be adequate in continuous roadway PTM 14 applications. It therefore is desirable to maintain a periodic spacing of the locking mechanism (that is fixed, perhaps to the parking lot PTM 14 interval) within the roadway PTM 14 configuration. Gasketing and fasteners are employed to additionally seal interfaces between PTM-CES 34 end caps and locking mechanisms shell. Each of the PTM 14 contained PTM-CES 34 exterior allows the enclosed electronics from the lower apex of each PTM-CES 34 to protrude into the trench bottom thereby allowing it to maintain direct thermal contact with the trench walls and with the power cabling directly below, within the apex of the "V" trench 38. Use of metal thermal through-wall vias into each PTM-CES 34 enclosed electronics area promotes good thermal transfer of heat

generated from internal electronics while also providing possible electrical grounding and electromagnetic shielding for contained PTM-CES 34 electronics. For certain installations it can be desirable to "pre-mate" RTC 92 or other power cabling to the bottom of the PTM 14 assembly prior to installation within its trench. This insures proper physical and electrical mating while not inhibiting the "blind mating" capabilities of the PTM 14 during maintenance swapping, once initially installed.

[00142] PTM-CES Assembly

[00143] Individual PTM-CES 34 units are designed to be structurally rugged, with an internal truss structure that fully supports worst case traffic loading without significant deformation or degradation from environmental and load cycling. The top of the PTM-CES 34 incorporates a Tank and Link Coil 74 filled containment cavity which produces a flat and well supported underlayment for the top roof/roadway surface area PTM-CES 34 within a typical roadway installation. The Tank and Link Coil 74 underlayment is further sealed against moisture by the incorporation of an electrical insulating and encapsulating agent such as a resin, wax or oil filling, that ensures mechanical and electrical stability under all operating conditions. The Tank and Link Coil 74 subassembly further contains spacer material that adds compressive and shear strength to the truss supported roof structure, as seen in Figure 17.

[00144] PTM Trench Installation

[00145] A "V" trench 38 is used to mount PTMs 14 flush with the roadway surface. Preparation of the trench proceeds by initially rough cutting a "V" cross-section with saws or other means into the road bed or parking lot bed. This is followed by a finishing coat such as concrete to achieve accurate, smooth and debris free sidewalls. Vibrating forms can be used to compress and rapidly form this finish coating. To prevent water intrusion once PTMs 14 are installed (mainly for freeze and corrosion protection), a waterproofing sealant coating can be applied to the side walls of the trench prior to PTM 14 installation. (Note: appropriate gasketing as applied to the exterior of PTM 14 may accomplish the same sealing property) If desired a power cable can be separately laid into the bottom of the trench with connectors facing upward at a spacing that mates with each PTM 14 or PTM-CES 34 as the given configuration requires. Otherwise the power cable can be pre-attached to PTM 14 prior to installation within the trench. PTMs 14 are then mechanically secured within the "V" trench at strategic locking points, including at minimum PTM 14 ends, as well as periodically along the length of PTM 14 in cases where longer PTM 14 lengths, with greater numbers of PTM-CES 34 units are employed. Locking also secures all primary power connections. The

locking mechanism allows PTM 14 to be drawn down into the trench while simultaneously being secured to the trench walls as the locking mechanism is tightened. The locking (and unlocking) mechanism is operated from the roadway surface for both installation and maintenance.

[00146] An alternative to separately applying a finishing concrete or other appropriate material to the initially cut trench wall, necessitating the use of separate forms and possible added time, a more rapid finishing may be obtained by use of PTM 14 itself as the form. In this way a release coating can be applied to the sides of PTM 14 prior to it being pressed into the Trench which has had newly applied finishing material (e.g. concrete). PTM 14 locking pads or pawls are extended from their unlocked position upon installation, and serve as elements of the "selfform" for creating sidewall detents. Removal of PTMs 14 requires that these locking pads/pawls are first retracted away from Trench side walls and vertical mechanical force applied to lift PTM 14 out of the Trench.

[00147] PTM Locking Mechanism Design

[00148] Figure 18 depicts one means for implementing a PTM 14 locking mechanism 98 (within an end-cap or otherwise distributed throughout a given PTM 14) is with a rotatable screw rod 100, being vertically captured within a bearing 102 just below its head, being countersunk within the top of PTM 14, below the roadway. This upper bearing 102 locks the screw rod 100 vertically and is in the form such as can be implemented with a groove machined through the upper section of the rod, just above the threads wherein an attached lock ring 104 can be captured within the slip bearing 102 wherein rotation resultant upward and downward vertical forces are applied to the entire PTM 14 as the screw rod 100 is turned CCW or CW respectfully. A clearance hole 104, downward through the locking mechanism, allows the screw rod 100 to freely turn while being attached to a lower located set of linkages 106 and associated pads 108, which come into direct contact with the side walls within the trench 38. In this lower set of linkages the screw rod 100 is vertically captured at a top control rod bearing 110 such as can be implemented with a groove machined through a section of the rods threads wherein (as in the screw head located bearing) an attached lock ring can be captured within the bearing and via associated linkages to the upper pivot bearings of two opposing pads, can in turn release or apply pressure against opposing side walls of the "V" trench. The threaded screw rod 100 then passes down through a threaded nut 112, which is in turn attached to bottom pivot bearings 114 of each pad via lower linkages, such that when the screw rod is turned clockwise, both of the pads are tilted, under added leverage from the lower linkages, and digs into the trench side walls with great

pressure. This creates a locking pressure against which a simultaneously downward drawing force is produced to vertically drive the PTM into the trench. This locking pressure occurs as a result of screw induced pressure as transmitted through the lower pad linkages leveraged by the pivot spacing on the pads and the actuating force produced as the threaded nut moves upward towards the slip bearing.

[00149] The thread pitch and starting depth of the locking assembly is such that the vertical movement is sufficient to fully draw the PTM down into the trench being securely braced by both pads against respective side walls, conversely securing the PTM, within and against the trench, against traffic loads and other forces. The PTM is removed simply by a counterclockwise rotation of the screw rod inducing the reverse of the afore described locking action. A "detent" providing a more positive sensory indication of proper screw rod and pad depths, greater tolerance in the locking range and an enhanced locking force can be produced by an introduction of suitable parallel grooves down the entire length of each sidewall within the trench. Such grooves can mate to the top of each pad, fixing the desired PTM seating depth while accommodating significant locking by pad tilting and resultant detention of the pads within the side walls during installation/locking. Such grooves can be produced by cutting into finished, cured and/or partly cured side walls during trench formation.

[00150] The use of a recessed screw rod head, when combined with a uniquely keyed head and mating rotating tool or tool sets can provide a fundamental level of theft protection. Other electronic means and mechanical key locking means at sporadic intervals can provide a further deterrent.

[00151] Alternative PTM Locking Mechanism Design

[00152] Another embodiment of the end cap locking mechanism 116 is depicted in Figure 19. It is comprised of a flat slider-driven set of pawls that swing out into the trench wall as the slider is depressed downward. Such a slider mechanism can potentially be made cheaper (e.g. entirely of plastic and thinner to minimize roadway "dead-space" while at the same time serve as a PTM-CES End Cap or End Capsbetween adjacent PTM-CES units). Pawls on either or both sides of this Locking Mechanism apply direct frictional pressure to the trench sidewall(s) thereby securing the PTM within the trench. A trench wall inclusion designed to be located at the pawl engagement depth can further enhance the degree of the mechanical locking and seating forces that are generated during installation. Again access to such locking and unlocking can be protected by the need for a unique mechanical key and /or electronic controls.

[00153] Integrated Tank and Link Coil Design

[00154] Tank and Link Coils 74 can be integrated within a common assembly as shown in Figure 20. One such integration machines or otherwise forms spiral Tank and Link Coil 74 channels into opposing top and bottom sides of a solid sheet of insulating material such as plastic. Machining or forming grooves on each side to a total combined depth less than the thickness of the sheet insures that the assembly remains as a single sheet during all phases of manufacture. It also insures that an electrical insulating layer of material separates each coil once installed. Flat conductors such as metal foil are then inserted into each spiral channel to separately form Tank and Link Coils 74. Coils 74 can then be electrically connected to suitable leads and filled with a suitable electrical insulating resin or other compound to form a finished subassembly. The use of a physically robust sheet material within which channels are formed adds considerable strength - both compressive and sheer, to PTM-CES 34 unit once installed within its Tank and Link Coil 74 cavity. Additional coils such as used for magnetic field sensing can be also integrated within the same subassembly, in an analogous manner. Flat conductors facilitate significantly lower conduction losses at the higher frequencies utilized within this subassembly. Such foil conductors can be highly cost effective both in raw material costs and in assembly labor. Thin flat metal stock can be pre-formed into a spiral (e.g. via rollers) then conveniently fit into respective spiral channels. Alternatively, coils 74 can be formed by metal deposition within said channels, with top and bottom sides suitably machined or abraded to remove any possible winding to winding shorts. This deposition technique can accommodate further current crowding control due to magnetic field intensity by introducing conductive path scrambling within the metal deposited within grooves/channels by selective machining and/or periodically inserted bridging conductors within a channel. The sheet material within which Tank & Link Coils 74 are embedded can contain ferromagnetic material designed to enhance the generation and shape of the generated magnetic field as well as provide the overall electrical insulation properties required.

[00155] The Tank Capacitor 120 can also be integrated within the assembly of Tank Coil 74 as seen in Figure 21. Alternatively all or a portion of the required Tank Coil Resonating Capacitor 120 may be embedded within the PTM-CES 34 housing itself as seen in Figure 22.

[00156] WAVES Power Transfer Regulation

[00157] The loosely coupled air core resonating design of the WAVES power transformer dictates the generation of high reactive power within the PTM Tank Coil 74 and associated Tank Capacitor 120. This is problematic from a safety and reliability standpoint

as it increases the costs and development difficulties of these key components. Further adding to operational difficulties on one hand is the significant variability in magnetic coupling to the user vehicle and on the other hand the need for regulated, standard power waveforms at the vehicle charging or energizing interface. This prompts the need for an automated feedback based regulation approach developed for WAVES 10. There are two main aspects to this approach: first, the maintenance of a "safe operating area" for the PTM based power amplifier and, second, generation of a regulated standard voltage and frequency output to the user vehicle and associated electrical systems. These aspects are related to each other in the sense that the time varying vehicular waveform and load demands as modulated by varying magnetic coupling across the roadway gap will in turn reflect a time varying load demand upon the PTM Tank Coil 74 and associated amplifier which needs to be included within its "safe operational area" capabilities. This is further complicated by the loosely couple air-core design utilized by WAVES 10 as it avoids the use of high-permeability materials.

[00158] The key is that the voltage waveform experienced by the Power Amplifier/Tank Link side of the Tank Coil 74 may not indicate the waveform expressed by the Tank secondary winding which may experience significantly more variable voltage swings especially under light loads. To insure safe the establishment of a safe operational area, the Power Amplifier Drive 122 needs to be inhibited by feedback whenever this voltage waveform exceeds specific limits. Additionally, power amplifier current sampling infers real power (not reactive power) delivered in real-time. An added feedback loop around this current sampled signal can also inhibit the Power Amplifier Drive 122 thereby accomplishing regulation (and/ or safe high current shutdown under failure or faults) that is inclusive of both vehicle loading and safe area operation. On the vehicle side, a time varying waveform imay be generated by active circuitry within the PRM 14. This circuitry can also self regulate within an acceptable operational range of power transfer to insure proving a standard power waveform to the vehicle e.g. 220v @ 60Hz. The demands of PRM load power (waveforms et. al.) are, of course, reflected back to the PTM Power Amplifier 122 as a time varying real power demand that requires seamless incorporation within its regulation.

[00159] WAVES PTM Tank Capacitor Design

[00160] Referring to Figures 23 and 24A, a key critical component to the high power and long-term reliable operation of the WAVES PTM 14 is the Tank Capacitor 120. The reason for this is the extreme voltages (many thousands of volts) and high frequencies (many hundreds of thousands of cycles per second) coupled with high currents (ampere levels) that

that this capacitor is required to handle on a continuous basis during active power transfer. These requirements dictate a conservative voltage and power dissipation & loss design which is satisfied by the precision machined assembly of stacked components comprising the WAVES design. Low loss dielectric material is utilized throughout. The "nested" configuration captures and encloses interior plates to provide a high degree of corona resistance which is a major factor in reliable operation. A long and secure dielectrically encompassed path is thereby provided which is easily sealed from the outside environment. The parallel plate design of this capacitor lends itself to thick conductive foils or plates for the elimination of expensive metals, with corresponding lighter weight, and facilitates mechanical trimming to achieve precision capacitance values. The WAVES Tank Capacitor 120 design is easily scalable in electrical ratings to accommodate differing power transfer requirements even at multi-kilowatt levels. Additionally, as embodied in a split-plate design, the WAVES Tank Capacitor 120 provides an integrated, safe and low-loss means for sampling and measuring tank voltage during operation.

[00161] Referring to Figure 24B, a key critical component to the high power and long-term reliable operation of the WAVES PTM 14 is the real-time control of the output of the Power Amplifier 122. Figure 24B depicts a means for achieving an economical, efficient and small sized implementation of deriving such a control signal. In particular, a Litz Strand Transformer (LST) 124 design yields an important means for instantaneous sampling of Power Amplifier (PA) output current (as input to the Link primary of the Tank Circuit 74) in a small, efficient and voltage divided manner, with sample voltage in direct proportion to the LST turns ratio. Such a means limits the saturation of the LST 124 core by restricting the flux of the sampled current to a ratio of the PA output current. This ratio is set by the ratio of the total number of strands in the Litz wire 126 formed primary of the Tank Circuit 74 to the number of strands used/split off as routed through the primary of the LST 124, and the number of turns that these strands make in the primary of the LST 124. This approach takes advantage of the nearly equal current sharing that exists within the strands of the Litz wire 126 formed Tank Circuit Primary and resulting split off strands within the LST 124 primary. Obtaining such a PA output current measurement is key to the safe and regulated control of the PA within the PTM 14 and its subsequent variable loading imposed by any PRM pickup. As depicted, the LST 124 secondary provides a sample voltage output in direct proportion to the PA output current with this proportionality set by the number of strands within the Tank Circuit Link and the turns ratio within the LST 124. Such a sample voltage can be subsequently rectified to provide a real-time feedback control signal to the PA 122 to shut it

down in cases of safety or protection under adverse circumstances or simply to afford regulation thus insuring that a stable power is deliver to the PRM 16 load under normal variations.

[00162] Extruded PTM-CES Construction

[00163] Individual PTM-CES 34 units can be constructed from a continuous plastic or other insulating material extrusion that is subsequently sliced to the proper length to form the chassis for PTM-CES 34 units. Such an extrusion process allows the inclusion of internal 3D structure designed to be structurally rugged while minimizing overall weight. Extrusion promotes the low cost, mass-fabrication of PTM-CES housings. End Caps with appropriate gasketing then provides environmental sealing to contained integrated electronics. Single or multiple PTM-CES 34 containing units can be formed within each extruded slice, to be environmentally sealed by end caps during assembly. Heat sink and electrical vias can be formed with machining of chassis penetrations. Heat sink components can be inserted from internal and external areas of each PTM-CES 34 electronics area, through sealed penetrations to be subsequently joined or riveted together during unit assembly to form a complete thermal path from internal electronics to trench side walls. PTM-CES 34 contained units are separately tested and numbers of such completed units mechanically held together to form a PTM 14 assembly suitable for parking lot or roadway installation within prepared trenches.

