EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	104681	((coil inductor inductance winding antenna loop) WITH (conductive conducting copper etch$3 PCB printed layer pattern)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:09
L8	21955	L7 AND ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:11
L9	4812	L8 AND (receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency))).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:12
L10	1227	L9 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base)).clm.	US-PGPUB; USPAT	ADJ	ON	2016/01/19 16:14
L11	35	L10 AND (third ADJ2 (terminal electrode end terminus "connecting land" end contact pin)) AND (fourth ADJ2 (terminal electrode end terminus "connecting land" end contact pin)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:20
L12	0	L11 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4) NEAR3 (space gap notch notched)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:41
L13	0	L11 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across)) NEAR3 (space gap notch).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:43
L14	0	L11 AND (((coil loop inductor inductance pattern conductive) NEAR3 (top)) NEAR3 (substrate)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:46

1/19/2016 4:48:21 PM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

Issue Classification	**Application/Control No.** 13663012	**Applicant(s)/Patent Under Reexamination** AN ET AL.
	Examiner JAMES P EVANS	**Art Unit** 2836

CPC				
Symbol			**Type**	**Version**
H04B	5	/ 0037	F	2013-01-01
Y10T	29	/ 4902	A	2015-01-15
B60L	11	/ 182	I	2013-01-01
G06K	19	/ 0723	I	2013-01-01
H02J	5	/ 005	I	2013-01-01
H02J	7	/ 025	I	2013-01-01
H01F	41	/ 14	I	2013-01-01
H04B	5	/ 0081	I	2013-01-01
Y02T	90	/ 122	A	2013-01-01
H02J	17	/ 00	I	2013-01-01
Y02T	10	/ 7005	A	2013-01-01
Y02T	90	/ 16	A	2013-01-01
Y02T	90	/ 14	A	2013-01-01
Y02T	10	/ 7072	A	2013-01-01
		/		

CPC Combination Sets							
Symbol			**Type**	**Set**	**Ranking**	**Version**
		/				
		/				

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	1/20/2016 (Date)	**Total Claims Allowed:** 21	
(Primary Examiner)	(Date)	O.G. Print Claim(s) 1	O.G. Print Figure 11

U.S. Patent and Trademark Office

Part of Paper No. 20160115

Issue Classification	**Application/Control No.** 13663012	**Applicant(s)/Patent Under Reexamination** AN ET AL.
	Examiner JAMES P EVANS	**Art Unit** 2836

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
		H	0	4	B	5 / 00 (2006.01.01)						

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	1/20/2016 (Date)	**Total Claims Allowed:** 21
(Primary Examiner)	(Date)	O.G. Print Claim(s): 1 / O.G. Print Figure: 11

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
13663012	AN ET AL.
Examiner	**Art Unit**
JAMES P EVANS	2836

☐ **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	-	17												
-	2	-	18												
2	3	9	19												
-	4	-	20												
-	5	10	21												
3	6	11	22												
4	7	20	23												
-	8	12	24												
5	9	13	25												
-	10	14	26												
6	11	15	27												
7	12	16	28												
8	13	17	29												
-	14	18	30												
-	15	21	31												
-	16	19	32												

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	1/20/2016 (Date)	**Total Claims Allowed:** 21	
(Primary Examiner)	(Date)	O.G. Print Claim(s) 1	O.G. Print Figure 11

U.S. Patent and Trademark Office | Part of Paper No. 20160115

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

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

Application Number	13/663,012	Filing Date	2012-10-29	Docket Number (if applicable)	SUN.LGI.420	Art Unit	2836
First Named Inventor	Jeong Wook An			Examiner Name	James P. Evans		

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 190065

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature
☐ Applicant Signature

Signature of Registered U.S. Patent Practitioner			
Signature	/JEFF LLOYD/	Date (YYYY-MM-DD)	2015-11-24
Name	Jeff Lloyd	Registration Number	35589

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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

Electronic Patent Application Fee Transmittal

Application Number:	13663012
Filing Date:	29-Oct-2012
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/MORGAN LAMPP
Attorney Docket Number:	SUN.LGI.420

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($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt

EFS ID:	24172742
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/MORGAN LAMPP
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	24-NOV-2015
Filing Date:	29-OCT-2012
Time Stamp:	10:25:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1200
RAM confirmation Number	10002
Deposit Account	190065
Authorized User	LLOYD, JEFF

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)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

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	Request for Continued Examination (RCE)	-RCE1.pdf	697793 ea1658a80b3904ec60248d73ba308bb90fdf4692	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30622 60e030bda2fbee0257f396b513d8ce4937a210ba	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	728415		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 10/19/2015
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	

ART UNIT	PAPER NUMBER
2836	

NOTIFICATION DATE	DELIVERY MODE
10/19/2015	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):

euspto@slepatents.com

PTOL-90A (Rev. 04/07)

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 13/663,012	**Applicant(s)** AN ET AL.	
	Examiner JAMES P. EVANS	**Art Unit** 2836	**AIA (First Inventor to File) Status** No

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

THE REPLY FILED 07 October 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires ______months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: .
   Claim(s) objected to: 23 and 31.
   Claim(s) rejected: 1,3,6, 7, 9,11-13,19-22,24-30 and 32.
   Claim(s) withdrawn from consideration: .

/JARED FUREMAN/ Supervisory Patent Examiner, Art Unit 2836	/JAMES P EVANS/ Examiner, Art Unit 2836

Continuation of 3. NOTE: Claim 1 has a claim limitation not previously included in claims - "wherein the coil unit overlaps the receiving space in a vertical direction perpendicular to an upper surface of the substrate". This raises new issues that would require further consideration and/or search.

DO NOT ENTER: /JE/

10/13/2015

I hereby certify that this correspondence is being electronically transmitted via EFS to the United States Patent and Trademark Office on October 7, 2015.

/JESSICA COWART/

Jessica Cowart

AMENDMENT UNDER 37 C.F.R. §1.116
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Confirm. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop **AF**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. §1.116

Sir:

In response to the Office Action dated August 24, 2015, please amend the application identified above as follows:

J:\SUN\LGI\420\Amd-Resp\Response2.doc/kh/jj/lcf

I hereby certify that this correspondence is being electronically transmitted via EFS to the United States Patent and Trademark Office on October 7, 2015.

/JESSICA COWART/

Jessica Cowart

AMENDMENT UNDER 37 C.F.R. §1.116
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Confirm. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop **AF**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. §1.116

Sir:

In response to the Office Action dated August 24, 2015, please amend the application identified above as follows:

J:\SUN\LGI\420\Amd-Resp\Response2.doc/kh/jj/lcf

In the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Currently Amended) A wireless power receiver comprising:

a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil, wherein the coil unit overlaps the receiving space in a vertical direction perpendicular to an upper surface of the substrate; ~~and~~

wherein the connecting unit is disposed in the receiving space and connected to the coil unit, and

wherein the connecting unit includes:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit~~, and~~

~~wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape~~.

2. (Canceled)

3. (Previously Presented) The wireless power receiver of claim 1, wherein the shape of the receiving space corresponds to a shape of the connecting unit.

4-5. (Canceled)

6. (Previously Presented) The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the substrate and surrounding the coil.

7. (Previously Presented) The wireless power receiver of claim 6, wherein the short-range communication antenna has a rectangular configuration formed by winding one conductive line several times.

8. (Canceled)

9. (Currently Amended) The wireless power receiver of claim 6, wherein the connecting unit is connected to the short-range communication ~~signal~~ antenna.

10. (Canceled)

11. (Previously Presented) The wireless power receiver of claim 1, wherein the conductive pattern is a conductive layer.

12. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

13. (Previously Presented) The wireless power receiver of claim 12, wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate.

14-18. (Canceled)

19. (Previously Presented) A wireless portable terminal, comprising the wireless power receiver of claim 1.

20. (Canceled)

21. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises magnetic material.

22. (Previously Presented) The wireless power receiver of claim 1, further comprising a wireless power receiving circuit connected to the connecting unit.

23. (Currently Amended) ~~The~~ A wireless power receiver ~~of claim 1,~~ comprising:

a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil;

wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the connecting unit includes:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit; and

wherein the coil unit is disposed on a top surface of the substrate and the connecting unit.

24. (Previously Presented) The wireless power receiver of claim 6, wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate.

25. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate is flexible.

26. (Previously Presented) The wireless power receiver of claim 6, wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil.

27. (Previously Presented) A wireless portable terminal, comprising the wireless power receiver of claim 3.

28. (Previously Presented) The wireless portable terminal of claim 19, which is a smartphone.

29. (Previously Presented) The wireless portable terminal of claim 27, which is a smartphone.

30. (Previously Presented) The wireless power receiver of claim 1, wherein the one end of the coil is at an inside portion of the conductive pattern and the other end of the coil is at an outside portion of the conductive pattern.

31. (Currently Amended) ~~The~~ A wireless power receiver ~~of claim 31,~~ comprising:

a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil;

wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the connecting unit includes:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit; and

wherein the conductive line of the conductive pattern crosses over the receiving space.

32. (Currently Amended) The wireless power receiver of claim 1, wherein the ~~connection~~ connecting unit is configured such that it is separable from the receiving space.

Remarks

Claims 1, 3, 6, 7, 9, 11-13, 19, and 21-32 are pending in the subject application. By this Amendment, claims 1, 9, 23, 31, and 32 are amended. No new matter is introduced. Support for the amendments can be found throughout the original specification (see, for example, Figure 11). Upon entry of these amendments, claims 1, 3, 6, 7, 9, 11-13, 19, and 21-32 will be before the Examiner for further consideration.

The amendments set forth herein should not be interpreted to indicate that Applicants have agreed with or acquiesced to the rejections set forth in the outstanding Office Action. The amendments to the claims have been made in an effort to lend greater clarity to the claimed subject matter and to expedite prosecution. Favorable consideration of the claims now presented, in view of the remarks and amendments set forth herein, is respectfully requested.

Objection to claim 31

Claim 31 has been objected to for informalities. In view of the amendments to claim 31 presented herein, Applicants respectfully request withdrawal of this objection.

Objection to claim 1

Claim 1 has been objected to for informalities. Claim 1 has been amended in accordance with the Examiner's helpful suggestion. Accordingly, Applicants respectfully request withdrawal of the objection to claim 1.

Rejection of claims 1, 3, 11, 21, 22, 30, and 32 under 35 U.S.C. §103(a)

Claims 1, 3, 11, 21, 22, 30, and 32 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno *et al.* (U.S. Patent Application Publication No. 2012/0187767; hereinafter referred to as "Kanno") in view of Waffenschmidt *et al.* (U.S. Patent Application Publication No. 2013/0069444; hereinafter referred to as "Waffenschmidt"). Applicants respectfully request reconsideration.