[00164] Power Transmit Module (PTM) Environmental Heat

[00165] PTM roadway and parking conditions are exposed and can receive heat loading from ambient air temperatures and direct solar absorption. This heat gain can result in severe temperatures at the surface of the PRM 16 which can lead to lack of mechanical stability of related housing materials, especially when combined with vehicle traffic weight loading. The addition of reflective material along top PRM 16 surfaces may help reduce such increases in concert with appropriate housing material choices. This “cover” material could also have thermal insulation properties that isolate internal housing structure from potentially significant surface temperatures. Another possibility is a more active method of cooling, based upon phase transfer of heat at a common temperature, located within the internal housing volume. Materials such as wax absorb considerable heat in transitioning from a solid to a liquid. An active pumping system can be employed within the housing that allows a fluid (e.g. oil) to convey heat to from the exposed top area of the PRM to lower/subsurface areas. Heat sink vias located within these areas can then conduct heat to exterior side wall areas of the Trench that are at significantly lower temperature.

[00166] PTM & PRM Fabrication Material

[00167] High Density Poly Ethylene (HDPE) has important properties that are suited to the manufacture of PTM-CES 34 and PRM 16 housings. Fastening is one option, but various parts are preferably joined by hot air or nitrogen welding. Also, ultrasonic, laser, and infrared welding may be used. HDPE can be injection molded as well as being available from recycled sources at lower costs. Glass material can be embedded within the top layers to enhance strength and achieve a proper degree of UV and thermal protection. Furthermore the excellent electrical properties make it possible to create high voltage/high frequency resonating capacitors within the housing structure itself, inserting conductive plates within slot cavities formed within the housing material, thus eliminating the need for separate dielectric materials or associated mechanical fixturing. The lack of glue-ability does not preclude the use of glue or rubber-like compounds between components that serve in a sealing gasket function so long as additional mechanical means are employed to hold components together.

[00168] Alternative PTM-CES Laminate Construction

[00169] Individual PTM-CES 34 units can be constructed from a set of cross-sectional wafers, as seen in Figure 25, that when aligned stacked and laminated form a solid PTM-CES 34, complete with environmental sealing and heat sinking to form an integrated electronics module. Such a laminating process allows the inclusion of internal 3D structure designed to be structurally rugged while minimizing overall weight. Lamination promotes the low cost, mass-fabrication of the entire housing while enabling easily formed heat sink and electrical vias between laminate layers through machining of individual channels (shallow depth cuts). One way of producing such a PTM-CES 34 laminate stack is by the stamp cutting, router milling, or saw cutting of individual wafers from sheet stock plastic (including recycled plastic composite sheet stock). Wafers can then be stacked and bonded together along with included thermal and electrical vias to form a completed assembly with electrical components inserted prior to final assembly, testing and installation of environmental sealing end caps (also formed as wafers using the same machining process options referred to earlier).

[00170] Figure 25 shows a simplified representation of the laminating approach wherein 2 basic cross-section types of wafers (solid end cap type, internal type) are stacked to form a given PTM-CES 34 unit. PTM-CES 34 wafers are bonded to one another to form a structurally sound and water-tight unit. The use of a bonding agent effectively eliminates the need for gaskets. Sidelocking straps provide added strength to hold individually bonded wafers together within a unit. Individual units can be in turn joined to adjacent PTM-CES 34 units by use of extended side-locking straps. Such straps preserve the smooth continuous

side walls of the triangular exterior of the PTM 14 while making the entire assembly cohesive with a appropriate degree of rigidity. A bonding agent, mechanical hardware and high strength strap material can strengthen the degree of cohesiveness within and throughout a chain of physically linked PTM-CES 34 units. Once bonded, stacked and strapped together the resulting PTM-CES 34 units can be machined (e.g. sanded) on the exterior to enhance trench fit accuracy that can result in better distribution of roadway induced loading against the side walls of the "V" Trench. Furthermore if the slope of the trench makes the included angle of the bottom of the "V" slightly more acute than that of the respective "V" profile of PTM-CES 34 in this respective bottom "V" area then the bottom are of each PTM-CES 34 can be made to come under higher compression than that of the rest of the module as it is installed into the trench, thereby insuring good thermal contact in that area (as well as enhanced physical protection of bottom trench located power and data interfaces). The slightly increased fit tolerances on the remaining upper portions of the side walls can be easily overcome by intervening sealant and/or ultimate unit deformation under roadway loading. Heat sinking and electrical and optical vias can be introduced into the resultant PTM-CES 34 by suitably machining across the thickness of given wafer(s) of the stack prior to lamination. In this way both external and internal openings can be introduced at given locations wherein conductive material can be embedded and sealed during the lamination process. Considering the heat sink, a succession of vertical slots through both lower side walls of each PTM-CES 34allow the embedments of a series of "C" or "I" beam like metal heat conductors which can form nearly continuous internal and external heat transfer regions within the Electronics Module portion of each PTM-CES 34 unit. The center portions of such "C" or "I" beams provide the thermal vias through the insulating side walls of the Electronics Module. Again, the outer surfaces of the "C" or "I" beams form heat conduction to the "V" Trench walls and can be machined (including sanded" flush to the exterior of the module affording optimized heat transfer. Additional considerations of such formed thermal vias include machining/relieving exterior and perhaps interior module housing material under the non-via portions of each "C" or "I" beam thermal via. In this way the resulting depth allows for enhances sealing area and enhanced mechanical resistance to sidewall compressive forces, thus strengthening and better sealing these critical electronics containing areas of the module. Likewise, a similar approach can be utilized for the installation of other power and signal interface components to ensure reliability.

[00171] The Tank & Link Coil 74 is integrated with strong winding separators and a strong central core to form a robust component that slips into and fills the associated PTM-

CES 34 cavity during assembly (from an open side of a PTM-CES 34 unit). Additional intervening sealant then completely fills the cavity which when enclosed by end caps, the coil completes the formation of a solid strength member parallel to the its roadway exposed surface, being supported immediately below by truss-work within PTM-CES 34. The utilization of truss-work as opposed to solid cross sections is three-fold, high vertical strength at significantly reduced weight, overall material savings and the ability to form internal cavities and structure that fixture and fabricate internal components.

[00172] Heat Sink Via Designs Suitable for Laminate and Extrusion Implementations

[00173] Figure 26 illustrates two embodiments of the heat via 128 embodiment, both of which are suitable for laminate forms of constructions; however, the second embodiment is suitable for extrusion implementations because it can be inserted (e.g. like a staple) through an existing sidewall with minimal effort. The heat via 128 is designed to provide a good heat flow path from higher ambient temperatures of directly mounted power electronics (having high heat concentrations) and indirectly heat coupled internal electronics to PTM-CES 34 exterior and adjacent trench side walls of a lower ambient temperature without compromising the waterproof integrity of PTM-CES 34 housing.

[00174] The first embodiment is an I-beam configuration that neatly fits into prepared (2D) indentations within a laminate slice and is further captured and sealed by an opposing laminate slice within the stack of slices comprising a PTM-CES 34 unit. The second embodiment is a T-beam configuration for insertion through a relatively narrow opening through a PTM-CES 34 chassis side wall. In this instance the outside (or perhaps interior side) heat flow surface must be suitably fastened to the penetrating "T" end section to form the via 128. Suitable fasteners include riveting or otherwise cold forming T material or spot welding or screw fasteners. The intent is to provide a flush exterior with good sidewall contact for heat flow and minimal inclusions that may serve to inadvertently lock the PTM 14 in place preventing future extraction. An additional attribute to the second design is that of being capable of strapping across the multiple slices of a stacked laminate constructed PTM-CES 34, such as to provide individual unit integrity before being strapped or otherwise secured into a given PTM 14 configuration prior to subsequent installation.

[00175] Power Transmit Module (PTM) Electrical Specifications

[00176] PTM 14 electrical specifications include peak and average power for the entire module as well as average power dissipations from electrical/electronic losses which is manifested as heat. Heat will be conducted away from the PTM 14 along two paths, one is to the subsurface of the roadway (primary path) and the other is through the transmitting coil at

the roadway surface interface (secondary) which will only be significant when roadway surface temperatures are well below subsurface ground temperatures. Table 8 below details the electrical specification for PTM 14:

Table 8

PTM Electrical Specifications	
Electrical Power - Kilowatts Peak	125
Continuous Power - Kilowatts	75.00
Power Dissipation Total - Kilowatts	7.5
Power Dissipation Per Foot - Watts	187.5

[00177] It should be noted that the nearly 200 watts (peak) per foot dissipation is a significant amount of heat within a confined (0.75 cubic foot) volume as exists within a one foot long triangular section. This implies the need for a good thermal path between internal electronics within PTM-CES 34 components as well as a good thermal path to and through the side walls of the PTM 14 to the roadway subsurface. Also note that during the summer and in areas of direct sunlight the top or roadway surface of the PTM 14 is a potential source of high heat loading that must be avoided. Underlaying thermal insulation immediately below each PTM-CES 34 coil prevents this path being a major heat load to electronics below.

[00178] PTM-CES 34 units are the common denominator for transmitting the magnetic fields that are the source of power coupled to vehicle mounted PRMs 16, as well as the source for control and critical communications links to those vehicles. Multiple PTM-CES units 34, when simultaneously energized by a reasonably aligned passing PRM 16, couple increased power to the associated vehicle in direct proportion to the number PTM-CES 34 units energized, as seen in Figure 27. The coil drive waveforms at adjacent PTM-CES 34 coils are synchronized and phased to oppose magnetically, resulting in a bunched or vertical fountain-like structure to the resulting fields along the axis of the PTM 14. The vertical structure optimizes power transfer to respective pickup coils within the PRM 16 and eliminates any short circuiting of field lines directly to adjacent coils. This structure forms a rugged Magnetic Field Window 130 that isolates the Tank Coil 74 from the physical environment at the roadway surface while virtually magnetically displacing the coil to the very top surface of the roadway, thereby maintaining the smallest possible coupling gap to a vehicle's PRM 16 above. In this manner the coils on both roadway and vehicle are protected without adding the thickness of the PTM 14 housing/window to the air gap through which magnetic field coupling occurs.

[00179] PTM-CES 34 electrical specifications include required peak and average or continuous electrical power as well as loss related dissipation, manifested as heat. Heat is conducted internal to each PTM-CES 34 by both structure and insulating oil to its apex or lower triangular point. This apex area is thermally conductive and in good thermal contact, through adjacent PTM 14 side walls, to the sub surface at the bottom of the roadway trench. In this way cooling is maintained without sacrificing environmental integrity of the PTM 14 and its subassemblies.

[00180] The secondaries of magnetically coupled transformer links, located entirely within each environmentally sealed PTM-CES 34, feed rectifiers for the generation of DC power used by internal electronics. DC power is at nominally low voltages and moderate currents (see Table 9). Transmitting tank coil and capacitor AC voltages are however quite high due to associated Tank Coil Link transformer step-up and resonance effects. This is especially true when the Tank becomes lightly loaded under worst case low magnetic coupling instances. Therefore coil and capacitor components are high voltage insulated within the PTM-CES 34 by an internal oil bath and there is no direct exposure from coil to roadway as a result of employing a magnetic window material seal at this interface. The electrical specifications for PTM-CES 34 are set forth in Table 9 below:

Table 9

PTM-CES Electrical Specifications	
Electrical Power - Kilowatts Peak (incl. losses)	2.16
Continuous Magnetic Field Power - Kilowatts	2.00
Power Dissipation Total - Watts	160
DC Primary Power Supply Voltage - Volts	480
DC Primary Power Supply Current - Amperes pk	4.50
DC Secondary Power Supply Voltage - Volts	12
DC Secondary Power Supply Current - Amperes	5
AC Coil & Cap Voltage - VAC pk	6000

[00181] The determination of the exact number of PTM-CES 34 units that are energized at any one time is in turn the role of the proximity links. The first proximity link is initiated by a magnetic field based data transmitter located within the vehicle PRM, such that PTM-CES 34 fields are only produced when there is the potential for adequate coupling to the PRM 16. The first proximity link data transmitter within vehicle PRMs 16 operate on a frequency separate from that of the PTM 14 and employ a pseudo-random modulation

designed to limit power carrier interference. The signaling frequency is made appropriate to be easily combined with all coils of PRM 16 in a manner that each PRM 16 coil radiates a magnetic field from vehicle to roadway having a spatial shape and coupling factor nearly identical to that of the PTM 14 power carrier (emanating from roadway to vehicle). This independent signaling frequency allows first proximity link receiver within each PTM-CES 34 to detect a proximity signal in the same coil used for power transfer to the vehicle and in the presence of a power carrier, thus insuring that the pickup coupling is analogous to that experienced during power transmission. Filter networks within the first proximity link receive path of each PTM-CES 34 and each transmit path of the PRM 16 are designed to be anti-resonant at the power carrier frequency but series resonant at the signaling frequency. This design effectively isolates subsequent signaling components from the high level power carrier, allowing reliable signaling carrier to interference ratios. Furthermore, the bandwidth of the signaling channel thus formed is made sufficiently broad (nominally 30kHz) to accommodate transmission of multiple copies (10 minimum) of a psuedo-random modulated vehicle ID word within the minimum interval of a single PRM 16 coil to PTM 14 coil passage (nominally 0.01 seconds).

[00182] Since the proximity link 28 function is critical to both human safety and to the proper operation of PTM-CES 34 modules, insuring adequate magnetic coupling is always present before energizing, additional proximity link hardware is included such that two valid proximity links are required in real time to generate an enabling signal. This second (additional) proximity link operates on an entirely different principle and employs a separate PTM-CES 34 UHF transmit signal and receiver analogous to that employed in store antitheft security systems, wherein a very simple chip is embedded within each vehicle PRM 16 coil that is activated as it passes over an interrogating PTM-CES 16 coil. Thus, three separately generated enabling signals must be present before any energy activation occurs

[00183] Referring to Figure 28, the ability of PTM 14 to literally track a vehicle's PRM 16 via proximity links 28 and 32, only powering up a PTM-CES 14 when it will be able to usefully couple power to an external and specific PRM 16 load, maintains overall efficiency and safety. Proximity enabling produces energized magnetic field "hot spots" or waves of power that travel down the PTM Lane 40 at vehicle velocities, with power transfer maintained on a continuous basis directly under vehicle PRM 16. There may be more than one PRM 16 placed on a vehicle as may be the case for trucks, trailers and other articulated vehicles that require proportionally greater power transfer. This proportionality in power transfer is a powerful feature in that the power transferred is a direct function of the number

of PTM-CES 34 units that are energized. So a larger vehicle such as a bus having the requirement for a greater power transfer, also has an ability to carry a greater number of PRM 16 pickup coils (longer PRM). Large vehicles can thereby be effectively powered from the same standardized power PTM-CES 34 units that power lighter vehicles within a common driving lane.

[00184] Referring to Figure 29, the PTM-CES 34 magnetic field generation design incorporates a MOSFET power amplifier and direct coupling to an associated resonant tank circuit to efficiently generate very high AC magnetic fields within the space between roadway and vehicle PRM 16. The MOSFET amplifier is in turn fed from a lower level signal generated by a gated exciter.

[00185] The MOSFET H Bridge configuration utilized as a power amplifier output stage derives its name from the "H" formed when two sets of vertically stacked transistors are joined horizontally between their respective center connections by the load. The load in this case being the Tank Link Coil 74.

[00186] The use of a transformer coupled H Bridge MOSFET configuration 70 for the power amplifier allows the presence of an exciter output to directly enable the amplifier's power generation. With no exciter driving signal, all four of the amplifier's MOSFETs are turned off and virtually no current flows. This is true whenever the exciter output is gated off. Thus a (low level) "Transmit Enable" logic level signal is used as a low power, low voltage gating of the exciter output to energize each PTM-CES 34.

[00187] When the amplifier is gated on, diagonally opposite MOSFET pairs of the H bridge70 (pair #1- upper left & bottom right; pair #2 - upper right & bottom left) are alternately switched on and off during each half of the power carrier cycle (one pair switched on while the other pair is switched off). This switching arrangement causes high alternating currents to flow within the Tank Link Coil 74, currents that switch direction at each half cycle in unison with alternating MOSFET pair conduction. The resulting alternating magnetic field of the link coil 132 is tightly coupled to the resonant tank coil 74, a coil having a significantly larger number of turns than the Link Coil 132. This turns ratio produces a large voltage step up from link to tank. The tank circuit is made parallel resonant at the switching frequency by the paralleled Tank Capacitor 120. Therefore, the net result is that the tank voltage builds rapidly with each cycle of link current. In normal operation, tank circuit loading is primarily from nearby (passing) vehicle PRM 16 coils which act as a loosely coupled transformer secondary winding. Reactive currents within the tank circuit are passed alternately from Tank Coil 74 to Tank Capacitor 120 as the magnetic field collapses

through the Tank Coil 74 and back to the Tank Coil 74 as the increased rate of Tank Capacitor 120 charge occurs on the next half cycle. The relatively loosely coupled vehicle PRM 16 coil presents an increasing real power load in proportion to the level of reactive power exchanged within the tank circuit, until the amount of real power coupled to the PRM 16 load matches the real power provided by the MOSFET amplifier Tank Link Coil 74 circuit (less minor losses). At this point constant maximum real power is exchanged wirelessly by the alternating magnetic field coupling between Tank Coil 134 and PRM 16 coil. Once the PRM 16 coil moves out of range as determined by the Proximity Link 28 to the PTM-CES 34, the PTM-CES 34 is gated off again and de-energized, allowing the tank resonant energy to rapidly decay to zero based on residual coupling to PRM 16 and tank circuit losses. It should be noted that a vehicle PRM 16 may be many coils long, therefore a given PTM-CES 34, once enabled, will remain energized for the entire duration of passage (several PRM 16 coil times). At 70 mph, with a 14 coil PTM, this energization would be for a time duration of 0.11 seconds.

[00188] Power Transmit Module (PTM) Charge Controller Function

[00189] The vehicle charge control function can be addressed wholly or in part by the PTM-CES 34 units within the PTM 16. When a vehicle is coupling energy whether statically or dynamically there must be a throttle on the amount of energy transferred, such that the vehicle's battery is not overcharged or discharged when sufficient power is available, or charged at a rate that exceeds specifications. An on board, vehicle based charge controller can accomplish this battery charging control by inhibiting the flow of power in the battery charging circuit to exactly match the instantaneous needs of the vehicle. If the vehicle is in motion there are motor power demands added to battery charging power demands. There may also be demands from vehicle accessories such as lights and air conditioning. The charge controller monitors the battery's state of charge and motor power to establish a battery terminal voltage that continuously balances wireless power input with the needs of the combined total vehicle electrical load. This implies that there will be a variable amount of wireless power coupled to vehicles under both static and dynamic roadway conditions. If the PTM-CES 34 units were to do nothing in response, the tank coil and capacitor voltages would be higher under light loads and lower with heavier loads as they are energized by the passing vehicle. A range of loading is acceptable so long as tank and pickup coil voltages are maintained at safe levels and the fringe fields above the pickup coil are sufficiently attenuated before reaching vehicle or occupants. Over-voltage conditions at the PTM-CES 34 tank can be sensed and made to gate the amplifier drive to better match amplifier output energy to

light loads. Sensing means can be a sense coil within the Tank Coil 134 field or a capacitive or resistive AC voltage divider from the ungrounded side of the Tank Coil 134. A spark gap in conjunction with a fast acting over-current shut-down can be further employed as an added safety feature that puts an ultimate limit on tank voltage swings.

[00190] Current monitoring can be effectively monitored using a current sampling transformer in either or both of the Link Coil 132 leads to the high power amplifier. The resulting AC waveform can be rectified and filtered if necessary to be used in comparison with control derived threshold voltages to inhibit amplifier drive and thereby power.

[00191] A particularly interesting mode to consider is the incorporation of a greater degree of charge controlling functionality within each PTM-CES 34 such as to shift the majority of this function from vehicle to roadway or parking lot. This provides a means to simplify vehicle charge controlling while archiving a degree of commonality from vehicle to vehicle. This works by using the WAVES Data Link 30 to transmit vehicle power needs in conjunction with vehicle ID such as to allow programing of PTM-CES 34 amplifier drive gating. Programming will in turn cause the proper amplifier power output when it is subsequently enabled by the WAVES proximity links 28 and 32 during vehicle passage. This in effect produces a closed loop around the magnetic power coupled to the vehicle battery and motor (dynamic). In the dynamic case, the Data Link 30 is sufficiently real-time to prime upcoming PTM-CES 34 units with the proper power level, in advance of their being enabled by the passing vehicle. Since this forms a closed loop, errors in coupled power (from instance to instance) can be corrected by changing power level programming of power transfers from continuously engaged PTM-CES 34 units (static) or subsequently enabled PTM-CES units (dynamic). In initial applications, wherein parking lot and household operation is sufficient, a static charge control function is all that is necessary.

[00192] Power Receive Module (PRM) Design

[00193] PRM 16 is required by any electric vehicle choosing to receive magnetically coupled power from roadway or parking lot embedded PTMs 14. Referring to Figure 30, the PRM 16 contains pickup coils rectifiers 136, deployment actuator 138, and monitoring and communications electronics 140 in an environmentally sealed composite housing 142. Since the PRM 16 is suspended below each vehicle, exposed to the airstream and the environment, design considerations must address minimizing weight and cost, while being rugged, and corrosion resistant. Cost and weight push the PRM 16 (and PTM 14) coils to be made from copper-nickel clad aluminum stranded cable wherein each strand is separately cladded and insulated to minimize skin effects and corrosion.

[00194] PRM 16 length varies with the vehicle to be able to match driving power requirements. Two lengths are suggested 11 feet for mid-sized car vehicles, and 34 feet for trucks and buses. The width, 3 feet, is the same in each case to accommodate 3-coil rows, to make pickup coupling less sensitive to lane position errors. The 4 point actuator allows PRM 16 to quickly swing down, in a road-surface parallel manner, towards the roadway during deployment. Similarly, when disabled actuators swing PRM 16 quickly back up to securely nest into a cushioned pocket located along the horizontal underside of the suspension. This "gears up" action can be manually initiated by the driver or automatically initiated by improper roadway clearance and debris. Part of the automatic retraction can be accelerated by the inherent up-swinging motion induced by physical pressure exerted by obstructions during forward motion of the vehicle. A forward facing PRM brush 144 normally clears the roadway surface under normal driving conditions. This brush may augmented by an additional brush or "air dam" like appendage mounted directly beneath the front of the vehicle, in line with, but apart from, the PRM 16. In this way small roadway debris can swept away without retraction. Major debris, obstructions or unsafe clearance conditions will however cause the brush to trigger a retraction thereby preventing serious harm to PRM 16. The heads-up display provides an indication of the state of PRM 16 deployment or retraction. Table 10 below provided the physical specifications for a preferred PRM 16.

Table 10

PRM Physical Specifications	Car	Truck/Bus
Length - Feet	11.2	33.6
Width - Feet	3	3
Depth - Feet	0.5	0.5
Basic Shape - Cross Section	Rectangular	Rectangular
Number of PRM Coil Rows - #	14	42
Total Number of PRM Coils - #	42	126
Coil Width - Inches	12	12
Coil Length - Inches	9.6	9.6
Weight - Pounds	20	60
Volume - Cubic Feet	16.8	50.4
Pounds per Cubic Foot	1.19	1.19
Power Leads - #	2	2
Data & Aux Power Leads - #	8	16

Data & Aux Power Leads	Pigtailed Female Conn	Pigtailed Female Conn
Mechanical Connections - for suspension	4	8

[00195] A further consideration is the use of a "brush" mounted in a "V shaped cowcatcher" fashion at the front of the vehicle and/or on the leading edge of PRM 16 in a manner as to just clear the roadway, brushing small debris away from PRM 16 as well as assisting in and triggering the vertical movement of PRM 16 away from roadway obstructions as might occur at slower speeds. In this manner, PRM 16 vertical distance to the PTM-CES 34 is safely maintained at nominally 3 inches. Both PTM 14 and PRM 16 coils are sealed and covered with a thick layer of tough plastic, fiberglass, carbon fiber, asphalt or other like material, made magnetically permeable by being heavily loaded with ferrite. Table 11 below sets forth the preferred PRM electrical specifications.

Table 11

PRM Electrical Specifications	Car	Truck/Bus
Electrical Power - Kilowatts Peak	28	84
Continuous Power - Kilowatts	28	84
Power Dissipation Total - Kilowatts	1.4	4.2
Power Dissipation Per Foot - Watts	125	125
DC Primary Power Output Voltage - Volts	400	400
DC Primary Power Supply Current - Amperes pk	70	210
DC Secondary Power Supply Voltage - Volts	12	12
DC Secondary Power Supply Current - Amperes	5	20

[00196] The output voltage and currents shown above are nominal and can vary from vehicle to vehicle as a specific vehicle's battery charge controller interface requirements may dictate. A worst case power dissipation can occur when the vehicle is parked or static over an activated set of PTM-CES 34 coils. In these instances there may be no moving air to assist in cooling. Therefore parking lot magnetic power transfer is limited to 1 KW per coil. Secondary power is supplied to the PRM 16 to power internal electronics such as actuators, proximity links and Data Link.

[00197] Power Receive Module (PRM) & Vehicle Interfaces

[00198] A vehicle's PRM 16 consists of a set of pickup coils, each with associated inductive reactance canceling AC capacitor and following high frequency bridge power

rectifier and series parallel wiring of DC outputs to the vehicle's battery charge controller. Three wireless links - two proximity links and a data link provide for energy transfer interlocking, billing data and passenger internet communications. These components are housed in a rugged weatherproof enclosure that when enabled for power transfer by the driver, is lowered and suspended below the vehicle at a nominal 3" fixed distance above the roadway.

[00199] Mechanical interface is accomplished by a suspension from the vehicle's front and rear axels and further augmented by roadway brushes that normally end 1" above the roadway that serve both as a means for debris removal and as a means to trigger raising of the PRM 16 to a "stow" position when major obstructions are encountered, such as a bump at moderate speeds or a rough roadway condition at normal highway speeds. The front and rear ends of PRM 16 are tapered to a V-shape to further limit the impact from roadway debris under all conditions. A dash panel control is used by the driver to lower PRM 16 towards the roadway and otherwise enable PRM power transfer. The mechanical actuator and controller for this deployment mechanism is located within PRM 16 itself and operates through the mounting points where the vehicle's axel extensions meet PRM 16.

[00200] PRM control electronics insures that actual power transfer occurs only when the vehicle's ID has been deemed valid and PRM 16 is in a proper alignment with PTM 14 coils as determined by the proximity links 28 and 32. Proximity links 28 and 32 include a low frequency magnetic signaling transmitter that utilizes the vehicle's power pickup coils themselves as transmission elements. This arrangement naturally limits the coupling coefficient of the proximity signal to a given PTM 14 coil in a manner that corresponds closely to that of the actual power transfer coupling coefficient between PTM 14 and PRM 16 coils. This insures an efficient transfer of energy. Additionally, the Proximity Link 28 signal from the vehicle is modulated with the vehicle's ID, that is demodulated at each PTM-CES 34 within local magnetic coupling range. This allows a further check on the validity of transferring power during the period of a PRMs 16 actual proximity to a given PTM-CES 34 coil. Normally each PTM-CES 34 coil maintains a dynamic stack or list of valid IDs in its neighborhood as established via the Data Link 30, a wide band LAN based communications link between vehicles and the roadway. Real time Proximity Link IDs are then matched from within this list to enable real-time power transfer. Eventually, IDs are dropped from the ID list as a vehicle leaves a given PTM-CES 34 neighborhood and new IDs are stored from approaching vehicles. In this manner there is a real time ID determining element having a non-complex and low data rate requirement.

[00201] The data link 30, with its greater flexibility, is dedicated more towards non-time critical functions of enabling and billing functions and vehicular internet communications. The data link 30 is a wireless microwave RF link between PTM-CES 34 mounted and vehicle PRM 16 mounted transceivers with associated antennas. PTM 14 segment interfaces then contain necessary routers and network adapters that link PTM 14 fiber data lines (with data to and from passing vehicle PRMs 16) to the internet network in a manner that effectively achieves continuous connectivity between vehicles and the internet. The PTM 14 power control logic may be seen in Figure 31 and the data link interfaces in Figure 32.

[00202] The DC power output from PRM 16 is at a voltage and current which is directly compatible with the vehicle's battery charge controller. The charge controller is capable of handling the combined power for both battery charging and the vehicle's electric propulsion motor demands while underway. The vehicle's battery supplies energy in parallel with the charge controller, and is therefore able to cover peak power demands of the vehicle, leaving PRM 16 driven charge controller to supply the average demand for both battery charging and propulsion. This cooperative energy sharing arrangement takes advantage of the best of both energy sources while minimizing stressful requirements. The resulting net efficiency of the WAVES energy transfer is therefore high, nominally 80%. This efficiency can be broken down into two multiplicative components: (1) PRM 16 and magnetic field generation; and (2) PRM 16 and charge controller efficiency, both of which are better than 90%.

[00203] As explained above, there are both static and dynamic applications for WAVES 10. From a market development perspective it may be advantages to begin with static parking lot or household charging applications since they avoid the need for comparatively large effects upon infrastructure, cost and government involvement. Given that initially there will be no electric or electric hybrid vehicles available with an integrated PRM 16, PRM 16 may be offered as a manufacturer add-on or as an aftermarket add-on to the vehicle. As such it is important to minimize mechanical and electrical interfaces to the production vehicle thereby minimizing costs. Especially regarding electrical interfaces, it is useful to consider that PRM 16 be able to supply voltages and currents that are directly compatible with the vehicle's existing "plug-in" battery charging port, thus eliminating the need for vehicle charge controller modification and warrantee restrictions.