Claim 1 has been amended to recite that the coil unit overlaps the receiving space in a vertical direction perpendicular to an upper surface of the substrate. This advantageous feature of the subject invention is discussed throughout the original specification and can be seen in at least Figure 11, in which a part of the coil unit **200** comprising the first connection terminal **210**, the second connection terminal **220**, and the coil **230** vertically overlaps the receiving space **130** of the magnetic substrate **100**.

On the other hand, Applicants submit that the combination of Kanno and Waffenschmidt fails to teach or suggest a wireless power receiver including a coil unit that overlaps a receiving space of a substrate. The Action concedes that Kanno does not teach a receiving space, but then cites Waffenschmidt as purportedly disclosing this element. However, Applicants note that, though the Waffenschmidt active area **181** provides a concave side surface corresponding to the extension module **180** cited in the Action as a connecting unit, the six coils within the active area **181** do not overlap a space surrounded by the concave side surface (see, *e.g.*, Waffenschmidt Figure 18). That is, the combination of Kanno and Waffenschmidt fails to teach or suggest a wireless power receiver including a coil unit and a receiving space as claimed. Moreover, Applicants submit that a person of ordinary skill in the art would not have had a reason to modify the modified Kanno device to arrive at the claimed invention. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 1, 3, 11, 21, 22, 30, and 32 under 35 U.S.C. §103(a).

<u>Rejection of claims 6, 7, 9, 24, and 26 under 35 U.S.C. §103(a)</u>

Claims 6, 7, 9, 24, and 26 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno in view of Waffenschmidt and in further view of Dainippon Printing Co. Ltd. (JP 2008-027015; hereinafter referred to as "JP '015"). Applicants respectfully request reconsideration.

The deficiencies of the combination of Kanno and Waffenschmidt have been discussed above. JP '015 does not cure these deficiencies. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 6, 7, 9, 24, and 26 under 35 U.S.C. §103(a).

<u>Rejection of claims 12 and 13 under 35 U.S.C. §103(a) based on Kanno, Waffenschmidt, and Kesler</u>

Claims 12 and 13 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno in view of Waffenschmidt and in further view of Kesler *et al.* (U.S. Patent Application

Publication No. 2013/0200716; hereinafter referred to as "Kesler"). Applicants respectfully request reconsideration.

The deficiencies of the combination of Kanno and Waffenschmidt have been discussed above. Kesler does not cure these deficiencies. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 12 and 13 under 35 U.S.C. §103(a) based on Kanno, Waffenschmidt, and Kesler.

Rejection of claims 12 and 13 under 35 U.S.C. §103(a) based on Kanno, Waffenschmidt, and Kuk

Claims 12 and 13 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno in view of Waffenschmidt and in further view of Kuk *et al.* (U.S. Patent Application Publication No. 2013/0106198; hereinafter referred to as "Kuk"). Applicants respectfully request reconsideration.

The deficiencies of the combination of Kanno and Waffenschmidt have been discussed above. Kuk does not cure these deficiencies. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 12 and 13 under 35 U.S.C. §103(a) based on Kanno, Waffenschmidt, and Kuk.

Rejection of claims 19 and 27-29 under 35 U.S.C. §103(a)

Claims 19 and 27-29 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno in view of Waffenschmidt and in further view of Seiko (JP 2006-042519). Applicants respectfully request reconsideration.

The deficiencies of the combination of Kanno and Waffenschmidt have been discussed above. Seiko does not cure these deficiencies. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 19 and 27-29 under 35 U.S.C. §103(a).

Rejection of claim 25 under 35 U.S.C. §103(a)

Claim 25 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Kanno in view of Waffenschmidt and in further view of Kato *et al.* (U.S. Patent Application Publication No. 2008/0164840; hereinafter referred to as "Kato"). Applicants respectfully request reconsideration.

The deficiencies of the combination of Kanno and Waffenschmidt have been discussed above. Kato does not cure these deficiencies. Accordingly, Applicants respectfully request withdrawal of the rejection of claim 25 under 35 U.S.C. §103(a).

Objection to claims 23 and 31

Claims 23 and 31 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants thank the Examiner for the indication of allowable subject matter. Claims 23 and 31 have each been rewritten in independent form including all of the limitations of claim 1 as previously presented.

In view of the foregoing remarks and amendments to the claims, Applicants believe that the claims as currently pending are in condition for allowance, and such action is respectfully requested.

Applicants invite the Examiner to call the undersigned if clarification is needed on any of this response, or if the Examiner believes a telephonic interview would expedite the prosecution of the subject application to completion.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

/JEFF LLOYD/

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/kh/jj/lcf

Electronic Acknowledgement Receipt

EFS ID:	23720263
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Jessica Cowart
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	07-OCT-2015
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Time Stamp:	16:01:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response2.pdf	107734 0fe1d2ed8b752a0c5808818f89153aa125cc3fad	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	11

Warnings:

Information:

Total Files Size (in bytes):	107734

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/663,012	Filing Date 10/29/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	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	10/07/2015	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 21	Minus	** 21	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 08/24/2015
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	

ART UNIT	PAPER NUMBER
2836	

NOTIFICATION DATE	DELIVERY MODE
08/24/2015	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):

euspto@slepatents.com

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 13/663,012	Applicant(s) AN ET AL.	
	Examiner JAMES P. EVANS	Art Unit 2836	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 *5/11/15*.
☐ 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) *1,3,6,7,9,11-13,19-30 and 32* is/are pending in the application.
5a) Of the above claim(s) *2,4,5,8,10,14-18,20* is/are withdrawn from consideration.
6)☐ Claim(s) _____ is/are allowed.
7)☒ Claim(s) *1,3,6,7,9,11-13,19-22,24-30 and 32* is/are rejected.
8)☒ Claim(s) *23,31* 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 *10/29/2012* 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: _____.

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

Specification Objections

2. Objections to the original specification, including the Abstract, are withdrawn based on amended Abstract and specification dated 5/11/2015.

Claim Objections

3. Objections to the original claims are withdrawn based on the amended claims dated 5/11/2015.

New Claim 31 is objected to.

"The wireless power receiver of claim 31, the conductive line of the conductive pattern crosses over the receiving space."

Should be:

"The wireless power receiver of claim 1, wherein the conductive line of the conductive pattern crosses over the receiving space."

Appropriate correction is required.

Amended Claim 1 is objected to for the ordering of the amended claim limitations. Examiner suggests that the limitation "..., and wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape" be moved from the end of the claim (*after the discussion of the connecting* *unit*) to immediately follow the *existing claim limitations for the conductive pattern*, i.e. after "conductive pattern on or within the substrate".

Allowable Subject Matter

4. Claims 23, 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 103

5. 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.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 1, 3, 11, 21-22, 30, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444).

Kanno ('767) teaches a wireless power receiver (Paragraph [0113]: non-contact transmission; Paragraph [0114]: power receiving antenna 109) comprising: a substrate (Paragraph [0099]: Fig. 3…back surface of the modules 10) with a connecting unit configured to connect to a wireless power receiving circuit (Figure 21: power receiving antenna 109 connects to Rectifier circuit 115 at the point of parallel combination 163); a coil unit including a first connection terminal, a second connection terminal, and a coil (as shown in Figure 9, output terminal 119 has two connection terminals), wherein the coil is configured to wirelessly receive power (Paragraph [0114]: power receiving antenna 109), wherein the coil (Figure 9: inductor 109a) is formed as a conductive pattern (Paragraph [0153]: 109a … a single-layer conductor pattern) on or within the substrate, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil (as shown in Figure 9, output terminal 119), and wherein the conductive pattern includes a conductive line wound at least two times (Figure 9, power receiving antenna 109 is wound two times) and the conductive pattern has a spiral shape (Paragraph [0139]: power receiving antenna 109 …. a spiral inductor).

Kanno (‘767) also discloses wherein the connecting unit includes: a third connection terminal connected to the first connection terminal of the coil unit; and a fourth connection terminal connected to the second connection terminal of the coil unit (Figure 3: connecting unit to the coil unit is a cable 143; Paragraph [0100]: cable … structure consisting of two lines that are either positive and negative lines or signal and ground lines. *The connections to the coil unit are inherent because they need to be made to operate the device*).

Kanno (‘767) does not teach: a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit, wherein the connecting unit is disposed in the receiving space and connected to the coil unit.

Waffenschmidt (‘444) teaches a wireless power system comprising (Paragraph [0018]: modular inductive power system) a substrate (Figure 20: printed circuit board 212) having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power ***transmitting*** circuit (Figure 18: extension module 180), wherein the connecting unit is disposed in the receiving space and connected to the coil unit (Figure 18: connecting unit (extension module 180) is disposed in the receiving spaces formed by six-coil unit 181 and connected to the coil unit 181 via interconnection units 185; Also Paragraph [0018]: extension module having at least one outer periphery part being shaped so as to fit in at least one direction to neighboring transmitter modules forming the power transmitting surface, the outer periphery part, where it is neighboring the transmitter modules, being shaped according to the outer periphery of the neighboring transmitter modules, which extension module comprises interconnection units for providing a power supply to neighboring transmitter modules).

It would have been obvious…… this method of connection of the receiving coil unit to make the wireless ***receivers*** of Kanno to be like the wireless power ***transmitters*** of Waffenschmidt (‘444) *(wireless receiver coils are interchangeable with wireless power transmitter coils)* comprising: a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power ***receiving*** circuit, wherein the connecting unit is disposed in the receiving space and connected to the coil unit, in order to connect with neighboring receiver modules for sharing power to a load (Waffenschmidt Abstract: such that the power transmitting surface is constituted by an uninterrupted pattern of adjacent transmitter coils extending in said surface, and interconnection units (110,111) for connecting with neighboring transmitter modules for sharing a power supply).

Regarding Claim 3, Kanno (‘767) in view of Waffenschmidt (‘444) teaches the wireless power receiver of claim 1, and Waffenschmidt (‘444) teaches wherein the shape of the receiving space corresponds to a shape of the connecting unit (Figure 18: coil unit 181 has receiving spaces corresponding to the shape of the connecting unit (extension module 180); Paragraph [0007]: module having an outer periphery being shaped so as to fit to neighboring transmitter modules).

Regarding Claim 11, Kanno (‘767) in view of Waffenschmidt (‘444) teaches the wireless power receiver of claim 1, and Kanno (‘767) teaches wherein the conductive pattern is a conductive layer (Paragraph [0153]: 109a … a single-layer conductor pattern).

Regarding Claim 21, Kanno ('767) in view of Waffenschmidt ('444) teaches the wireless power receiver of claim 1, and Kanno ('767) teaches wherein the substrate comprises magnetic material (Paragraph [0135]: eddy current avoiding space 159 is produced on the surface of the second fixing member 155, which is located right under the power receiving antenna 109; Paragraph [0136]: The eddy current avoiding space 159 may be made of a magnetic body).

Regarding Claim 22, Kanno ('767) in view of Waffenschmidt ('444) teaches the wireless power receiver of claim 1, and Kanno ('767) teaches further comprising a wireless power receiving circuit (Figure 21 (and others): Rectifier circuit 115) connected to the connecting unit.

Regarding Claim 30, Kanno ('767) in view of Waffenschmidt ('444) teaches the wireless power receiver of claim 1, and Kanno ('767) teaches wherein the one end of the coil is at an inside portion of the conductive pattern and the other end of the coil is at an outside portion of the conductive pattern (per Figure 9, power receiving antenna 109).

Regarding Claim 32, Kanno ('767) in view of Waffenschmidt ('444) teaches the wireless power receiver of claim 1, and Waffenschmidt ('444) teaches wherein the connection unit is configured such that it is separable from the receiving space (Paragraph [0129]: A modular power transmitting system comprises multiple transmitter modules; Paragraph [0065]: In an embodiment, to allow the mounting of arbitrarily shaped modules in an arbitrary order, connectors with vertical pins are provided).

Claims 6, 7, 9, 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) in further view of Dainippon Printing Co. Ltd. (JP 2008-027015).

Regarding claim 6, Kanno ('767) in view of Waffenschmidt ('444) discloses the wireless power receiver of claim 1 but does not disclose further comprising a short-range communication antenna formed on the substrate and surrounding the coil.

Dainippon ('015) teaches further comprising a short-range communication antenna (communications aerial 11; as shown in Fig.2 (b)) formed on the substrate (base material) and surrounding the coil (antenna 17; as shown in Fig.2 (b)).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno in view of Waffenschmidt with the teaching of Dainippon further comprising a short-range communication antenna, in order to deliver and receive information along with power to energize any display devices on the receiver (as disclosed in Dainippon Paragraphs [0001]-[0002]).

Regarding claim 7, Kanno ('767) in view of Waffenschmidt ('444) in further view of Dainippon ('015) discloses the wireless power receiver of claim 6, and Dainippon further teaches wherein the short-range communication antenna comprises a near field communication (NFC) antenna (antenna 11) that has a rectangular configuration formed by winding one conductive line several times (communications aerial 11 is formed by winding a conductive (inherent) line three times, as shown in Fig.2 (b)).

Regarding claim 9, Kanno (‘767) in view of Waffenschmidt (‘444) in further view of Dainippon (‘015) discloses the wireless power receiver of claim 6, and Dainippon further teaches wherein the connecting unit is connected to the short-range communication signal antenna (Paragraph [0015]: As shown in Fig.2 (b), ...the communications aerial 11 ..., and arranging it on the card base material. All interconnections must be made on the base material to form a connecting unit to enable the connections between the elements shown in figure 1).

Regarding claim 24, Kanno (‘767) in view of Waffenschmidt (‘444) in further view of Dainippon (‘015) discloses the wireless power receiver of claim 6, and Dainippon further teaches wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate (Paragraph [0015] As shown in Fig.2 (b), ...the communications aerial 11 ..., and arranging it on the card base material).

Regarding claim 26, Kanno (‘767) in view of Waffenschmidt (‘444) in further view of Dainippon (‘015) discloses the wireless power receiver of claim 6, and Dainippon further teaches wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil (As shown in Fig.2 (b).

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) in further view of Kesler (US 2013/0200716).

Regarding Claim 12, Kanno ('767) in view of Waffenschmidt ('444) teach the wireless power receiver of claim 1, but do not clearly disclose wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

Kesler ('716) teaches wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove (Paragraph [0193]: core material 1132 may have any number of notches or cutouts of various depths… to accommodate conductor loops).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno ('767) in view of Waffenschmidt ('444) with the teaching of Kesler ('716) wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove, in order to make the receiver as thin as possible (Paragraph [0484]: The systems and methods described herein may be integrated into the hearing aid and may reduce the size of the necessary batteries which may allow even smaller hearing aids).

Regarding Claim 13, Kanno ('767) in view of Waffenschmidt ('444) in view of Kesler ('716) teach the wireless power receiver of claim 12, and Kesler ('716) discloses wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate (Paragraph [0193]: core material 1132 may have any number of notches or cutouts of various depths… to accommodate conductor loops).

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) in further view of Kuk (US 2013/0106198).

Regarding Claim 12, Kanno ('767) in view of Waffenschmidt ('444) teach the wireless power receiver of claim 1, but do not clearly disclose wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

Kuk ('198) teaches wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove (Paragraph [0086]: Referring to the embodiment of FIG. 6, in the core 120', grooves 120a may be formed in the concave parts 122 and 123 in a direction in which the coils 111 and 112 (see FIG. 3) are wound).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno ('767) in view of Waffenschmidt ('444) with the teaching of Kuk ('198) wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove, in order to make the coil be positioned in a stable manner (Kuk - Paragraph [0027]: disposition of the coils may be stably maintained).

Regarding Claim 13, Kanno ('767) in view of Waffenschmidt ('444) in further view of Kuk ('198) teach the wireless power receiver of claim 12 and Kuk ('198) further discloses wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate (Per Figure 7).

Claims 19, 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) in further view of Seiko (JP 2006-042519).

Regarding claim 19, Kanno ('767) in view of Waffenschmidt ('444) teaches the wireless power receiver of claim 1, but does not disclose wherein a wireless portable terminal comprises the wireless power receiver of claim 1.

Seiko teaches a wireless portable terminal comprising a wireless power receiver (Seiko Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (a wireless portable terminal)). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno ('767) in view of Waffenschmidt ('444) with the teaching of Seiko wherein a wireless portable terminal comprises the wireless power receiver, in order to provide non-contact transfer of power to the receiving device (Seiko Paragraph [0001]).

Regarding claim 27, Kanno ('767) in view of Waffenschmidt ('444) discloses the wireless power receiver of Claim 3 but does not disclose wherein a wireless portable terminal comprises the wireless power receiver of claim 3.

Seiko teaches a wireless portable terminal comprising the wireless power receiver (Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (*a wireless portable terminal*)). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno (‘767) in view of Waffenschmidt (‘444) with the teaching of Seiko wherein a wireless portable terminal comprises the wireless power receiver, in order to provide non-contact transfer of power to the receiver (Seiko Paragraph [0001]).

Regarding claim 28, Kanno (‘767) in view of Waffenschmidt (‘444) in further view of Seiko discloses a wireless portable terminal of Claim 19, and Seiko further discloses wherein the wireless portable terminal comprises a smartphone (Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (*smartphone*)).

Regarding claim 29, Kanno (‘767) in view of Waffenschmidt (‘444) in further of Seiko discloses a wireless portable terminal of Claim 27, and Seiko further discloses wherein the wireless portable terminal comprises a smartphone (Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (*smartphone*)).

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) in further view of Kato (US 2008/0164840 A1).

Regarding claim 25, Kanno (‘767) in view of Waffenschmidt (‘444) discloses the wireless power receiver of Claim 1 but does not disclose wherein the substrate is flexible.

Kato (‘840) teaches a coil for a wireless power system wherein the substrate is flexible (Abstract: One planar portion of the planar coil is attached on the surface of the flexible printed-circuit board).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kanno in view of Waffenschmidt with the teaching of Kato (‘840) wherein the substrate is flexible, in order to make the substrate thin which is useful in slim, rechargeable cell phone design (Kato Paragraph [0082]: The flexible printed-circuit board 90 is a substrate in the form of an extremely thin sheet; Paragraph [0003]: … incorporated in a small-size, thin portable terminal such as a mobile phone unit).

Examiner Note

6. The examiner cites particular columns and lines numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested that, in preparing responses, the applicant fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kato (‘840) (previously cited) further teaches connections between a coil and a connecting unit (Abstract) where the coil is a spiral conductor pattern and the substrate is magnetic (Paragraph [0044]), and that the principles and

methods of manufacture of a noncontact power-transmission coil can be applied both the power-transmission side and the power-receiving side (Paragraph [0104]) also discloses the wireless receiving in portable terminals and phones (Claims 19, 27-29).

Kesler ('716) (also previously cited) further teaches a wireless power receiver comprising: a substrate (Paragraph [0193]: core of the planar resonator structure) having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit (Paragraph [0193]: core may have complex geometries and may have indentations, notches, ridges, and the like; core material 1132 may have any number of notches or cutouts 1133 of various depths, width, and shapes to accommodate …, packaging, and the like), wherein the connecting unit is disposed in the receiving space and connected to the coil unit (Paragraph [0194]: shape and dimensions of the core may be further dictated by the dimensions and characteristics of the device that they are integrated into. The core material … may require non-symmetric notches or cutouts to allow clearance for parts of the device).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES P. EVANS whose telephone number is (571) 270-0639. The examiner can normally be reached on Monday-Friday 8 AM-5pm ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jared Fureman can be reached on 571-272-2391. 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.

/JAMES P EVANS/
Examiner, Art Unit 2836

/ROBERT DEBERADINIS/
Primary Examiner, Art Unit 2836

Notice of References Cited

Application/Control No. 13/663,012	Applicant(s)/Patent Under Reexamination AN ET AL.	
Examiner JAMES P. EVANS	Art Unit 2836	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2013/0106198	05-2013	Kuk et al.	307/104
*	B	US-2012/0187767	07-2012	Kanno et al.	307/82
*	C	US-2013/0200716	08-2013	Kesler et al.	307/104
	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)
	U	
	V	
	W	
	X	

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/17 08:34
L3	21	L2 and flexible	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 08:34
L4	21	L2 and flexible and ((uniform$2 or consistent$2 or consistency or perfect$3 or balanc$3 or equaliz$3 or overcom$3 or eliminat$3 or advantag$6 or benefit$4 or beneficially or allow$3 or effect$3 or less or great$3 or better$3 or more or most or improv$5 or simplify$3 or well or simplification or fewer or fewest or least or better or best or superior or increas$3 or decreas$3 or enhanc$5 or lower$3 or lessen$3 or short$5 or higher or highest or lighter or lightest or brighter or brightest or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 09:46

		cheap$3 or fast$3 or long$3 or lengthen$3 or shorten$3 or extend$3 or wide$2 or prolong$3 or prevent$3 or eliminat$5 or mitigat$3 or without or effective$4 or efficien$3 or reduc$4 or compact$3 or small$3 or enhanc$3 or boost$3 or simple$2 or simplify$3 or easy or ease$2 or easi$3 or inhibit$3 or $savin$1 or environment$4 or $1friendly or sav$3 or safe$2 or protect$3 or possible or possibilit$3 or mak$3 or possible or possibilit$3 or solv$2 or fix$2 or solution or maximum or maximiz$5 or accomplish$4 or minimiz$5 or minimum or optimiz$5 or low$1cost or reliable or reliably or avoid$3 or excellent or (very ADJ high) or (very ADJ low) or stable or stabili$6 or portable or modular or slow$3 or speed$3 or hasten$3 or strenghthen$3 or resilien$3))				
L5	1	L2 and "modular power transmitting system"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:02
L6	358681	(coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:17
L7	5890	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/17 11:18
L8	380	L7 AND (coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:18
L9	180	L7 AND (coil|winding) SAME (groove$1|recess$2|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:19
L10	94	L7 AND (coil|winding) SAME (groove$1|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/08/17 11:22