[00204] One way to accomplish this is to allow PTM 14 to be amplitude modulated (AM modulated) at 60 Hz such that the rectified and power carrier filtered PRM 16 output

delivers 60 Hz standard voltages e.g. 110VAC / 220VAC and currents e.g. 15A / 30A. Note that this offers respectable charging rates of 1,650 watts / 6,600 watts. AM modulation is simply and directly accomplished within each PTM-CES 34 by a 60 Hz logic level gating of the power carrier using the exciter "Carrier Enable" control signal. In this manner the parking lot or home market is served in a manner transparent to the magnetic link coupling employed by WAVES. Vehicle ID data within the PRM's Proximity Link 28 determines the use of this modulation. Thus the same PTM roadway 36 embedded hardware is made to work with both early static market PRMs 16 and later, dynamic and vehicle integrated PRMs 16 without change thereby providing a seamless path towards the end goal of a ubiquitous roadway infrastructure.

[00205] Power Receive Module (PRM) Magnetic Power Coupling and Control

[00206] PRM 16 unit is suspended below the vehicle in a manner that allows vertical deployment towards the roadway when the driver enables WAVES to be used to couple power from the roadway. It is preferred that PRM 16 be flexibly suspended such that roadway obstructions cause an immediate and dampened retraction and preferable that the main suspension be from the wheel axels as opposed to underbody to minimize vertical motion effects from the vehicle's suspension. In this manner PRM 16 vertical distance to PTM 14 coils can be safely maintained at nominally 3 inches. It can be noted that both PTM 14 and PRM 16 coils are sealed and covered with a thick layer of tough plastic or other like material, made magnetically permeable by being heavily loaded with ferrite. This magnetically permeable layer forms a rugged Magnetic Field Window that removes the Tank Coil 74 from the physical environment at the roadway surface while virtually magnetically displacing coil 74 to the very top surface of the roadway thereby maintaining the smallest possible coupling gap to the vehicle PRM 16. In this manner the coils on both roadway and vehicle are protected without adding the thickness of the plastic to the air gap through which magnetic coupling occurs.

[00207] PRM 16 consists of several coils made resonant at the PTM operational power frequency to cancel the inductive reactance of each coil and thereby maximize coupled power. The total power coupled is the sum of coupling to all the PRM coils at any one time. By arranging PRM coils in a contiguous line down the center of the vehicle, from front to back, one can achieve this maximum power coupling with a similarly arranged line of PTM coils, located along the middle of the driving lane, by centering the vehicle within the lane. The more PRM coils that are in alinement, the more power is coupled. This highly useful attribute of WAVES to essentially provide greater power coupling in proportion to a larger

number of coupled coils, such as on larger vehicles, inherently matches power demands across a range of vehicle types utilizing a common roadway PTM.

[00208] Integrated Power Receive Module (PRM) Design

[00209] An integrated pickup coil and rectifier assembly for PRM 16, as shown in Figure 33, can be designed using techniques described previously within the above referenced Integrated Tank and Link Coil Design section. Grooved channels for each pickup coil can be machined or otherwise formed within an electric insulator sheet and subsequently filled with conductor material as previously described. Such a sheet can then be used as the substrate for mounted/integrated electronics required to interface with the vehicle's electric system. Such a formed sheet assembly can contain one and up to an entire PRM's contingent of coils, machined and assembled as a single unit. An outer cover can serve to envelop, protect and stiffen the entire PRM producing a robust sealed unit suitable for suspension under a moving vehicle.

[00210] Additional coils can be integrated within PRM 16 sheet assembly to serve as magnetic signaling pickup sensors that for instance can enable roadway or parking lot power transfer or transmit vehicle ID and/or other data from the vehicle to PTMs 14. One interesting design using multiple overlapping PTM 14 coils an minimize scalloping or misalignment losses during power transfer from associated PTM 14 coils. Rectifier/DC outputs from such interstitial and overlapping coils are or tied with other outputs to achieve graceful power summation as alignments between PTM and PRM change, sometimes continuously. Separate coil channels can be made from both sides of an electrical insulating sheet as one way to achieve coil overlap consistent with the previous implementation.

[00211] Note that the sheet material within which PRM 16 Pickup Coils are embedded can contain ferromagnetic material designed to enhance the concentration and coupling of the received magnetic field as well as provide the overall electrical insulation properties required.

[00212] It is possible to integrate pickup coil resonating capacitors within each coil to reduce size and cost. Furthermore such capacitors can be fabricated within the same material utilized to form the PRM 16 chassis (e.g. HDPE) and could be compactly located within the center area of each pickup coil. One such fabrication is to mill vertical slots into the (insulating) chassis material to into which metal capacitor plates are subsequently inserted to form the resonating capacitor. The separation between plates forming the required dielectric separators between opposing plates of the capacitor.

[00213] PRM to Vehicle Interface Design

[00214] Initial PRM 16 design and demonstration development focuses upon static charging capability, capable of supplying up to approximately 6.5 kw of continuous power through the vehicles conventional 60Hz AC power connection. A PRM output interface can be provided that duplicates 220VAC 60 Hz input such as to minimize wiring changes to the vehicle's charging circuitry. This can be accomplished by PTM waveform control wherein either the magnetic power carrier waveform is modulated or preferably, PRM 16 rectifier outputs are switched in polarity at a 60Hz rate to form a (filtered) square wave suitable for direct connection to the vehicle's grid compatible input. Regulation to maintain standard peak to peak AC voltages can be accomplished by circuitry within PRM 16 (e.g., duty cycle modulation of rectified output) or within a feedback loop to PTM 14 magnetic waveform power regulation or both.

[00215] As requirements to demonstrate greater energy transfer to the vehicle are presented, there will be a need to interface high DC power transfer to the vehicle's propulsion battery. Depending upon the vehicle's existing charge controller design and battery technology, separate charge controlling circuitry may be required within PRM 16 battery interface, along with associated wiring, software and circuit changes within existing vehicle components. The issue becomes one of making sure that the battery is always protected from receiving more energy than it can safely or effectively use. If the vehicle is under motion, some or perhaps all of PRM 16 power can be utilized by the vehicles motor with any excess power available for battery charging.

[00216] The preferred embodiment is that an additional (Class III) charging port is available within the vehicle's onboard charge controller and that this can be enabled while the vehicle is underway. In this way significantly high power charging can occur at all times and under proper supervision to insure safety and battery lifetime. PRM 16 electronics would then appropriately interface to this port as required (e.g. several hundred VDC at high currents netting high power transfer capability). Baring the availability of such a high capacity port, it may be possible to slave PRM 16 charge control circuitry to the vehicle's charge controller current regulation signal or other proxy signal such that a parallel battery charging circuit can be wired directly from PRM 16. This parallel circuit would of course be separately fused and current controlled to inhibit catastrophic failure from occurring. Alternatively, there may be a way to essentially mimic the operation of the vehicle's dynamic braking energy recovery system wherein associated circuit paths can be energized by PRM 16 in lieu of the vehicle's motor-as-generator energy source.

[00217] Dual Mode - Power Receive Module Charging or Physical Plug in Charging

[00218] There may be a need to be able to support both wireless and hardware plug in charging at a common parking site. This could be a way to ease market penetration, especially during the early phases of market acceptance where the majority of EVs are set up to only interface with plug charging. Referring to Figure 34, a dual mode may be accomplished by essentially locating an auxiliary PRM 16 pickup coil(s) and associated rectification/60 Hz waveform generation within/near the roadway located PTM 14 and appropriately combining and interfacing the embedded PRM 16 power to a plug station mounted adjacent to the parking area to be serviced. Figure 34 depicts one such method of achieving dual mode charging. A WiFi billing interface normally associated with PRM 16 can also be co-located with this kiosk or plug station to serve as an external energy metering and billing interface for the vehicle's driver. PTM internal charge control logic automatically adapts and insures that an appropriate power level is utilized in charging, same as would occur during wireless operation, however in this case the coupling between internally mounted PRM 16 and the tank coil 74 of the PTM 14 would be significantly higher. Therefore when the plug mode is enabled the external magnetic (leakage) field would be very low.

[00219] Conversely, when the wireless mode is desired, the vehicle's PRM 16 is utilized, the Plug and associated WiFi is disabled and PTM pickup coil within PRM 16 simply idles with essentially no power being supplied to an external (plug) load. The influence of the imbedded idling PTM pickup coil can be controlled in terms of capacitance within the design by appropriate spacing from the Tank and Link coils 134 and 132, respectively. Furthermore, due the availability of significantly greater coupling between these co-embedded coils, one may dispense with a resonating cap on the internal pickup coil, thereby decreasing it's influence in this regard, even further.

[00220] Roadway Intersection Installation

[00221] Intersection installations as depicted in Figure 35 offer a key transitioning and long-term solution to urban wireless electrification for vehicular traffic. It allows vehicles that are waiting at intersections to receive high rates of charging as well as receiving energization and charging during acceleration upon leaving. Through or opposing traffic can also receive high rates of energy transfer while passing through such intersections. Given that successive intersections are electrified, vehicles traversing a series of such intersections can be entirely compensated for, indeed net charged, for their energy needs while traveling. Since a continuous PTM roadway installation is not required, intersection electrification becomes an excellent intermediate step in highway electrification, requiring significantly less

investment in infrastructure while at the same time having good grid access. It is important to note that this city environment can also benefit from the incorporation of CHP for WAVES in cooperation with the needs of heating, cooling and powering of nearby buildings.

[00222] Referring to Figure 36, a simple "heads up" indicator notifies the driver where to steer within the lane to achieve maximum energy transfer based upon field sensing within the vehicle's PRM 16. It is anticipated that following a relatively few hours of use the driver will unconsciously refer only sporadically to this display, having been accustomed to driving with PRM 16 centered on lane and with knowledge that it is not critical that power transfer needs to be present 100% of the time. This sensing, in the future, can linked to steering and automated to the degree allowed by the safety and reliability of a future WAVES coordinated traffic flow system. In the initial phases of such development a servo-like linkage from lane sensing to steering would induce a "sweet spot" or slight inclination torque that gives the driver a steering wheel based sensory feedback that indicates steering for optimal power transfer.

[00223] Note that the future is very bright with regards further driving automation. Since individual PTM-CES 34 modules relay real-time vehicle ID and position within the roadway and operate as a 2-way data link to the vehicle, a highway system could indeed issue real-time commands to the vehicle to control steering, velocity and spacing to adjacent vehicles. This type of system would of course require safety backups such as now being deployed with vehicular radar, in a manner that produces a truly robust automated system.

[00224] Referring to Figure 37, the ability to widen the coupling aperture of PRM 16, such as to reduce driving accuracy requirements, requires additional parallel lines of PRM 16 coils. Each parallel line of coils effectively adds directly to the cross-roadway pickup aperture in a passive manner given an appropriately designed interconnection between pickup coils.

[00225] For the 1.0 foot wide x 0.8 foot long coils at both PTM 14 and PRM 16, the useful lateral driving accuracy requirements are 1.0 foot (+- 0.5 foot) per line of parallel PRM 16 coils. The nominal number of parallel PRM 16 coils on a vehicle is 3, yielding a 3 foot driving accuracy requirement for optimum power coupling, or +- 1.5 feet either side of the center of a given lane. This is a minimal system for accommodation of driving errors and could be linearly expanded by the addition of parallel lines of coils with minimal additional cost to PRM 16.

[00226] An appropriately designed interconnection non coherently combines the AC power from separately roadway coupled individual PRM 16 coils. First the AC power carrier

frequency resonant PRM 16 coils are individually rectified to produce DC power at nominally 200 V RMS @ 10 A RMS per coil. Then, individually rectified (potential) coil power sources are then parallel wired laterally across the three lengthwise running (column) PRM 16 lines of coil rectifiers to instantiate the required widened coupling aperture. This widened aperture is achieved since any one or more of the three lateral (row) coil sources can feed DC power to the PRM's output. This paralleling of coil rectifiers creates Row-DC power outputs, one for each row of PTM 14 coils (laterally across the vehicle's direction of travel). Row-DC outputs are then wired in a series parallel arrangement to achieve the desired voltage and current for input to the vehicle's battery charge controller.

[00227] WAVES 10 is a way to immediately normalize peak battery energy demands to allow them to become, at most, average energy demands for the majority of driving modes and applications. This energy normalization increases overall transportation system efficiencies while at the same time eliminates electric vehicle "range anxiety", charging time and effort. Thus WAVES accelerates DOE's critical drive to electrify ground transportation by the promotion of a broader and more robust electric vehicle market through lowered cost, increased performance and convenience.

[00228] Wireless Automated Vehicle Energizing System (WAVES) Prototype

[00229] An aggressive prototype development program has resulted in the design, construction and testing of a 3 Coil Demonstration Unit (3CDU). 3CDU Prototype Performance - Testing has produced a compact 115 VAC powered prototype capable of being transported to a non-laboratory based meeting where 115 VAC 20A fused standard wall plug power is available. It is capable of wirelessly transmitted (magnetically linked) power transfer of approximately 1.5 kW across a 6" gap to a resistive load bank consisting of 36 incandescent light bulbs. The operational frequency is nominally 360 kHz. In addition to the power transfer function, power management circuitry is incorporated to maintain a fixed power transfer at gaps less than 6 inches so as to maintain a safe power level at these closer coupling distances. Internal remote actuation, GFI and fusing are added safety features embodied within the design. The overall operational efficiency is estimated to be greater than 90% based upon light brightness and DC power levels input to amplifier modules. Lack of significant heating in power electronics and Tank Coils and Capacitors provides confirming evidence of very high operational efficiency.

[00230] 3CDU Prototype Detailed High Level Design

[00231] Figures 38 and 39 illustrate the 3CDU as comprised of 3 power amplifier modules, each with associated power transformer-less power supplies (AC-DC

3.5A@150VDC). A common oscillator and 12VDC control electronics power supply module provides carrier drive and control electronics power to each amplifier module. This subassembly forms PTM 14. A separate pickup coil and load bank subassembly forms PRM 16. PRM 16 is "floated" above PTM 14 on roller spaces to establish a 6" air gap between them.

[00232] 3CDU Prototype Power Amplifier Schematic

[00233] Figure 40 shows the 3CDU power amplifier as an H-Bridge configuration 70 of 4 commercial off the shelf low cost power MOSFET transistors. A current sensing transformer within one leg of the H-Bridge 70 is used to provide feedback to associated power control electronics that can suppress 1 or more half cycles of carrier generation to accomplish power regulation. Also shown are tuning capacitors that cancel Tank Coil Link 132 inductance to enhance efficiency. Tank Coil 134 and Tank Cap 120 are shown in a parallel resonant configuration (important to minimize power and voltages with under-coupled of PRM load cases) to complete the magnetic energy generation process associated with the PTM function. High frequency toroidal gate drive transformers provide the voltage isolations, phase relationships and low impedances necessary to adequately drive power MOSFET gates.