			DERWENT; IBM_TDB			
S1	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2015/01/20 10:41
S2	8	("20050046573" | "20080122570" | "20080154178" | "20080197957" | "20090058358" | "20100277004" | "20120057322" | "6008622").PN.	US-PGPUB; USPAT	OR	ON	2015/01/20 10:51
S3	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:23
S4	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:34
S5	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S6	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S7	158	S6 AND S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S8	398217	(coil$1 or winding$1) SAME (power or energy or current) SAME(terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S9	27303	(substrate or base or core or "ferrite magnet layer") SAME (space or shape or shaped) SAME (connector or "connecting unit") SAME (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S10	1934	S9 SAME S8	US-PGPUB; USPAT; USOCR;	OR	ON	2015/01/20 12:24

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S11	392	WO adj "2008053599" WO adj "2013174340" EP adj "1870984" WO adj "2012169728" WO adj "2006127829" EP adj "0037921" WO adj "2005034152" WO adj "1992014254" WO adj "2006134712" WO adj "2007007516" WO adj "2007055265" "20030006657" EP adj "2642632" EP adj "2202499" EP adj "2642632" CN adj "1110225" "3634878" "3848208" "20130249302" WO adj "2006047953" CN adj "1151100" WO adj "2013149781" CN adj "103326473" JP adj "2012235630" "5724018" CN adj "100466382" CN adj "101071909" EP adj "2367263" WO adj "2011147451" WO adj "2014183352" EP adj "1487087" WO adj "2004045050" WO adj "2009070705" JP adj "2013138404" WO adj "2004030845" EP adj "2309620" JP adj "2005065018" JP adj "2004023961" JP adj "2010110168" EP adj "2256751" WO adj "2009155030" EP adj "2642591" WO adj "2012015839" EP adj "2814047" JP adj "2004072867" "2091798" WO adj "1993013532" WO adj "2008135507" "3660791" WO adj "2006101049" WO adj "2002046653" WO adj "2007049788" JP adj "2001144642" "3146419" EP adj "1868280" EP adj "1883998" JP adj "2014023281" "3792410" CN adj "201340774" "20060278387" CN adj "1855761" JP adj "2013157917" EP adj "1717967" CN adj "101189692" CN adj "102056328" "3848205" WO adj "2013022255" JP adj "2014027102" EP adj "1821556" "3767102" EP adj "2375531" JP adj "2008017141" WO adj "2005034307" JP adj "2010093386" EP adj "2629361" WO adj "2005030528" CN adj "1941230" "3163840" "3863040"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:52
S12	299	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:58
S13	3	EP adj "2642632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 14:51

S14	22	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$ or US-20130249302-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/20 15:01
S15	22	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 15:01
S16	2	"20080164840"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 17:13
S17	6	"39593692".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/20 17:15
S18	2	"20120044114"	US-PGPUB; USPAT	OR	ON	2015/01/20 17:26
S19	3	(("Jeong Wook") near2 (AN)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:52
S20	2	(("Jeong Wook") near2 (AN)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:54
S21	8	(("Jung Oh") near2 (LEE)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:55
S22	1	(("Jung Oh") near2 (LEE)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:57
S23	3	(("Sung Hyun") near2 (LEEM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:58
S24	0	(("Sung Hyun") near2 (LEEM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:04
S25	7	(("Yang Hyun") near2 (KIM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 09:05
S26	3	(("Yang Hyun") near2 (KIM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:19
S27	5	"47598569".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/23 11:34
S28	24	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-	US-PGPUB; USPAT; FPRS;	OR	ON	2015/01/26 13:45

		20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$).did.	JPO; DERWENT			
S29	2993903	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:02
S30	1440492	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:07
S31	3326212	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:10
S32	2674608	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:19
S33	2115289	(connect$3 or link$3 or coupl$3 or join$3) near3 (terminal or node or lead or electrode or contact)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:22
S34	80414	S29 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:28
S35	2254	S34 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:29
S36	328	S35 SAME S32	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S37	52	S36 SAME S33	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S38	133047	S29 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S39	2254	S38 SAME S30	US-PGPUB;	ADJ	ON	2015/01/26

			USPAT; USOCR			14:31
S40	5809	S30 near3 S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:32
S43	27	jp and "2006042519"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 12:52
S44	0	jp and "04-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:35
S45	4911	jp and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:36
S46	0	jp and "rotary transformer" and "flexible substrate (35)"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S47	20	jp and "rotary transformer" and "flexible substrate"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S51	2	"4-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:42
S52	61	"hitachi ferrite" and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:49
S53	17	"hitachi ferrite" and "rotary transformer" and grooves	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:52

S57	4554	"satoshi" AND "shinji"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S58	100	murata AND S57	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S59	2	JP2010022098A	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 10:40
S60	38	"6008622"	US-PGPUB; USPAT	OR	ON	2015/01/28 17:01
S61	1	"6008622" and Norio	US-PGPUB; USPAT	OR	ON	2015/01/28 17:02
S62	1	"17402302".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/28 17:03
S63	336	H04B5/0037	US-PGPUB; USPAT	OR	ON	2015/01/28 17:30
S64	42	H04B5/0081	US-PGPUB; USPAT	OR	ON	2015/01/28 17:31
S65	38	H01F41/14	US-PGPUB; USPAT	OR	ON	2015/01/28 17:32
S66	1111	H02J17/00	US-PGPUB; USPAT	OR	ON	2015/01/28 17:55
S67	32971	H02J17/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/28 17:55
S68	6341	H01F41/14	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:19
S69	20594	H01Q7/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:27
S70	1439	H04B5/0081	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/01/29 08:29

			DERWENT; IBM_TDB			
S71	21809	S70 OR S69	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S72	394	S71 and ("rectang$4" OR "square")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:38
S73	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/05/19 08:45
S74	18	S73 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/05/19 08:48
S92	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:16
S93	771	S92 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:16
S94	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls.	US-PGPUB; USPAT;	OR	ON	2015/08/11 17:18

		29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S95	771	S94 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S96	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S95	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S97	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S98	771	S97 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S99	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S98	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S100	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S101	771	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S102	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S101	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23

S103	72	((coil or winding or antenna or resonator or "receiving element") WITH conductive WITH (layer or pattern)) AND S102	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S104	934	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:29
S105	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S106	934	S105 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S107	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S106	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S108	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/11 17:35
S109	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc.	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2015/08/11 17:35

		B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	EPO; JPO; DERWENT; IBM_TDB			
S110	934	S109 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S111	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S112	0	S111 AND S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S113	165	S111 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:41
S114	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S115	372	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S116	0	S115 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:10
S117	389	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2015/08/11 18:11

		((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	IBM_TDB			
S118	0	S117 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:11
S119	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S108) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:13
S120	27	S119 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:14
S121	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 13:32
S122	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S121) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:32
S123	27	S122 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:32

S124	11	S121 NOT S123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 13:32
S125	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S126	934	S125 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S127	0	S126 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S128	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S129	389	S128 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S130	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:11
S131	160	S130 and spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:11
S132	165	S130 and spiral	US-PGPUB; USPAT;	OR	ON	2015/08/12 14:13

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S133	160	S132 AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:13
S134	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 14:34
S135	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 14:36
S136	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S135) AND S134	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:36
S139	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 15:22

		deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)				
S140	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 15:22
S141	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S140) AND S139	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S142	253	S141 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S144	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 16:04
S145	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 16:04

		or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S146	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S145) AND S144	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S147	253	S146 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S148	198	S147 and ((first near3 (connector|connect$3|terminal) SAME (second near3 (connector|connect$3|terminal))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S149	28	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:00
S150	1	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:02
S151	2	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121030"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:02
S152	6	S147 and ((first NEAR2 (connector|connect$3|terminal) SAME (second NEAR2	US-PGPUB; USPAT; USOCR;	OR	ON	2015/08/12 17:11

		(connector|connect$3|terminal)))) AND @ad<"20120323"	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S153	0	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	JPO	ADJ	ON	2015/08/13 11:35
S154	11	((substrate or base or core or "ferrite magnet layer") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	JPO	ADJ	ON	2015/08/13 11:35
S155	9194	H01F38/14.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 11:59
S156	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 12:04
S157	164	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 12:05
S158	40	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 12:06
S161	477	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND	US-PGPUB; USPAT; USOCR;	OR	ON	2015/08/13 13:10

		(coil$1 or winding$1 or resonator or secondary or inductor)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S162	293	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND (space or notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:11
S164	30	S156 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:18
S165	8	"8,092,251"	USPAT	OR	ON	2015/08/13 19:28
S166	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:33
S167	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 19:34
S168	30	S167 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2015/08/13 19:34

		AND (notch or cutout or "cut-out")	EPO; JPO; DERWENT; IBM_TDB			
S169	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:35
S170	5	S169 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:35
S171	21496	713/3??.ccls.	US-PGPUB; USPAT	OR	ON	2015/08/13 19:52
S172	10	S171 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:53

8/17/2015 1:17:16 PM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

Search Notes	Application/Control No. 13663012	Applicant(s)/Patent Under Reexamination AN ET AL.
	Examiner JAMES P EVANS	**Art Unit** 2836

CPC- SEARCHED

Symbol	Date	Examiner
H04B5/0037	1/29/2015	JPE
H04B5/0081	1/29/2015	JPE
H01F41/14	1/29/2015	JPE
H01F38/14	8/13/2015	JPE

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
307	104	1/29/2015	JPE
713	3XX	8/13/2015	JPE

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Search	1/21/2015	JPE
Keyword search	1/20/2015	JPE
IP.com search	1/20/2015	JPE
and all docs cited in European search report	1/20/2015	JPE
Search with SSE (Michael Obinna)	1/26/2015	JPE
Consulted Jared Fureman (SPE)	1/29/2015	JPE
Consulted Primary Dan Cavallari	8/13/2015	JPE
Consulted Primary Alex Gilman in Connectors	8/13/2015	JPE
Consulted Primary Carlos Amaya	8/14/2015	JPE
Consulted Primary Bob Deberadinis	8/17/2015	JPE

INTERFERENCE SEARCH

/JAMES P EVANS/ Examiner.Art Unit 2836	

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

/JAMES P EVANS/ Examiner.Art Unit 2836	

Index of Claims	Application/Control No. 13663012	Applicant(s)/Patent Under Reexamination
	Examiner JARED FUREMAN	Art Unit 2836

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

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

CLAIM		DATE								
Final	Original	02/06/2015	08/17/2015							
	1	✓	✓							
	2	-	-							
	3	✓	✓							
	4	-	-							
	5	-	-							
	6	✓	✓							
	7	✓	✓							
	8	-	-							
	9	✓	✓							
	10	-	-							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	-	-							
	15	-	-							
	16	-	-							
	17	-	-							
	18	-	-							
	19	✓	✓							
	20	-	-							
	21	✓	✓							
	22	✓	✓							
	23	✓	✓							
	24	✓	✓							
	25	✓	✓							
	26	✓	✓							
	27	✓	✓							
	28	✓	✓							
	29	✓	✓							
	30		✓							
	31		✓							
	32		✓							

I hereby certify that this correspondence is being electronically transmitted via EFS to the United States Patent and Trademark Office on May 11, 2015.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

AMENDMENT UNDER 37 C.F.R. §1.111
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Confirm. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop **Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. §1.11

Sir:

In response to the Office Action dated February 13, 2015, please amend the application identified above as follows:

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In the Specification

Please amend the paragraph at page 4, lines 25-26, as follows:

FIG. 15 is a plan view illustrating a wireless power receiver **1000** according to the ~~fourth~~ fifth embodiment;

Please amend the Abstract as shown on the attached sheet

In the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Currently Amended) A wireless power receiver comprising:

a substrate having a receiving space of a predetermined ~~shaped~~ shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit;

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil, and

wherein the connecting unit is disposed in the receiving space and connected to the ~~first and second terminals~~ coil unit,

wherein the connecting unit includes:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit, and

wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape.

2. (Canceled)

3. (Previously Presented) The wireless power receiver of claim 1, wherein the shape of the receiving space corresponds to a shape of the connecting unit.

4-5. (Canceled)

6. (Previously Presented) The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the substrate and surrounding the coil.

7. (Previously Presented) The wireless power receiver of claim 6, wherein the short-range communication antenna has a rectangular configuration formed by winding one conductive line several times.

8. (Canceled)

9. (Previously Presented) The wireless power receiver of claim 6, wherein the connecting unit is connected to the short-range communication signal antenna.

10. (Canceled)

11. (Previously Presented) The wireless power receiver of claim 1, wherein the conductive pattern is a conductive layer.

12. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

13. (Currently Amended) The wireless power receiver ~~ofclaim 12~~ of claim 12, wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate.

14-18. (Canceled)

19. (Previously Presented) A wireless portable terminal, comprising the wireless power receiver of claim 1.

20. (Canceled)

21. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises magnetic material.

22. (Previously Presented) The wireless power receiver of claim 1, further comprising a wireless power receiving circuit connected to the connecting unit.

23. (Previously Presented) The wireless power receiver of claim 1, wherein the coil unit is disposed on a top surface of the substrate and the connecting unit.

24. (Currently Amended) The wireless power receiver of ~~claim 8~~ claim 6, wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate.

25. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate is flexible.

26. (Previously Presented) The wireless power receiver of claim 6, wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil.

27. (Previously Presented) A wireless portable terminal, comprising the wireless power receiver of claim 3.

28. (Previously Presented) The wireless portable terminal of claim 19, which is a smartphone.

29. (Previously Presented) The wireless portable terminal of claim 27, which is a smartphone.

30. (New) The wireless power receiver of claim 1, wherein the one end of the coil is at an inside portion of the conductive pattern and the other end of the coil is at an outside portion of the conductive pattern.

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31. (New) The wireless power receiver of claim 31, the conductive line of the conductive pattern crosses over the receiving space.

32. (New) The wireless power receiver of claim 1, wherein the connection unit is configured such that it is separable from the receiving space.

Remarks

Claims 1, 3, 6, 7, 9, 11-13, 19, and 21-29 are pending in the subject application. By this Amendment, claims 1, 13, and 24 are amended, and new claims 30-32 are added. In addition, the specification is amended to correct a typographical error and the Abstract is amended to be at least 50 words. No new matter is introduced. Support for the amendments and new claims can be found throughout the original specification (see, for example, page 7, lines 5-7 and 18-23, and Figure 11). Upon entry of these amendments, claims 1, 3, 6, 7, 9, 11-13, 19, and 21-32 will be before the Examiner for further consideration.

The amendments set forth herein should not be interpreted to indicate that Applicants have agreed with or acquiesced to the rejections set forth in the outstanding Office Action. The amendments to the claims have been made in an effort to lend greater clarity to the claimed subject matter and to expedite prosecution. Favorable consideration of the claims now presented, in view of the remarks and amendments set forth herein, is respectfully requested.

Objection to Specification

The specification has been objected to for informalities. In view of the amendment to the specification presented herein, Applicants respectfully request withdrawal of this objection.

Objection to claims 1 and 24

Claims 1 and 24 have been objected to for informalities. In view of the amendments to claims 1 and 24 presented herein, Applicants respectfully request withdrawal of this objection.

Rejection of claims 1, 3, 11-13, 21, 23, and 25 under 35 U.S.C. §102(b)

Claims 1, 3, 11-13, 21, 23, and 25 have been rejected under 35 U.S.C. §102(b) as being anticipated by JP H-04-5115-U (hereinafter after referred to as "JP '115"). Applicants respectfully request reconsideration.

Claim 1 has been amended to recite that the connecting unit includes a third connection terminal connected to the first connection terminal of the coil unit and a fourth connection terminal connected to the second connection terminal of the coil unit, wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape. These advantageous features of the subject invention are discussed throughout the original specification and can be seen in at least Figure 11, in which the connecting unit includes a third connection terminal **310** connected to the first connection terminal **210** of the coil unit **200** and a fourth connection terminal **320** connected to the second connection terminal **220** of the coil unit **200**, wherein the conductive pattern **230** includes a conductive line wound at least two times and the conductive pattern **230** has a spiral shape (see also, e.g., page 7, lines 5-7 and 18-23).

On the other hand, Applicants submit that JP '115 fails to teach, or even suggest, a wireless power receiver as claimed. Applicants submit that the JP '115 device does not include a connecting unit having the claimed features and a coil formed as a conductive pattern that includes a conductive line wound at least two times and that has a spiral shape. Because JP '115 fails to disclose each and every element of the claimed invention, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1, 3, 11-13, 21, 23, and 25 under 35 U.S.C. §102(b).

Rejection of claims 6, 7, 9, 22, 24, and 26 under 35 U.S.C. §103(a)

Claims 6, 7, 9, 22, 24, and 26 have been rejected under 35 U.S.C. §103(a) as being anticipated by JP '115 in view of JP 2008-027015 (hereinafter referred to as "JP '015"). Applicants respectfully request reconsideration.

The deficiencies of the JP '115 have been discussed above. JP '015 does not these deficiencies. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 6, 7, 9, 22, 24, and 26 under 35 U.S.C. §103(a).

Rejection of claims 19, 27, 28, and 29 under 35 U.S.C. §103(a)

Claims 19, 27, 28, and 29 have been rejected under 35 U.S.C. §103(a) as being anticipated by JP '115 in view of JP 2006-042519 (hereinafter referred to as "JP '519"). Applicants respectfully request reconsideration.

The deficiencies of the JP '115 have been discussed above. JP '519 does not these deficiencies. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 19, 27, 28, and 29 under 35 U.S.C. §103(a).

In view of the foregoing remarks and amendments to the claims, Applicants believe that the claims as currently pending are in condition for allowance, and such action is respectfully requested.

Applicants invite the Examiner to call the undersigned if clarification is needed on any of this response, or if the Examiner believes a telephonic interview would expedite the prosecution of the subject application to completion.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

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Attachment: Replacement Abstract

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ABSTRACT

A wireless power receiver ~~according to one embodiment includes~~ can include a magnetic substrate and a coil configured to wirelessly receive power. ~~, wherein the~~ The coil ~~is~~ can be formed as a conductive layer on the magnetic substrate. A connecting unit can be disposed in a receiving space of the magnetic substrate and can be connected to the coil unit.

Electronic Acknowledgement Receipt

EFS ID:	22306729
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/GEORGIA KOSMAKOS
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response1-.pdf	424354 b128781dfc53dd442490072e38e63ae154eb52ea	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Specification	2	2
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	Abstract	10	10
Warnings:			
Information:			
	Total Files Size (in bytes):	424354	

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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 13/663,012	Filing Date 10/29/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	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

05/11/2015	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 21	Minus	** 20	= 1	x $80 =	80
Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	x $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	**80**

AMENDMENT

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 02/13/2015
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	

ART UNIT	PAPER NUMBER
2836	

NOTIFICATION DATE	DELIVERY MODE
02/13/2015	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):

euspto@slepatents.com

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 13/663,012	Applicant(s) AN ET AL.	
	Examiner JAMES P. EVANS	Art Unit 4186	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 *10/29/2012*.
☐ 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) *1,3,6,7,9,11-13,19 and 21-29* 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) *1,3,6,7,9,11-13,19 and 21-29* 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 *10/29/2012* 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: _____.

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

Specification

2. The abstract of the disclosure is objected to because it is too short (only 33 words vs 50). Correction is required. See MPEP § 608.01(b).

3. The disclosure is objected to because of the following informalities:

• "[0035] FIG. 15 is a plan view illustrating the wireless power receiver 1000 according to the fourth embodiment"

Should be

• "[0035] FIG. 15 is a plan view illustrating the wireless power receiver 1000 according to the fifth embodiment".

Appropriate correction is required.

Claim Objections

4. The claims filed on 4/29/2014 are objected to for the following informalities:

5. Claim 24 depends on Claim 8, which has been cancelled. Note: since claim 8 was dependent upon claim 6 in the original application, the examiner is assuming that Claim 24 is dependent directly on Claim 6.

6. Claim 1: (minor informality) – "predetermined shaped" should be "predetermined shape". Correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

6. **Claims 1, 3, 11-13, 21, 23 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Hitachi Ferrite, Ltd (JPH-04-51115-U).**

7. **Regarding claim 1**, Hitachi Ferrite teaches a wireless power receiver (transformer) comprising:

a substrate having a receiving space of a predetermined shaped formed therein for a connecting unit (Figure 2 discloses a space between the ferrite core (1) and the substrate mounting groove (5) to accommodate the "flexible substrate" which forms the connector unit) configured to connect to a wireless power receiving circuit (the receiving side of a transformer is inherently configured to connect to a power receiving circuit; the means of power transfer is also wireless);

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive layer-pattern (Embodiments: coils are obtained by winding a conductive wire material) on (Figure 1) or within the substrate , wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil (Embodiments: Leads (3) of the coils are soldered to a connecting land on the flexible substrate (4); Figure 1; What is Claimed Is: terminals of coils are connected to the substrate), and

wherein the connecting unit (flexible substrate (4) and associated solder connections as shown in Figure 1) is disposed in the receiving space (Figure 2 discloses a space between the ferrite core (1) and the substrate mounting groove (5) to accommodate this connector unit) and connected to the first and second terminals (Embodiments: Leads (3) of the coils are soldered to a connecting land on the flexible substrate (4); Figure 1).