[00234] The use of an H-Bridge 70 effectively doubles the voltage swing on the Tank Link as related to the HBPA DC supply voltage, thereby allowing a factor of 4X power increase over single ended switch configurations. This is very important in reducing PA primary supply voltages for any given power output demand. Furthermore the ratio of Tank Coil 74 turns/Link (or autotransformer primary) turns is a further source of voltage increase and resultant V^2 increase in reactive power availability within the Tank Coil 74 field. Thus, by halving the number of Link turns for a given Tank Coil 74, the reactive/magnetic field power will increase by 4. This of course places voltage related stresses upon the Tank Coil 74 and Tank Cap 120 and corresponding insulation requirements all around, including link to Tank Coil 74 insulation. Furthermore, not immediately obvious, the net reactive energy cycling and stored within the parallel resonant tank circuit, similarly increased by such means, and available for (PRM) load coupling can also feed back in reverse, back to the power MOSFET switches during periods of normal (gate drive modulation for power control) and abnormal (load failure or rapid changes) conditions. Thus stored energy related transients can generate reverse voltage spikes and current surges that can be immediately and catastrophically destructive to MOSFETs within the HBPA. Reverse voltage spikes can defeat the nominal capability of intrinsic MOSFET diode designs and stimulate the parasitic

generation of a destructive avalanched transistor within the FET junction monolithic structure, permanently destroying said structure and producing severe current surges in surrounding components. Furthermore, gate "shoot through" due to before mentioned load related "spikes" can also destroy FET junctions with similar catastrophic results. High-voltage ultra-fast diodes have been paced in reverse bias across each MOSFET to inhibit the introduction of reverse voltage "spiking". Direct gate transformer drive connections are also made to a low inductance secondary and low voltage step up toroid transformer driven by a low impedance bipolar transistor driver configuration as a means for reducing the possibility of "gate shoot through". Additionally (discrete and other) capacitance has been reduced surrounding each MOSFET and high voltage rated (2X to 4X supply DC) MOSFETs are employed to reduce transient current requirements while increasing intrinsic voltage standoff capability. It has also been learned that it is important to maintain phase matching between (especially) adjacent HBPAs and associated Tank Coils 74 in order to reduce the possibility of outer Tank Coil winding to adjacent Tank Coil arcing and transient generation. This phase match is controlled by both HBPA drive signal phase relationships and by Tank resonant frequency matching (not immediately obvious). Future designs can mitigate such Tank to Tank phase shifts by closing a phase locked loop solution around a measurements of instantaneous phases within each tank magnetic field such as to accommodate load dynamic and circuit related phase mismatch.

[00235] 3CDU Tank Coil Design

[00236] Figure 41 illustrates the Tank Coil 74 design associated with each 3CDU Power Amplifier Module. High frequency AC skin effect and resistive losses are important factors to control within the design. The design is a single spiral coil constructed in a flat plane from hand formed Litz wire 126 comprised of 4 strands of #20 insulated coated solid copper of circular cross-section. Winding to winding separation and insulation within the Tank Coil 74 is important to withstand high voltage per turn differentials.

[00237] 3CDU Prototype Tank Cap Design

[00238] Figure 42 shows the 3CDU Tank Cap 120 design that provides critical high voltage rated and low dielectric and conduction losses necessary for reliable and efficient operation. Note the center "trimmer" section critical to being able to match Tank resonance to desired operational frequency.

[00239] 3CDU Prototype Pickup Coil Design

[00240] Figure 43 illustrates the 3CDU pickup coil design within PRM 16. This is a critical function in achieving a maximal coupling and efficient energy transfer from PTM 14

to PRM 16. High frequency AC skin effect and resistive losses remain important factors to control within the design. The design is a single spiral coil constructed in a flat plane from hand formed Litz wire comprised of 6 strands of #20 insulated coated solid coper of circular cross-section.

[00241] 3CDU Prototype Pickup Coil Resonating Cap Design

[00242] Figure 44 illustrates the 3CDU pickup coil resonating cap design within PRM 16. This is a critical function in cancellation of the pickup coil's inductive reactance and achieving a maximal coupling and efficient energy transfer from PTM 14 to PRM 16. High frequency AC dielectric and resistive losses are important factors to control within the design. Note the center "trimmer" section critical to being able to match Tank resonance to desired operational frequency.

[00243] 3CDU Prototype Power Amplifier Control Electronics

[00244] Figure 45 illustrates the 3CDU control electronics design within the PA 122 Module. The functions include PA 122 waveform over-current threshold detection and associated PA drive gating. PA 122 waveform over-voltage threshold detection and associated PA drive gating. Drive signal inhibit from externally derived control signal. Transistor drivers suitable for driving high MOSFET gate capacitance via PA 122 located transformers. The PA gate drive and coil polarity relationships may be seen n Figure 46.

[00245] 3CDU Prototype Variable Frequency Electronics

[00246] Figure 47 illustrates the single Variable Frequency Oscillator and associated 12VDC power supply for it and the 3 PA 122 module Control Electronics. The functions include carrier waveform generation and associated external/operator inhibit switch for PA 122 drive gating.

[00247] 3CDU Prototype PTM Chassis Layout

[00248] Figure 48 shows the physical relationship between major subassemblies within the PTM chassis and relationship to PRM 16 and co-located load bank.

[00249] 3CDU Prototype PRM Chassis Layout

[00250] Figure 49 illustrates the physical relationship between major subassemblies within the PRM chassis with co-located load bank and relationship to PTM 14. Three sets of pickup coils associated resonating caps and 12 incandescent bulbs are shown. Bulbs are wired as 3 subsets of 4 bulbs in series, with all subsets wired in parallel to form a single resistive load for each pickup coil. Thus a total of 3 x 12 or 36 bulbs comprise the total load bank. This load bank is capable of safely dissipating 1.5 kW for reasonably long periods of steady state/CW wireless power coupling during demonstrations.

[00251] It is significant to note that metal foil covered plastic has been used in the construction of the 3CDU Prototype. Rectangular cell sheets of plastic were covered with aluminum foil tape and electrically connected to power and module grounds to form a cohesive termination of residual ground current loops and shielding to help attenuate any unintended RF radiation. The additional use of individual heavy aluminum foil covers over control electronics at each PA 122 module is a means to protect sensitive electronics from power carrier magnetic field induced interference. The use of such foil conductive materials is a fundamental means for reducing weight and cost, while allowing the use of plastics and other lightweight, tough and flexible structural materials for the body of PTM 14 or PRM 16 construction. The use of foil materials are especially relevant to a resultant conduction verses weight efficiency match to the relatively shallow skin depth of the majority of conducted currents at Power Carrier frequencies.

[00252] Note that the completed prototype was successfully operated and total coupled power levels were estimated to be in excess of 1000 watts, while the operational efficiency was estimated to be greater than 90% from line to load over a 6" air gap.

[00253] Power Transmit Module Energy Transfer and Waveform Management Features

[00254] One important aspect of the present invention is the inclusion of fail-safe & self-protection features integrated within each PTM-CES 34 enable low failure rates, performance monitoring and autonomous fault location. Included among these are the automated power fold-back and/or shutdown to protect against abnormal load conditions or component failures.

[00255] Another important feature of the present invention is the soft adaptability to flexibly meet Differing Vehicle Interfaces and Operation with minimal or no added vehicle hardware are provided by the RF Data Link 30 interactivity with vehicle electronic control systems. Critical real-time operational control is facilitated (via software) to accommodate variations in battery state of charge, apportionment of energy between battery and motor, acceleration and braking operations, traffic status and other. The ability of PTM 14 to electronically modulate bursts of energy to create 60 Hz/50Hz or other AC power frequencies and voltages as direct output from PRM 16 allows direct charging or vehicle powering from conventional "plug in" interfaces. A "smart roadway" and "smart parking area" is created by such an environment, delivering only appropriate levels and formats of energy to the vehicle or otherwise effecting vehicle systems behavior to achieve the safe and efficient operation.

[00256] Yet another important aspect of the present invention is the high power generation efficiency achieved by power amplifier gating and parallel resonance within the Tank Coil 74. The Power amplifier 122 remains gated off when no vehicle loads are present or enabled. The MOSFET amplifier configuration allows near zero power dissipation whenever gate drives are removed. The inhibiting of Power Amplifier 122 gate drives for all times except for when the vehicular load is present is therefore a primary way of limiting losses. Additionally, the use of a parallel resonant tank circuit as the magnetic radiator allows losses at this high power point to be a percentage (small) of the power coupled to the vehicular load and not constant, thus further facilitating efficiency.

[00257] A further advantage of the present invention is the closed loop charging power regulation via interactivity between PTM 14 and PRM 16 over the Data Link 30 with data from vehicle charge sensors providing a means for controlling delivered power and consequently reducing the need for vehicle charge control hardware while increasing safety and efficiency. In this way PTM-PRM power is transmitted directly to battery 26 without passing through added high power electronic control systems onboard the vehicle, in the amount dictated by real time battery storage and environmental needs.

[00258] As seen in Figure 50, yet another important aspect of the present invention is the integration of the Tank Coil 74 and Tank Cap 120 into a common single integrated component utilizing conductive foil or otherwise high area conductors with dielectric spacing to establish parallel resonance. This approach minimizes high voltage wiring and high voltage Tank Cap 120 requirements. Further integration of drive link coupling as an autotransformer at the grounded end of the Tank Coil 74 is a further reduction in discrete components (note that foils can readily serve as effective conductors within both capacitors and coils at the frequencies nominally employed within power electronics). Foil construction is especially relevant to maintaining low weight and cost while reducing skin effect losses associated with AC current transfer.

[00259] Roadway Physical Locking can be accomplished by a centralized vertical bolt with special keying to inhibit theft at each PTM-CES 34 module. This bolt travels within central reinforcement structural strength member that is environmentally isolated from internals of module. The bottom end of bolt engages with bottom of roadway trench to secure module to roadway. The attachment to roadway trench can be indirect via the RTC wherein the RTC is independently and periodically secured to the roadway trench and provides an appropriately located and spaced socket for the vertical bolts from the top of PTM-CES 34 modules.

[00260] The present invention also involves Faraday and non-resonant shielding of PTM 14 and roadway surface located Tank Coils by the use of nonmagnetic metal skins, including foils and films that surround individual PTM-CES 34 and PTM 14 components. The purpose being to significantly reduce the unintended emission or radiation of RF energy, especially at the GPMI and power carrier frequencies and related harmonics and sidebands, without significantly effecting magnetic field coupling to vehicles, either at power or signaling frequencies. The use of a metallic skin overlay over the top (roadway level) of the Tank Coil is especially significant in this regard, this skin can be patterned to provide RF attenuation while at the same time remain transparent to magnetic fields utilized by WAVES. Patterning in effect can be non-resident at power carrier and magnetic signaling frequencies thereby minimizing respective induced currents.

[00261] The present invention also includes thermal transfer and high voltage insulation by the use of an oil that surrounds high voltage & high power components (especially power carrier components such as Tank Coil Cap 120, high power amplifier components and perhaps Tank Coil 74). Oils such as silicon based oil have both excellent thermal conduction/ convective/ distribution properties and excellent high voltage insulating properties that when properly employed internal to PTMs 14 allows corona suppression and heat dissipation to outer and lower subsurface areas of the roadway trench where lower temperature promote efficient heat transfer at correspondingly lower operational temperatures. Such a design limits moisture penetration ant related corrosion and electrical conduction issues. Furthermore the potential exists to eliminate solid dielectrics within critical capacitors such as within the Tank Cap 120. Such oils can serve this function directly while again promoting heat transfer from high power capacitors.

[00262] The "V" Shaped PTM 14 of the present invention promotes efficient design for heat transfer from "V" bottom areas of PTM 14 to external side-walls and trench. The "V" shape is also an efficient volumetric match to the needs for a relatively large surface for roadway-level Tank Coil 74 at the top of the "V" and the relatively smaller dimensioned and volume associated with power electronics potentially located lower down within the "V" cross-section. The Tank Cap 120 could be conveniently integrated as a distributed capacitance within the Tank Coil 74 itself or given the need for added capacitance could be a separate component located directly below Tank Coil 74. High area as available within this region of the "V" is an advantage in lowering the cost and mounting of such capacitors especially at the frequencies nominally employed by the power carrier. Advantage can also be made of the vertical dimension of the "V" for such Tank Cap 120 location while overall

volume is conserved over other perhaps rectangular cross-sections. The "V" cross-section also promotes ease of installation minimizing additional or difficult filing of roadway material both at surface and subsurface of PTM 14. Additionally, and critically, The "V" cross-section is inherently mechanically strong, easily internally cross-brace able to further strengthen and allows direct downward weight and related traffic loads to be distributed to the vertical side-walls of the receiving trench, providing crush resistance with minimal distortion. Such "V" trench sidewalls can readily receive sealant/cushioning/tolerance absorbing/weatherizing/sealing/heat conducting material during installation to insure proper installation and tolerances to roadway surface.

[00263] Primary Power Distribution Features

[00264] The present invention includes an efficient PTM-CES 34 power distribution architecture that minimizes GPMI 48 conversion losses from the grid 18 and/or CHP 50 and associated roadway or parking area transmission cable 92 and related PTM 14 primary power losses. The high voltage transformer-less design of GPMI 48 reduces conversion losses and the modularity allows subdivision of the load by the number (or effective number) of phase lanes of provided as load. This subdivision reduces GPMI 48 design requirements to where current technology is able to cost effectively implement this function. This subdivision also introduces redundancy within the transmission and load architecture where phase failures represent a "soft" system failure, degrading PTM 14 power generation in a more or less linear fashion. The ability to electronically optimize GPMI 48 phase power generation, based upon roadway loading, increases conversion efficiency. The provision of multiple phases at transformer primaries within RTC 92 reduces current by the number of phases thereby making the size and material of each related phase transformer practical and cost effective. The relatively high frequency (60 kHz nominal) makes the implementation of each phase transformer practical for this application. The design of RTC 92 negates skin effect losses associated with this relatively high frequency by the use of metalized plastic or metal foil conductors that in turn can provide a low cost light weight alternative to conventional cabling such as copper wire. Further geometry considerations within RTC 92 cabling allow a shielded transmission line ducting of transmitted energy enhancing EMI shielding and reducing losses. Furthermore, internal geometry of foil conductors facilitates connections to imbedded transformer primaries thereby enhancing reliability and lowering costs of manufacture. The ability of high speed turbines as utilized within current CHPs allow the migration of some or all GPMI 48 power conversion into CHP 50 function with appropriate associated electrical generator design.

[00265] The present invention also encompasses grid back-up configurations with distributed generation and peak shaving that is facilitated by the CHP 50 grid inter-tie functionality and WAVES 10 ability to "smartly" interact with vehicle loading. Grid inter-tie further enhances reliability beyond load sharing to being able to completely supply roadway or parking needs under periods of grid failures or vice-versa under CHP failures. RTCs 92 can be terminated into RTCs 92 in adjacent roadway or parking segments to produce a combined network of power distribution and distributed generation and grid connectivity that further enhances redundancy for failure mitigation. The phase locking mechanisms within each GPMI 48 readily facilitates such segment to segment inter-tie.

[00266] The present invention also provides inherently weatherized interconnection to PTM-CES 34 units by utilizing magnetic fields as the power transfer mechanism and thus allows liberal use of waterproof electrical insulation surrounding RTC 92 imbedded phase transformer primaries and associated secondaries within PTM-CES 34 units. Only the physical parting interface is exposed to the roadway/parking environment. Such magnetic material is readily formulated and/or coated to resist corrosion at these parting interfaces with minimal effect upon power transfer efficiency.

[00267] The present invention further accomplished simplified and efficient PTM 14 coil and related electronics implementation due to the modularity and construction of individual PTM-CES 34 units. The relatively large number of PTM-CES 34 units activate able per vehicle (nominally 14 for small vehicles) allows the use of low cost and electrically efficient power generation and control electronics such as power MOSFETs and diodes etc. The Tank Coil 74 is a critical component in the establishment of the roadway/parking magnetic field source for energy transfer. Since the operational frequency is in the region where skin effect is an important source of losses (nominally 360 kHz) the design of this component requires careful consideration. Current Litz wire 126 construction can be replaced with metal foil implementation wherein a spiral of metal foil and associated interwinding dielectric or other geometry coil is fabricated. The depth of this coil from the roadway can be made to accommodate the foil width required, to suitably reduce resistive losses (bulk conduction and skin effect). Furthermore, the design of this coil can be tuned to resonance at the operational power frequency through the control of dielectric spacing and material and by the number of foil turns within the coil. This can accommodate the Tank Coil 74 and all or part of the Resonating Tank Capacitor 120 function thereby decreasing cost and overall volume while simplifying the architecture.

[00268] Power Receive Module Features

[00269] The present invention may provide for passive driving error mitigation by the use of multiple PRM 16 receive coils. The energy received by two or more PRM 16 receive coils on an plane parallel to the roadway and on an axis relatively perpendicular to the vehicle's direction of travel can be coherently (AC) or noncoherently (DC) combined such as to effectively increase the PRM's energy receiving aperture in direct proportion to the combined area of the individual receive coils. In this manner, driving errors can be mitigated with minimal loss in efficiency and no physical tracking by PRM 16.

[00270] The present invention may additionally provide simplified physical and electrical integration vehicle steering sensory feedback adjuncts via the sensing of roadway magnetic fields in relation to vehicle path enables feedback to both driver and automated steering systems onboard vehicles to either allow errors to be sensed and easily manually corrected or fully automated steering. This includes automatic alerting and drive mitigation with regards adjacent lane or fore and aft vehicles in a WAVES connected roadway environment. Knowledge gained from energized PTM-CES 34 units can be collected, aggregated and disseminated by the WAVES (system) to roadway vehicles to address roadway navigation and safety issues.

[00271] The present invention further provides an integrated pickup oil and resonating cap combined into a common single integrated component utilizing conductive foil or otherwise high area conductors with dielectric spacing to establish parallel resonance. This approach minimizes high voltage wiring and high voltage PRM Resonating Cap 120 requirements (note that foils can readily serve as effective conductors within both capacitors and coils at the frequencies nominally employed within power electronics). Foil construction is especially relevant to maintaining low weight and cost while reducing skin effect losses associated with AC current transfer.

[00272] The present invention includes parallel and otherwise resonated load specific to the power carrier frequency(s) employed allow for selective power transfer to vehicle loads. This represents a fundamental means for limiting power transfer to non-intended loads such as passive metallic objects on the roadway or vehicles. This feature can be employed to selectively supply energy to specific classes of vehicles or to otherwise differentiate the power transfer mechanism.

[00273] Like the roadway surface, the present invention includes Faraday and non-resonant shielding of PRM 16 and located pickup coils by the use of nonmagnetic metal skins, including foils and films that surround individual PRM 16 and PRM 16 components. The purpose being to significantly reduce the unintended emission or radiation of induced RF

energy, especially at the power carrier frequency and related harmonics and sidebands, without significantly effecting magnetic field coupling to the vehicle and roadway, either at power or signaling frequencies. The use of a metallic skin overlay over the bottom (roadway level) of PRM 16 coils is especially significant in this regard, this skin can be patterned to provide RF attenuation while at the same time remain transparent to magnetic field frequencies employed by WAVES 10. Patterning in effect can be non-resident at power carrier and magnetic signaling frequencies thereby minimizing respective induced currents.

[00274] The present invention also employs imbedded DC rectification with power summing capability for the passive mitigation of driving errors and the accommodation of different voltage/current outputs to meet differing EV energization needs. Or-tying of power carrier rectified power can in turn sum respective outputs from several PRM 16 coils with minimal loss from coils not fully excited magnetically. This is deemed non-coherent power summation. Series parallel combinations of rectified coils, in turn, provide combinations of voltage/current outputs from PRM 16 to meet differing EV energization requirements.

[00275] Referring to Figure 51, the present invention provides imbedded synchronous rectification with power summing and AC voltage generation capability for the passive mitigation of driving errors and the accommodation of different voltage/current outputs to meet differing EV energization needs. Synchronous rectification is an efficient means of rectification since fast high power switching transistors such as power MOSFETs can nearly eliminate the diode voltage drops associated with power diodes, which may be typically 1.2 volts for fast high voltage diodes. By dynamically synchronizing to alternating phases of the power carrier frequency picked up by PTM 14 coils, AC waveforms of lower power frequencies can be synthesized. Of particular interest are 50 and 60 Hz which are standard AC power frequencies world wide. Such converted power is useful for direct application to existing EV charging circuitry so as to provide hardware minimal interfaces to existing charging ports.

[00276] By phase synchronizing drive signals (transformer isolated) to the power carrier waveform as received by PRM 16 from PTM 14, the polarity of the output can be controlled in both static and dynamic senses by way of the switching of appropriate power MOSFETs on each side of the output circuit. Furthermore, gate drives can be duty-cycle modulated or otherwise shaped to effect net instantaneous power transfer to the output, thereby allowing sinusoidal or other net waveform generation at sub-carrier output frequencies (e.g. 60 Hz) including DC. Note that power carrier related components of the

output are smoothed/integrated/filtered/sufficiently eliminated by carrier filter capacitors or other output filtering that leave desired sub-carrier waveform intact.

[00277] WAVES Strapping Approach to PTM Assembly and Fabrication

[00278] Referring to Figure 52, it is important to be able to easily and robustly assemble at least three levels of PTM 14 housing to insure integrity and strength while minimizing costs. The use of heavy duty strapping allows the levels of housing components to be placed in compression awith great pressure thus insuring that components remained sealed under lifetime of use with heavy traffic loads. Strapping can be removed for maintenance as necessary. Tensioning of straps during manufacture is easily and cheaply accomplished as the straps are inserted through various slots within the PTM cross-section and looped or otherwise secured following compressive tensioning.

CLAIMS

What is claimed is:

1. A wireless energizing system for charging an electric battery positioned in a vehicle, comprising:

a power transmit module positioned in a fixed location and including at least one transmit coil for transmitting power via a magnetic field;

an interface magnetically coupling said power transmit module to a power source; and

a power receive module attached to said vehicle and interconnected to the battery, wherein said power receive module includes at least one pickup coil for receiving said power from said power transmit module via said magnetic field when positioned proximately to said power transmit module.

2. The system of claim 1, wherein said transmit coil and said pickup coil are formed from conductive foil.

3. The system of claim 1 wherein said interface comprises a grid power multiphase interface comprising a set of phase inverters that are phase linked to transform power received from said power source to six phase if nominally multi-kHz power.

4. The system of claim 3, wherein said interface further comprises a transformer cable having a set of magnetically coupled transformer links for transmitting power from said set of phase inverters to said power transmit module.

5. The system of claim 4, wherein said interface comprises conductors formed by conductive foil.

6. The system of claim 3, wherein said grid power interface enables distributed generation power sources in parallel with grid power sourcing.

7. The system of claim 1, wherein each said transmit coil comprises a power amplifier for energizing a link coil having a first predetermined number of turns that is magnetically coupled to a tank circuit including a tank coil having a second predetermined number of turns that is greater than said first predetermined number of turns of said link coil and a tank capacitor.

8. The system of claim 7, wherein said tank capacitor includes a plate split into first and second sections, and wherein said first section is coupled to an external capacitor for monitoring the voltage of said tank capacitor in real-time and regulating power inductively coupled to a load based on said monitoring.

9. The system of claim 8, further comprising a transformer with primary formed from a set of conductors within a Litz wire primary.

10. The system of claim 8, wherein said transmit coil is formed from conductive foil.

11. The system of claim 1, wherein said power transmit module further includes a microprocessor programmed to establish a proximity link to said vehicle that triggers the transmission of power from said transmitter when said vehicle is located proximately to said power transmit module.

12. The system of claim 1 further comprises a display configured to indicate to a driver of said vehicle the location of said vehicle relative to said power transmit module.

13. The system of claim 12, further comprising a series of power transmit modules, each of which is triggered to transmit power when said vehicle is located proximately to said power transmit module.

14. The system of claim 13, wherein said series of power transmit modules are concatenated and positioned along a section of a roadway.

15. The system of claim 14, wherein each of said concatenated power transmit modules are energized only when said vehicle is proximity thereto.

16. The system of claim 1, wherein said power receive module includes a microprocessor programmed to establish said first and second proximity links and said data link with said microprocessor of said power transmit module.

17. The system of claim 1 wherein said power receive module includes a predetermined plurality of pickup coils, the number of which are based on the power demands of the vehicle.

18. The system of claim 1, wherein said power transmit module is located within a V-shaped groove.

19. The system of claim 18, wherein a plurality of said power transmit modules are concatenated and removeably positioned within said groove.

20. The system of claim 19, wherein said groove is formed in a roadway lane.

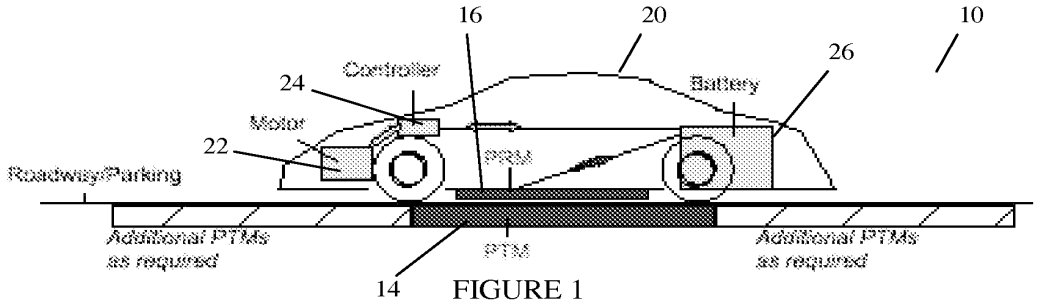


FIGURE 1

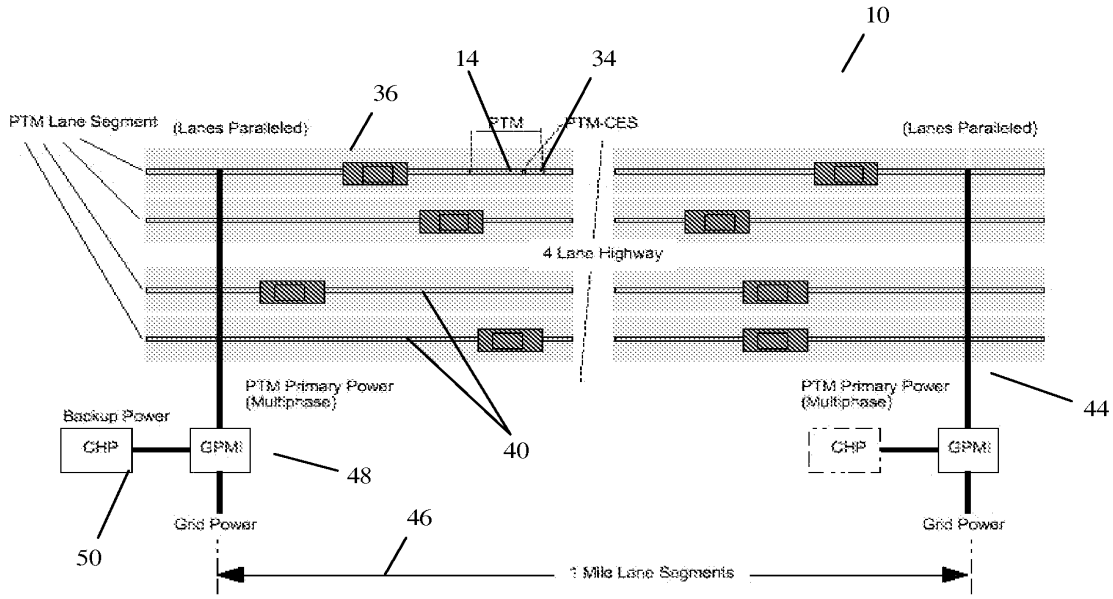


FIGURE 2

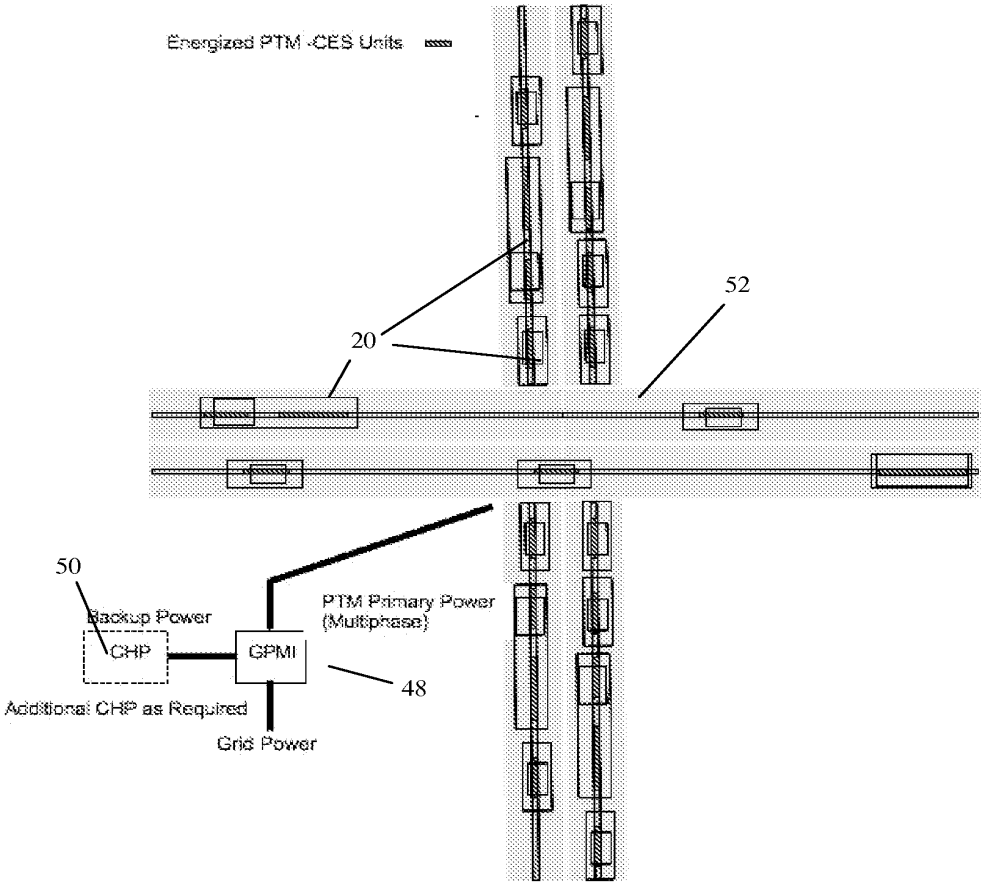

Energized PTM 4CES Units
20
52
50
Backup Power
CHP
GPMI
PTM Primary Power
(Multiphase)
48
Additional CHP as Required
Grid Power