8. **Regarding claim 3**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the shape of the receiving space corresponds to a shape of the connecting unit (Figure 2 discloses a space between the ferrite core (1) and the substrate mounting groove (5) to accommodate this connector unit).

9. **Regarding claim 11**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the conductive coil pattern is a conductive layer (Embodiments: The coils are obtained by winding a conductive wire material into a spiral shape).

10. **Regarding claim 12**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the substrate comprises a pattern groove (Embodiments: coil-arranging grooves (2) are formed on a main plate of a disk-shaped ferrite core (1) and coils are arranged in the coil-arranging grooves (2); Figure 2) for receiving a part of the coil and wherein the part of the coil (Embodiments: The depth of the substrate mounting groove may be determined based on the thickness of the substrate and the thickness for connecting and fixing the leads of the coils) is disposed in the pattern groove (Embodiments: coils are arranged in the coil-arranging grooves (2); Figure 2) .

11. **Regarding claim 13**, Hitachi Ferrite teaches the wireless power receiver of claim 12, wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate (Embodiments: The depth of the substrate mounting groove may be determined based on the thickness of the substrate and the thickness for connecting and fixing the leads of the coils; therefore if the groove depth is chosen appropriately, the upper portion of the coil will be exposed).

12. **Regarding claim 21**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the substrate comprises magnetic material (ferrite core (1); Figure 1).

13. **Regarding claim 23**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the coil unit (coil) is disposed on a top surface of the substrate (ferrite core (1)) and the connecting unit (flexible substrate (4)); configuration as shown in Figure 2).

14. **Regarding claim 25**, Hitachi Ferrite teaches the wireless power receiver of claim 1, wherein the substrate is flexible (Embodiments- the flexible substrate (4)).

Claim Rejections - 35 USC § 103

15. 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.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

16. Claims 6, 7, 9, 22, 24 and 26 are rejected under 35 U.S.C. 103(a) as being anticipated by Hitachi Ferrite, Ltd (JPH-04-51115-U) in view of Dainippon Printing Co. Ltd. (JP 2008-027015).

17. **Regarding claim 6**, Hitachi discloses the wireless power receiver of claim 1; Hitachi does not disclose further comprising a short-range communication antenna formed on the surround substrate and surrounding the coil.

Dainippon teaches further comprising a short-range communication antenna (communications aerial 11) formed on the surround substrate (base material) and surrounding the coil (antenna 17; as shown in Fig.2 (b)).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the teaching of Dainippon further comprising a short-range communication antenna, in order to deliver and receive information along with power to energize any display devices on the receiver (as disclosed in Dainippon Paragraphs [0001]-[0002]).

18. **Regarding claim 7**, Hitachi in view of Dainippon discloses the wireless power receiver of claim 6. Hitachi does not further disclose wherein the short-range communication antenna comprises a near field communication (NFC) antenna which has a rectangular configuration formed by winding one conductive line several times. Dainippon further teaches wherein the short-range communication antenna comprises a near field communication (NFC) antenna (antenna 17) that has a rectangular configuration formed by winding.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the further teaching of Dainippon wherein the short-range communication antenna comprises a near field communication antenna having a rectangular configuration formed by winding one conductive line several times in order to deliver and receive information (as addressed earlier) shaped in order to improve the efficiency (Takaishi (US 2008/0122570) [0016] is a coil with a rectangular (square) shape which is larger than the circular coil and which has improved efficiency).

19. **Regarding claim 9**, Hitachi in view of Dainippon discloses the wireless power receiver of claim 6. Hitachi does not further disclose wherein the connecting unit is connected to the short-range communication signal antenna. Dainippon further teaches wherein the connecting unit is connected to the short-range communication signal antenna (Paragraph [0015] As shown in Fig.2 (b), ...the communications aerial 11 ..., and arranging it on the card base material. All interconnections must be made on the base material to form a connecting unit to enable the connections between the elements shown in figure 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the further teaching of Dainippon wherein the connecting unit is connected to the short-range communication signal antenna, in order to in order to deliver and receive information along with power to energize any display devices on the receiver (as disclosed in Dainippon Paragraphs [0001]-[0002]).

20. **Regarding claim 22**, Hitachi discloses the wireless power receiver of claim 1. Hitachi does not clearly disclose further comprising a wireless power receiving circuit connected to the connecting unit. Dainippon teaches further comprising a wireless power receiving circuit (rectifier circuit 18, capacitor 19) connected to the connecting

unit (All interconnections are made on the base material to form a connecting unit to enable the connections between the elements shown in figure 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the teaching of Dainippon further comprising a wireless power receiving circuit connected to the connecting unit, in order to deliver and receive information along with power to energize any display devices on the receiver (as disclosed in Dainippon Paragraphs [0001]-[0002]).

21. **Regarding claim 24**, Hitachi in view of Dainippon discloses the wireless power receiver of claim 8 (really claim 6, per objection). Hitachi does not further teach wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate. Dainippon further teaches wherein the coil unit (antenna 17) is disposed at an inner portion of the substrate ([0015] As shown in Fig.2 (b), .. .arranging it to the inner circumference side), and wherein the short-range communication antenna (communications aerial 11) is arranged at an outer peripheral portion of the substrate ([0015] As shown in Fig.2 (b), .. .the communications aerial 11 .. arranging it on the card base material ...at the outer circumference side).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the teaching of Dainippon wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate, in order to ([0015] minimize the portions of the two coils that overlap in a plane direction).

22. **Regarding claim 26**, Hitachi in view of Dainippon discloses the wireless power receiver of claim 6. Hitachi does not further teach wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil. Dainippon further teaches wherein the short-range communication antenna (communications aerial 11) is arranged at an outer peripheral portion of the coil (Paragraph [0015] As shown in Fig.2 (b), .. .the communications aerial 11 ...at the outer circumference side). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the further teaching of Dainippon wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil, in order to minimize the portions of the two coils that overlap in a plane direction (Paragraph [0015]).

23. **Claims 19, 27, 28 and 29 are rejected under 35 U.S.C. 103(a) as being anticipated by Hitachi Ferrite, Ltd (JPH-04-51115-U) in view of Seiko (JP 2006-042519).**

24. **Regarding claim 19**, Hitachi discloses the wireless power receiver of claim 1; Hitachi does not disclose wherein a wireless portable terminal comprises the wireless power receiver of claim 1. Seiko teaches a wireless portable terminal comprising a wireless power receiver (Seiko Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (a wireless portable terminal)). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the teaching of Seiko wherein a wireless portable terminal comprises the

wireless power receiver, in order to provide non-contact transfer of power to the receiving device (Seiko Paragraph [0001]).

25. **Regarding claim 27**, Hitachi discloses the wireless power receiver of Claim 3; Hitachi does not disclose wherein a wireless portable terminal comprises the wireless power receiver of claim 3. Seiko teaches a wireless portable terminal comprising the wireless power receiver (Seiko Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (a wireless portable terminal). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the teaching of Seiko wherein a wireless portable terminal comprises the wireless power receiver, in order to provide non-contact transfer of power to the receiver (Seiko Paragraph [0001]).

26. **Regarding claim 28**, Hitachi in view of Seiko discloses a wireless portable terminal comprising the wireless power receiver of claim 1 as discussed in Claim 19. Hitachi does not teach wherein the wireless portable terminal comprises a smartphone. Seiko further discloses wherein the wireless portable terminal comprises a smartphone (Seiko Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (smartphone)). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the further teaching of Seiko wherein the wireless portable terminal comprises a smartphone, in order to provide non-contact transfer of power to the smartphone (Seiko Paragraph [0001]).

27. **Regarding claim 29**, Hitachi in view of Seiko discloses a wireless portable terminal comprising the wireless power receiver of claim 1 as discussed in Claim 27

earlier. Hitachi does not teach wherein the wireless portable terminal comprises a smartphone. Seiko further discloses wherein the wireless portable terminal comprises a smartphone (Seiko Paragraph [0008]: ...power receiving equipment mounts on a cellular phone (smartphone)). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hitachi with the further teaching of Seiko wherein the wireless portable terminal comprises a smartphone, in order to provide non-contact transfer of power to the smartphone (Seiko Paragraph [0001]).

Examiner Note

28. The examiner cites particular columns and lines numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested that, in preparing responses, the applicant fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Conclusion

29. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Murata (JP 2012-191134) also teaches the wireless power receiver of claims 1, 3, 11, and 12. Murata (JP 2012-191134) discloses a wireless power receiver with a coil unit of conductors formed as a conductive layer-pattern in recessed grooves within a substrate, and a connector disposed in a receiving space of the same size within the substrate, connected to a wireless power receiving circuit. TDK (JPH 07-074038) of the applicant admitted prior art teaches a wireless power receiver (a rotary transformer) with a coil unit formed of coil conductors within recessed grooves on a magnetic substrate. Omron (JPS-56-78415) of the applicant admitted prior art teaches a coil formed as a conductive layer-pattern on or buried in a substrate with a power connector on a flexible printed circuit board. Murata (JP 06-267746) of the applicant admitted prior art teaches a noise eliminating element comprising a rectangular conductor in recessed grooves on a substrate (core), wherein the coil includes a first and second connection terminal. Murata (JP 2012-010533) of the applicant admitted prior art teaches a wireless power receiver in a cell phone with a coil unit formed of coil conductors on or within a magnetic substrate, a connector unit (terminals and electrodes) and a wireless power receiving circuit.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES P. EVANS whose telephone number is (571) 270-0639. The examiner can normally be reached on Monday-Friday 7:30AM-5pm ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jared Fureman can be reached on 571-272-2391. 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.

/JAMES P EVANS/
Examiner, Art Unit 2836

/JARED FUREMAN/

Supervisory Patent Examiner, Art Unit 2836

Notice of References Cited	Application/Control No. 13/663,012	Applicant(s)/Patent Under Reexamination AN ET AL.	
	Examiner JAMES P. EVANS	Art Unit 4186	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-			
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	I	US-			
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	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)
	U	Murata (JP 2012-191134) - Translated patent; October 2012.
	V	Dainippon Printing (JP 2008-027015 Translation F5; February 2008.
	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.