FIGURE 3

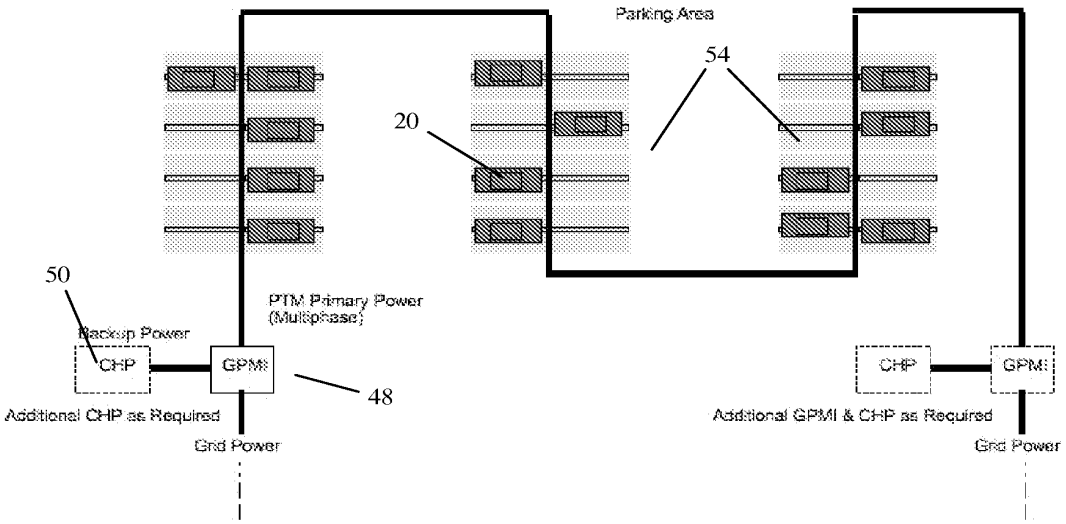


FIGURE 4

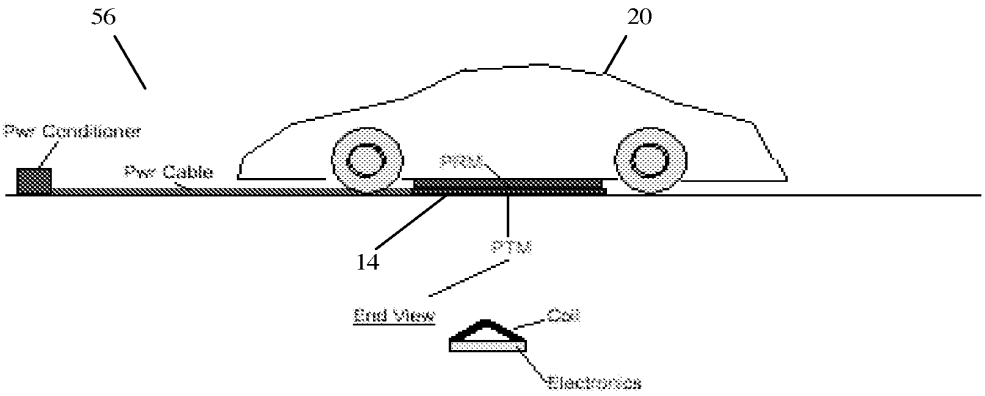


FIGURE 5

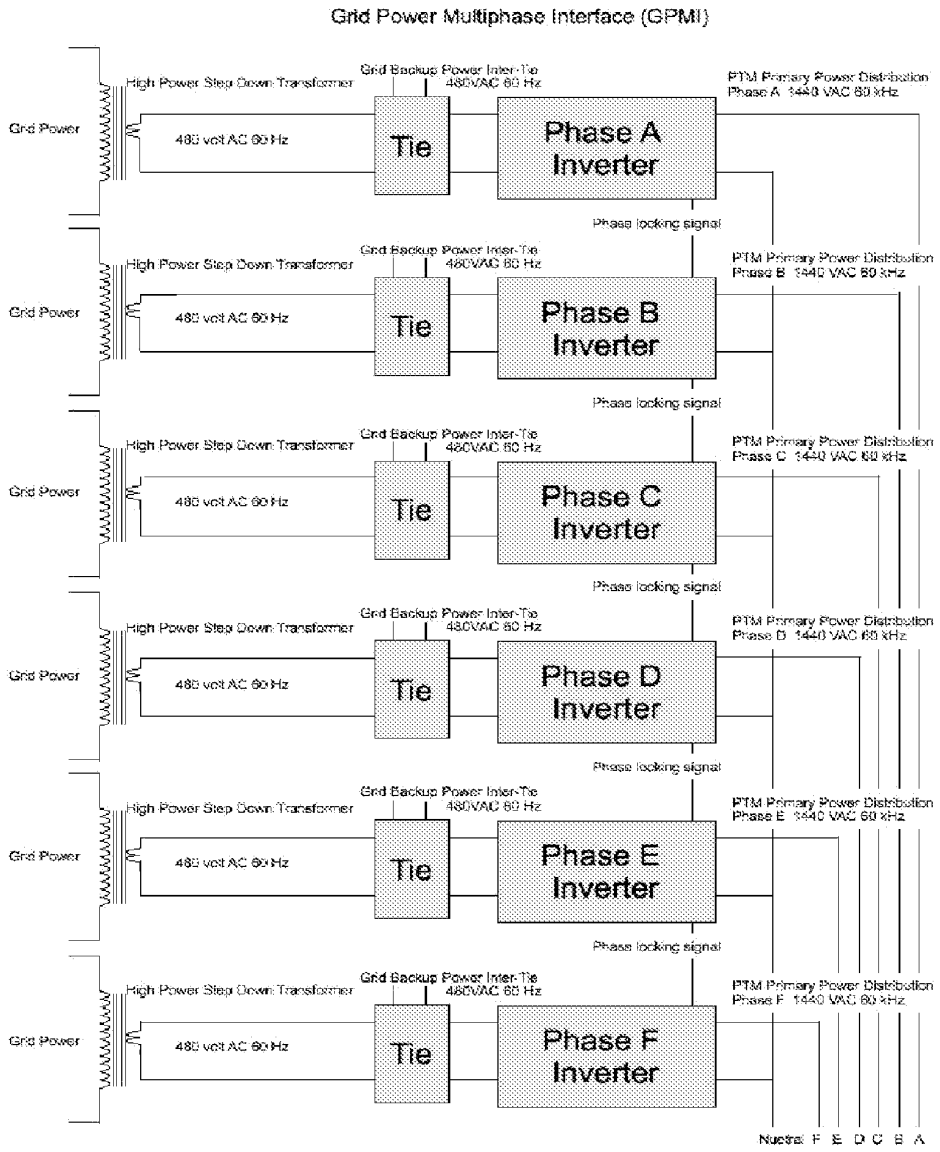

Grid Power Multiphase Interface (GPMI)
Grid Power
High Power Step Down Transformer
480 volt AC 60 Hz
Grid Backup Power Inter-Tie
480VAC 60 Hz
Tie
Phase A Inverter
Phase B Inverter
Phase C Inverter
Phase D Inverter
Phase E Inverter
Phase F Inverter
Phase locking signal
PTM Primary Power Distribution
Phase A 1440 VAC 60 kHz
Phase B 1440 VAC 60 kHz
Phase C 1440 VAC 60 kHz
Phase D 1440 VAC 60 kHz
Phase E 1440 VAC 60 kHz
Phase F 1440 VAC 60 kHz
Neutral F E D C B A

FIGURE 6

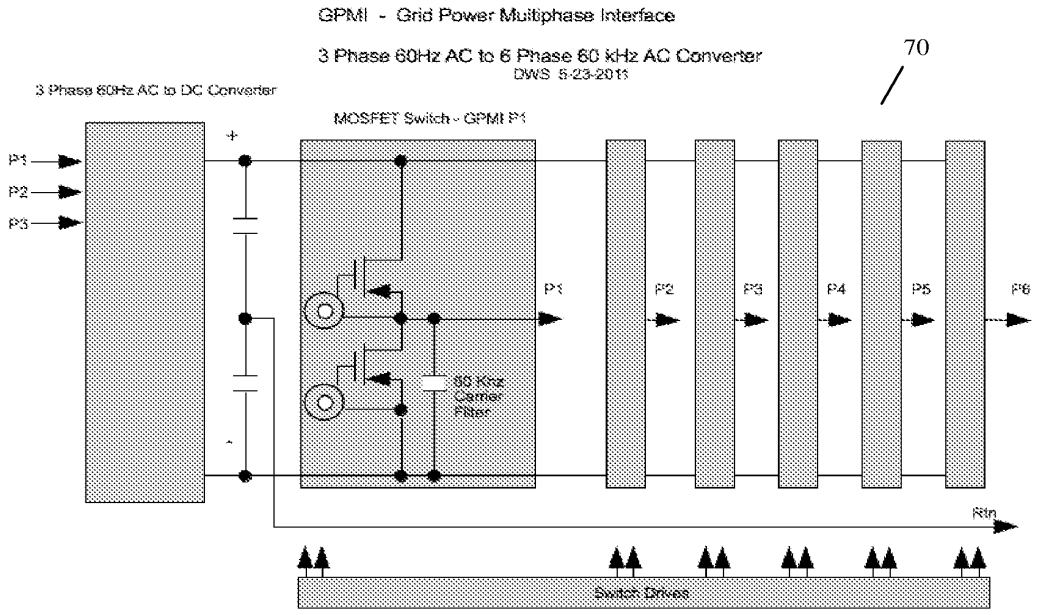


FIGURE 7

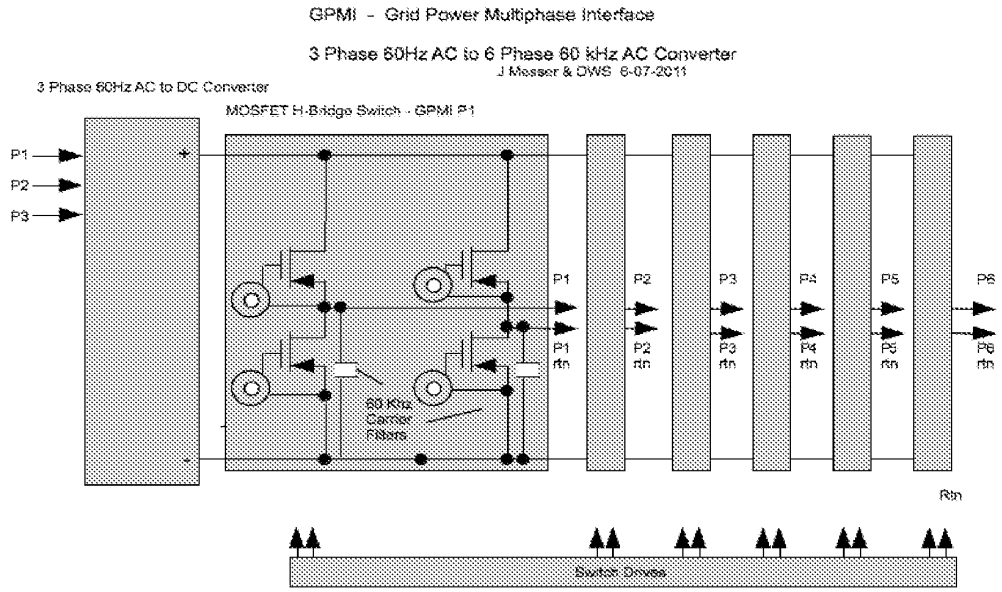


FIGURE 8

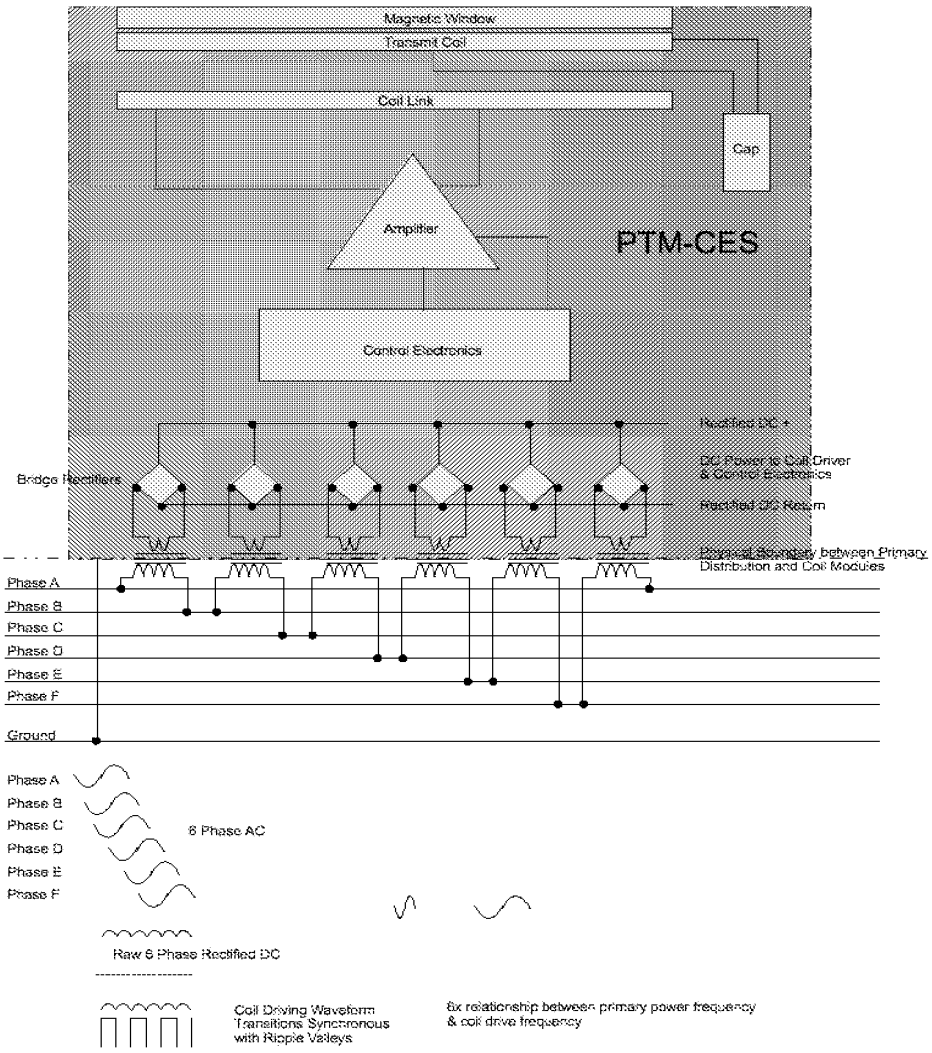

Magnetic Window
Transmit Coil
Coil Link
Cap
Amplifier
PTM-CES
Control Electronics
Rectified DC +
DC Power to Coil Driver & Control Electronics
Rectified DC Return
Bridge Rectifiers
Physical Boundary between Primary Distribution and Coil Modules
Phase A
Phase B
Phase C
Phase D
Phase E
Phase F
Ground
Phase A
Phase B
Phase C
Phase D
Phase E
Phase F
6 Phase AC
Raw 6 Phase Rectified DC
Coil Driving Waveform Transitions Synchronous with Ripple Valleys
fix relationship between primary power frequency & coil drive frequency

FIGURE 9

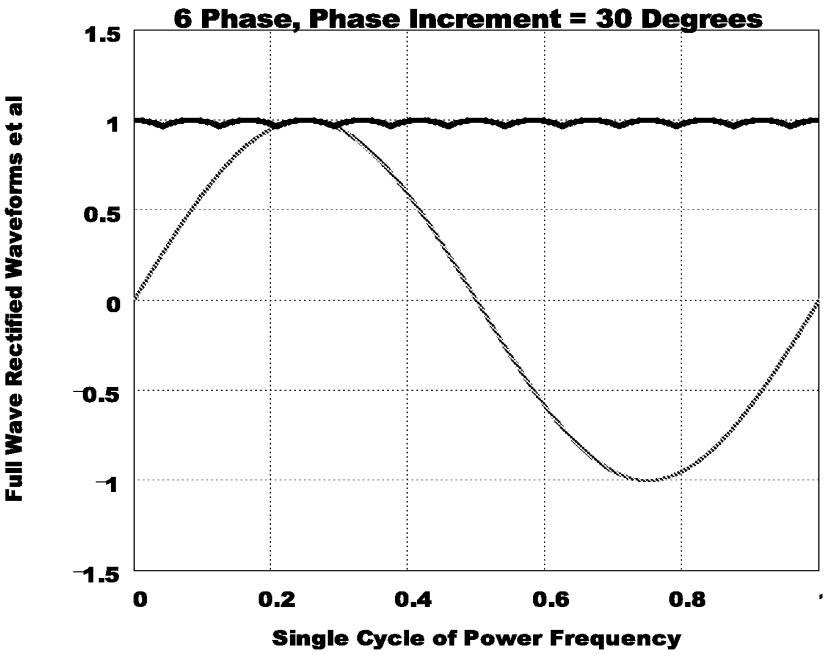

6 Phase, Phase Increment = 30 Degrees
Full Wave Rectified Waveforms et al
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.2
0.4
0.6
0.8
Single Cycle of Power Frequency

FIGURE 10

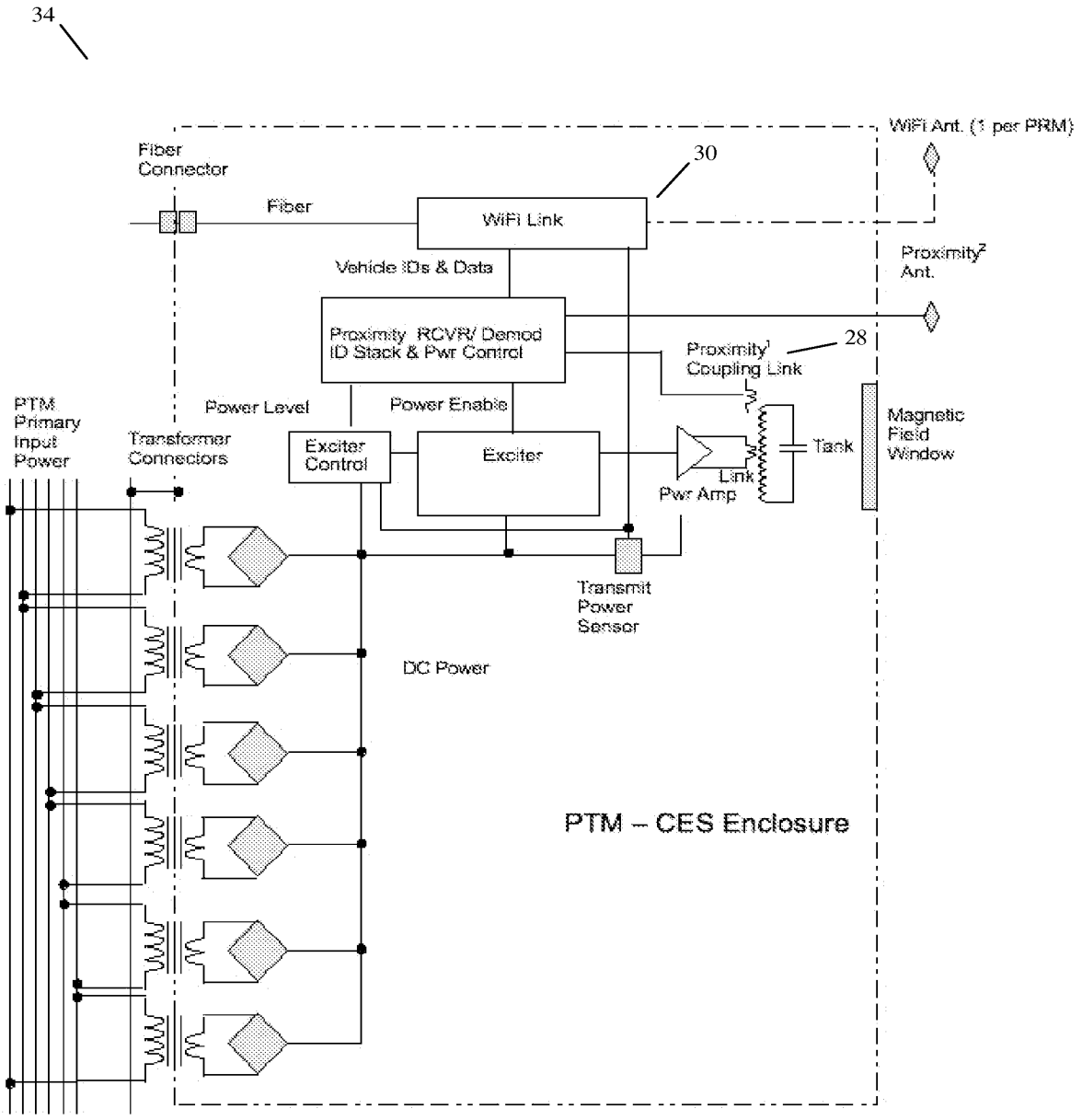

34
WiFi Ant. (1 per PRM)
Fiber Connector
30
Fiber
WiFi Link
Vehicle IDs & Data
Proximity² Ant.
Proximity RCVR/ Demod ID Stack & Pwr Control
Proximity¹ Coupling Link
28
PTM Primary Input Power
Power Level
Power Enable
Transformer Connectors
Exciter Control
Exciter
Link Pwr Amp
Tank
Magnetic Field Window
Transmit Power Sensor
DC Power
PTM – CES Enclosure

FIGURE 11

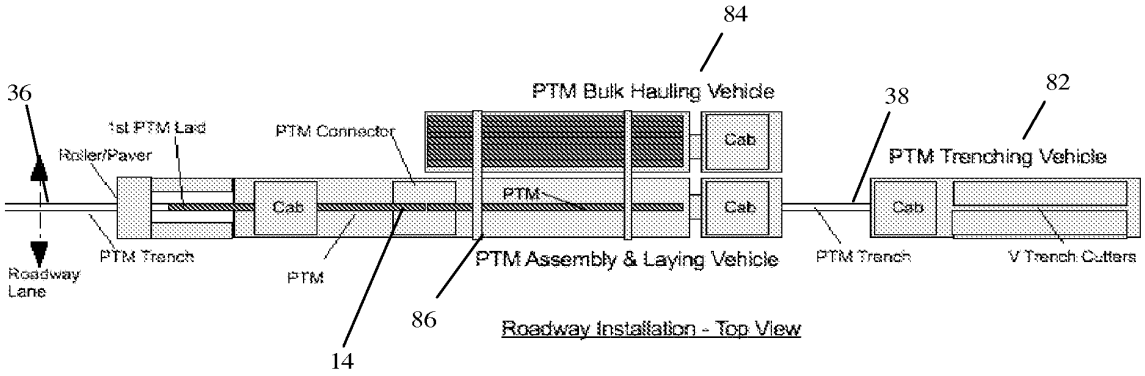


FIGURE 12

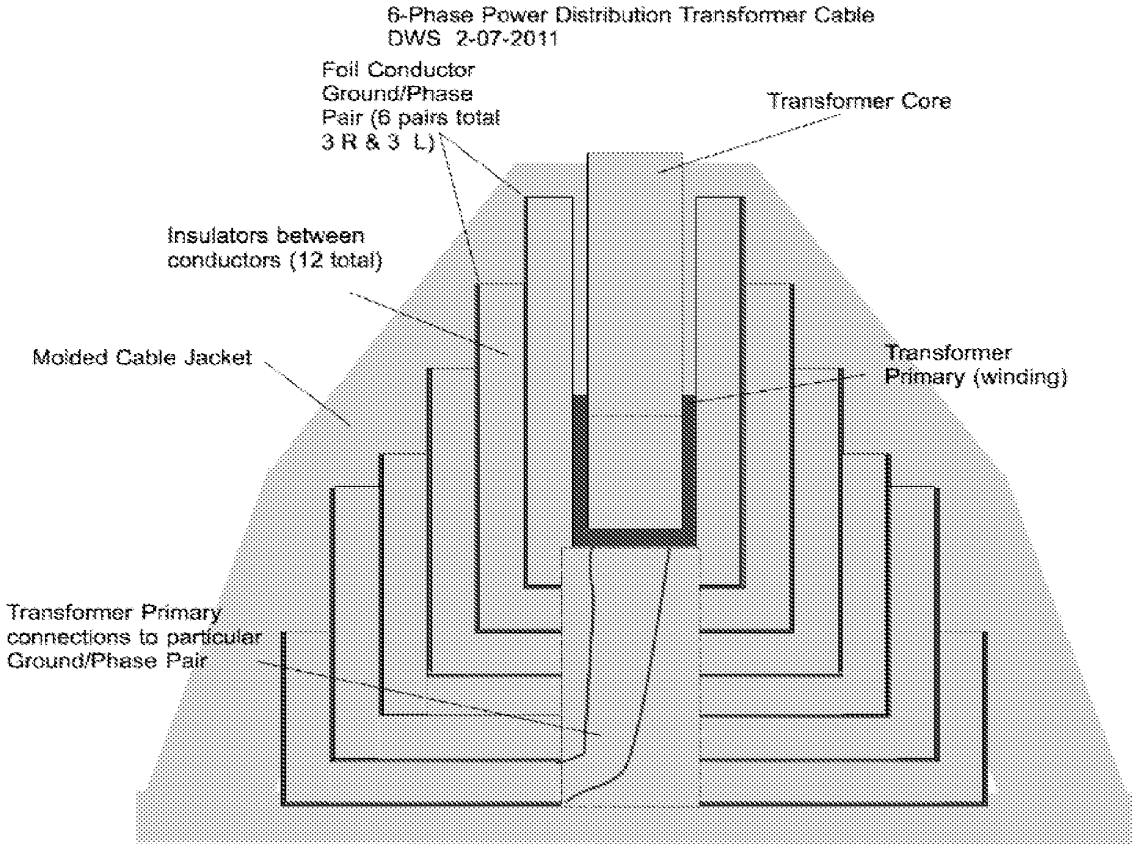


FIGURE 13

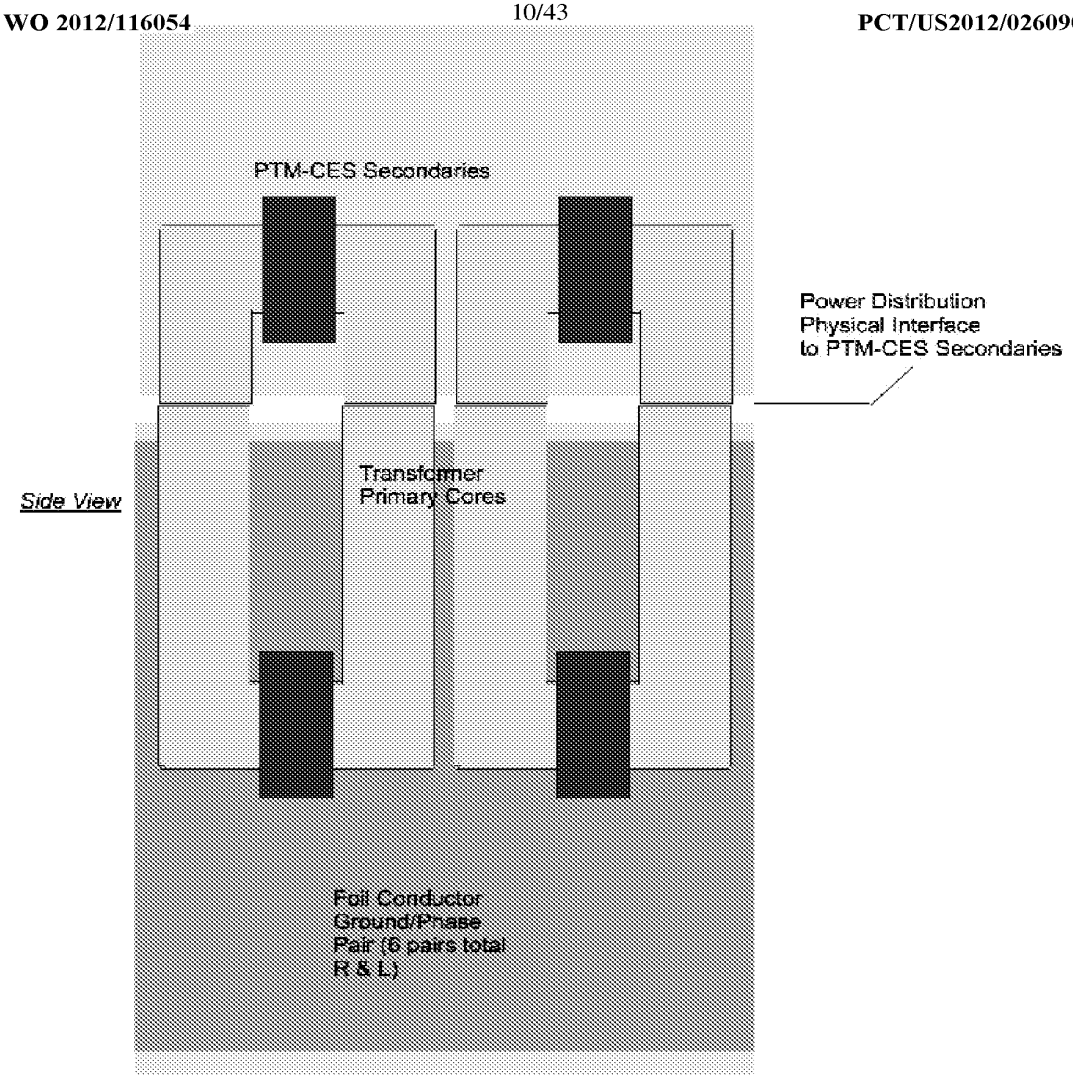

PTM-CES Secondaries
Power Distribution
Physical Interface
to PTM-CES Secondaries
Side View
Transformer
Primary Cores
Foil Conductor
Ground/Phase
Pair (6 pairs total
R & L)

FIGURE 14