Index of Claims	Application/Control No. 13663012	Applicant(s)/Patent Under Reexamination
	Examiner JARED FUREMAN	**Art Unit** 2836

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

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

CLAIM		DATE								
Final	Original	02/06/2015								
	1	✓								
	2	-								
	3	✓								
	4	-								
	5	-								
	6	✓								
	7	✓								
	8	-								
	9	✓								
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	17	-								
	18	-								
	19	✓								
	20	-								
	21	✓								
	22	✓								
	23	✓								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								
	29	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2015/01/20 10:41
S2	8	("20050046573" | "20080122570" | "20080154178" | "20080197957" | "20090058358" | "20100277004" | "20120057322" | "6008622").PN.	US-PGPUB; USPAT	OR	ON	2015/01/20 10:51
S3	175746	(coil$1 or winding$1) WITH (power or energy or current)WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:23
S4	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:34
S5	175746	(coil$1 or winding$1) WITH (power or energy or current)WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S6	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S7	158	S6 AND S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S8	398217	(coil$1 or winding$1) SAME (power or energy or current)SAME(terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S9	27303	(substrate or base or core or "ferrite magnet layer") SAME (space or shape	US-PGPUB; USPAT;	OR	ON	2015/01/20 12:23

		or shaped) SAME (connector or "connecting unit") SAME (terminal or lead or "connecting land")	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S10	1934	S9 SAME S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:24
S11	392	WO adj "2008053599" WO adj "2013174340" EP adj "1870984" WO adj "2012169728" WO adj "2006127829" EP adj "0037921" WO adj "2005034152" WO adj "1992014254" WO adj "2006134712" WO adj "2007007516" WO adj "2007055265" "20030006657" EP adj "2642632" EP adj "2202499" EP adj "2642632" CN adj "1110225" "3634878" "3848208" "20130249302" WO adj "2006047953" CN adj "1151100" WO adj "2013149781" CN adj "103326473" JP adj "2012235630" "5724018" CN adj "100466382" CN adj "101071909" EP adj "2367263" WO adj "2011147451" WO adj "2014183352" EP adj "1487087" WO adj "2004045050" WO adj "2009070705" JP adj "2013138404" WO adj "2004030845" EP adj "2309620" JP adj "2005065018" JP adj "2004023961" JP adj "2010110168" EP adj "2256751" WO adj "2009155030" EP adj "2642591" WO adj "2012015839" EP adj "2814047" JP adj "2004072867" "2091798" WO adj "1993013532" WO adj "2008135507" "3660791" WO adj "2006101049" WO adj "2002046653" WO adj "2007049788" JP adj "2001144642" "3146419" EP adj "1868280" EP adj "1883998" JP adj "2014023281" "3792410" CN adj "201340774" "20060278387" CN adj "1855761" JP adj "2013157917" EP adj "1717967" CN adj "101189692" CN adj "102056328" "3848205" WO adj "2013022255" JP adj "2014027102" EP adj "1821556" "3767102" EP adj "2375531" JP adj "2008017141" WO adj "2005034307" JP adj "2010093386" EP adj "2629361" WO adj "2005030528" CN adj "1941230" "3163840" "3863040"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:52
S12	299	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:58

S13	3	EP adj "2642632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 14:51
S14	22	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$ or US-20130249302-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/20 15:01
S15	22	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 15:01
S16	2	"20080164840"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 17:13
S17	6	"39593692".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/20 17:15
S18	2	"20120044114"	US-PGPUB; USPAT	OR	ON	2015/01/20 17:26
S19	3	(("Jeong Wook") near2 (AN)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:52
S20	2	(("Jeong Wook") near2 (AN)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:54
S21	8	(("Jung Oh") near2 (LEE)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:55
S22	1	(("Jung Oh") near2 (LEE)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:57
S23	3	(("Sung Hyun") near2 (LEEM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:58
S24	0	(("Sung Hyun") near2 (LEEM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:04
S25	7	(("Yang Hyun") near2 (KIM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 09:05
S26	3	(("Yang Hyun") near2 (KIM)).INV.	EPO; JPO;	OR	ON	2015/01/21

			DERWENT			09:19
S27	5	"47598569".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/23 11:34
S28	24	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/26 13:45
S29	2993903	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:02
S30	1440492	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:07
S31	3326212	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:10
S32	2674608	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:19
S33	2115289	(connect$3 or link$3 or coupl$3 or join$3) near3 (terminal or node or lead or electrode or contact)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:22
S34	80414	S29 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:28
S35	2254	S34 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:29
S36	328	S35 SAME S32	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S37	52	S36 SAME S33	US-PGPUB;	ADJ	ON	2015/01/26

			USPAT; USOCR			14:30
S38	133047	S29 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S39	2254	S38 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S40	5809	S30 near3 S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:32
S43	27	jp and "2006042519"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 12:52
S44	0	jp and "04-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:35
S45	4911	jp and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:36
S46	0	jp and "rotary transformer" and "flexible substrate (35)"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S47	20	jp and "rotary transformer" and "flexible substrate"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S51	2	"4-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:42
S52	61	"hitachi ferrite" and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:49

S53	17	"hitachi ferrite" and "rotary transformer" and grooves	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:52
S57	4554	"satoshi" AND "shinji"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S58	100	murata AND S57	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S59	2	JP2010022098A	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 10:40
S60	38	"6008622"	US-PGPUB; USPAT	OR	ON	2015/01/28 17:01
S61	1	"6008622" and Norio	US-PGPUB; USPAT	OR	ON	2015/01/28 17:02
S62	1	"17402302".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/28 17:03
S63	336	H04B5/0037	US-PGPUB; USPAT	OR	ON	2015/01/28 17:30
S64	42	H04B5/0081	US-PGPUB; USPAT	OR	ON	2015/01/28 17:31
S65	38	H01F41/14	US-PGPUB; USPAT	OR	ON	2015/01/28 17:32
S66	1111	H02J17/00	US-PGPUB; USPAT	OR	ON	2015/01/28 17:55
S67	32971	H02J17/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/28 17:55
S68	6341	H01F41/14	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:19
S69	20594	H01Q7/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/01/29 08:27

			DERWENT; IBM_TDB			
S70	1439	H04B5/0081	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S71	21809	S70 OR S69	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S72	394	S71 and ("rectang$4" OR "square")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:38

1/29/2015 8:40:26 AM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

Sheet 1 of 2

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JPH-04-51115-U	04-30-1992	HITACHI FERRITE, LTD.	ALL	
	F2	JPH-07-74038-A	03-17-1995	TDK CORP	ALL	
	F3	JPS-56-78415-U	06-25-1981	OMRON CORPORATION	ALL	

Examiner Signature	/James P. Evans/	Date Considered	01/28/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kind Codes of USPTO Patent Documents at www.uspto.gov or MPEP901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard T.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Group Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

Sheet 2 of 2

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated October 7, 2014 in Japanese Application No. 2012-238615.	

Examiner Signature	/James P. Evans/	Date Considered	01/28/2015

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[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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PTO/SB/08A

Substitute for form 1449A/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	**Application Number**	13/663,012
(use as many sheets as necessary)	**Filing Date**	October 29, 2012
	First Named Inventor	Jeong Wook An
	Art Unit	2836
	Examiner Name	Rexford N. Barnie
Sheet 1 of 1	**Attorney Docket Number**	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	US-2008/0164840	07-10-2008	Kato *et al.*	ALL
	U2	US-2012/0044114	02-23-2012	Eom *et al.*	ALL
	U3	US-			
	U4	US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP 2002-299138	10-11-2002	Kawasaki Steel Corp.	ALL	
	F2	JP 2008-172872	07-24-2008	Sony Ericsson Mobile Comm. JP	ALL	
	F3	JP 2008-205215	09-04-2008	Seiko Epson Corp.	ALL	
	F4	JP 2008-210861	09-11-2008	Yonezawa Densen KK	ALL	
	F5	JP 2008-27015	02-07-2008	Dainippon Printing Co. Ltd.	ALL	
	F6	JP 61-69811	05-13-1986	Fuji Denki Kagaku Kabushiki Kaisha	ALL	
	F7	JP 6-267746	09-22-1994	Murata Mfg. Co. Ltd.	ALL	
	F8	KR 10-2008-0074640	08-13-2008	Anyquitous Co. Ltd.	ALL	
	F9	KR 10-2012-0016778	02-27-2012	Samsung Elec. Co. Ltd.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated November 11, 2013 in Korean Application No. 10-2012-0123375.	
	R2	Office Action dated November 12, 2013 in Japanese Application No. 2012-238616.	
	R3		
	R4		

Examiner Signature	/James P. Evans/	Date Considered	01/28/2015

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[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet	1	of	2

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Application Number	13/663,012
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U.S. PATENT DOCUMENTS

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	U1	2010/0277004-A1	11-04-2010	Suzuki *et al.*	ALL
	U2	2005/0046573-A1	03-03-2005	Velasco *et al.*	ALL
	U3	2008/0197957-A1	08-21-2008	Kondo *et al.*	ALL
	U4	2009/0058358-A1	03-05-2009	Inoue *et al.*	ALL
	U5	2012/0057322-A1	03-08-2012	Eberhard Waffenschmidt	ALL
	U6	2008/0154178-A1	06-26-2008	Carter *et al.*	ALL
	U7	2008/0122570-A1	05-29-2008	Konomu Takaishi	ALL
	U8	6,008,622	12-28-1999	Norio Nakawatase	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code[3] - Number[4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2006-042519-A	02-09-2006	Seiko Epson Corp.	ALL	
	F2	JP-2012-010533-A	01-12-2012	Murata MFG Co., Ltd.	ALL	
	F3	JP-H08-79976-A	03-22-1996	TDK Corp.	ALL	

Examiner Signature	/James P. Evans/	Date Considered	01/28/2015

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2014
First Named Inventor	Jeong Wook An
Group Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

NON PATENT LITERATURE DOCUMENTS

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	R1	European Search Report dated July 1, 2014 in European Application No. 12190583.0.	

Examiner Signature	/James P. Evans/	Date Considered	01/28/2015

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[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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CONFIRMATION NO. 3575

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/663,012	10/29/2012 **RULE**	307	2836	SUN.LGI.420

APPLICANTS
LG INNOTEK CO., LTD., Seoul, KOREA, REPUBLIC OF

INVENTORS
Jeong Wook AN, Seoul, KOREA, REPUBLIC OF;
Jung Oh LEE, Seoul, KOREA, REPUBLIC OF;
Sung Hyun LEEM, Seoul, KOREA, REPUBLIC OF;
Yang Hyun KIM, Seoul, KOREA, REPUBLIC OF;

** **CONTINUING DATA** *************************

** **FOREIGN APPLICATIONS** *************************
REPUBLIC OF KOREA 10-2012-0029987 03/23/2012
REPUBLIC OF KOREA 10-2012-0079004 07/19/2012

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
11/16/2012

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /JAMES P EVANS/ Examiner's Signature	☐ Met after Allowance Initials	KOREA, REPUBLIC OF	21	20	3

ADDRESS

SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614
UNITED STATES

TITLE

WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

FILING FEE RECEIVED		
1260	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

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Search Notes	**Application/Control No.** 13663012	**Applicant(s)/Patent Under Reexamination** AN ET AL.
	Examiner JAMES P EVANS	**Art Unit** 2836

CPC- SEARCHED

Symbol	Date	Examiner
H04B5/0037	1/29/2015	JPE
H04B5/0081	1/29/2015	JPE
H01F41/14	1/29/2015	JPE

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
307	104	1/29/2015	JPE

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Search	1/21/2015	JPE
Keyword search	1/20/2015	JPE
IP.com search	1/20/2015	JPE
and all docs cited in European search report	1/20/2015	JPE
Search with SSE (Michael Obinna)	1/26/2015	JPE
Consulted Hared Fureman (SPE)	1/29/2015	JPE

INTERFERENCE SEARCH

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

/JAMES P EVANS/ Examiner.Art Unit 2836	

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

Sheet 1 of 2

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JPH-04-51115-U	04-30-1992	HITACHI FERRITE, LTD.	ALL	
	F2	JPH-07-74038-A	03-17-1995	TDK CORP	ALL	
	F3	JPS-56-78415-U	06-25-1981	OMRON CORPORATION	ALL	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Group Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated October 7, 2014 in Japanese Application No. 2012-238615.	

Examiner Signature		Date Considered	

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[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

J:\SUN\LGI\420\IDS-Refs\12-29-14\PTO-SB-08(3).doc/bdt

Application No. (Date): (Hei) 2-92260 (1990.8.31)

Publication No. (Date): (Hei) 4-51115 (1992.4.30)

Applicant: HITACHI FERRITE, LTD.

Title of Invention: Rotary Transformer

What is claimed is:

A rotary transformer in which ring-shaped coil-arranging grooves are provided on a main plane of each disk-shaped ferrite core and a pair of disk-shaped ferrite cores with coils arranged in coil arranging grooves thereof are disposed to have their main planes face each other, wherein a substrate mounting groove, which extends in a radial direction, is provided on the main plane on at least one side of the pair of disk-shaped ferrite cores, a substrate is disposed in the substrate mounting groove, and terminals of coils are connected to the substrate.

Detailed Description of the Invention

(Industrial Applicability)

The invention relates to a rotary transformer for use in a video recorder, etc.

(Description of the Related Art)

FIG. 3 illustrates a plan view of a conventional rotary transformer, and FIG. 4 illustrates a rear view of the conventional rotary transformer. The conventional rotary transformer includes four coil-arranging grooves (32), which are formed on a main plane of a disk-shaped ferrite core (31), and coils (not illustrated) are arranged in the coil-arranging grooves (32). Leads (34) of the coils are drawn out through slit grooves (33), which extend in a radial direction, and are soldered to a connecting land of a flexible substrate (35), which is bonded onto the rear surface of the conventional rotary transformer. A protruding piece (36) extended from the flexible substrate (35) is used for connection to an external circuit.

(Technical problems of the Invention)

In accordance with recent trends for the miniaturization and thin shaping of devices that can be embedded in a rotary transformer, there has been a strong demand for the miniaturization of a rotary transformer.

To form a rotary transfomer into a thin shape, the thickness of a disk-shaped ferrite core, the thickness of a flexible substrate and the height of lead soldering may all need to be reduced, but attempts have been made to form a rotary transformer into a thin shape mostly by reducing the thickness of the disk-shaped ferrite core. However, there is a limit in reducing the thickness of the disk-shaped ferrite core because of rigidity issues.

A structure has been suggested in which part of a disk-shaped ferrite core to which a flexible substrate is bonded is formed in a stepwise shape. However, because of the thinness of the stepwise portion, rigidity issues have also arisen.

To address these and other problems, the invention provides a rotary transformer with a new structure capable of realizing a thin shape.

(Technical Solutions of the Invention)

The invention provides a rotary transformer in which ring-shaped coil-arranging grooves are provided on a main plane of each disk-shaped ferrite core and a pair of disk-shaped ferrite cores with coils arranged in coil arranging grooves thereof are disposed to have their main planes face each other, wherein a substrate mounting groove, which extends in a radial direction, is provided on the main plane on at least one side of the pair of disk-shaped ferrite cores, a substrate is disposed in the substrate mounting groove, and terminals of coils are connected to the substrate.

(Embodiments)

FIG. 1 illustrates a plan view of a rotary transformer according to an embodiment of the invention, and FIG. 2 illustrates an enlarged cross-sectional view of the rotary transformer. In the present embodiment, four coil-arranging grooves (2) are formed on a main plane of a disk-shaped ferrite core (1), and coils are arranged in the coil-arranging grooves (2). The coils are obtained by winding a conductive wire material into a spiral shape. A substrate mounting groove (5), which extends in a radial direction, is formed on the main plane of the disk-shaped ferrite core (1), and a flexible substrate (4) is bonded in the substrate mounting groove (5). Leads (3) of the coils are soldered to a connecting land on the flexible substrate (4) in the substrate mounting groove (5) of the core (1).

According to the invention, a substrate mounting groove may be obtained by modifying slit grooves for drawing out the leads of coils, and a substrate may be mounted in the substrate mounting groove so as for the leads of coils to be connected thereto. Accordingly, a thin-shape rotary transformer may be realized. The depth of the substrate mounting groove may be determined based on the thickness of the substrate and the thickness for connecting and fixing the leads of the coils.

Also, since no substrate is bonded to the rear surface of a core, the dimension precision on the rear surface, and the processability, of the core may be improved.

A substrate mounting groove and a substrate according to the invention are not limited to the embodiment set forth herein, and various modifications can be made thereto without departing from the scope of the invention.

(Advantageous Effects of the Invention)

According to the invention, slit grooves for drawing out the leads of coils are modified into a substrate mounting groove, and a substrate is mounted in the substrate mounting groove so as for the leads of coils to be connected thereto. Accordingly, it is possible to realize a thin-shape rotary transformer.

Description of the Drawings

FIG. 1 is a plan view of a rotary transformer according to an embodiment of the invention.

FIG. 2 is an enlarged cross-sectional view of the rotary transformer according to an embodiment of the invention.

FIG. 3 is a plan view of a conventional rotary transformer.

FIG. 4 is a rear view of the rotary transformer of FIG. 3.

1: Disk-shaped ferrite core, 2: Coil arranging grooves, 3: Coil leads, 4: Flexible substrate, 5: Substrate mounting groove

[redacted] [redacted]

⑲日本国特許庁（JP）　⑪実用新案出願公開

⑫公開実用新案公報（U）　平4−51115

⑤Int. Cl.⁵　識別記号　庁内整理番号　㊸公開　平成4年(1992)4月30日

H 01 F 23/00　A　8123−5E

審査請求　未請求　請求項の数 1　（全　頁）

㉞考案の名称　ロータリートランス

㉑実　願　平2−92260

㉒出　願　平2(1990)8月31日

⑫考案者　池　本　　治　鳥取県鳥取市南栄町33−12　日立フエライト株式会社鳥取工場内

⑫考案者　田　中　克　典　鳥取県鳥取市南栄町33−12　日立フエライト株式会社鳥取工場内

⑫考案者　村　上　豊　彦　鳥取県鳥取市南栄町33−12　日立フエライト株式会社鳥取工場内

⑫考案者　馬場崎　康　典　鳥取県鳥取市南栄町33−12　日立フエライト株式会社鳥取工場内

⑫考案者　井手野　博　人　鳥取県鳥取市南栄町33−12　日立フエライト株式会社鳥取工場内

⑪出願人　日立フエライト株式会社　東京都新宿区百人町1−25−1

明　細　書

考案の名称

ロータリートランス

実用新案登録請求の範囲

円板状フェライトコアの主平面に環状のコイル配設用溝が施され、該コイル配設用溝にコイルが配設された一対の円板状フェライトコアを前記主平面が相対向される如く配置されてなるロータリートランスにおいて、前記一対の円板状フェライトコアの少なくとも一方は、前記円板状フェライトコアの主平面に、径方向に伸びる基板装着溝を有し、該基板装着溝に基板が配置され、該基板に、前記コイルの端末が接続されていることを特徴とするロータリートランス。

考案の詳細な説明

（産業上の利用分野）

本考案は、ビデオテープレコーダ等に使用されるロータリートランスに関するものである。

（従来の技術）

ロータリートランスの従来例の平面図を第３図に、裏面図を第４図に示す。この従来例は、円板状フェライトコア３１の主平面に、４つのコイル配設用溝３２が形成され、このコイル配設用溝３２に、コイル（図示せず）を配設したもので、そのコイルのリード３４を径方向に伸びたスリット溝３３を通して裏面へ引き出し、裏面に接着されたフレキシブル基板３５の接続用ランドへ半田付けしたものである。そして、そのフレキシブル基板３５より伸びた突片３６を外部回路との接続に用いていたものである。

（考案が解決しようとする課題）

ロータリートランスの組み込まれる装置の小型化に伴い、ロータリートランスの小型化、薄型化が強く要望されている。

従来の構造で、薄型を検討すると、円板状フェライトコアの厚さと、フレキシブル基板の厚さと、

[redacted] [redacted]

リードの半田付け処理高さを加えたものを薄くする必要があるが、主に円板状フェライトコアの厚さを薄くすることにより、薄型化が試みられる。しかしながら、強度の問題から、円板状フェライトコアの厚さを薄くすることにも限界があった。

また、円板状フェライトコアの裏面のフレキシブル基板が接着される部分を段差状とする構造も提案されているが、その段差状部分の厚さが極端に薄くなり、強度上の問題があった。

本考案は、上記の事を鑑みて、薄型化を達成できる新規な構造のロータリートランスを提供することを目的とする。

（課題を解決するための手段）

本考案は、円板状フェライトコアの主平面に環状のコイル配設用溝が施され、該コイル配設用溝にコイルが配設された一対の円板状フェライトコアを前記主平面が相対向される如く配置されてなるロータリートランスにおいて、前記一対の円板

状フェライトコアの少なくとも一方は、前記円板状フェライトコアの主平面に、径方向に伸びる基板装着溝を有し、該基板装着溝に基板が配置され、該基板に、前記コイルの端末が接続されているロータリートランスである。

（実施例）

本考案に係る一実施例の平面図を第１図に、拡大断面図を第２図に示す。この実施例は、円板状フェライトコア１の主平面に、４本のコイル配設用溝２が形成されており、このコイル配設用溝２にコイルが配設されている。このコイルは、導電線材をスパイラル状に巻いたものである。また、この円板状フェライトコア１の主平面には、径方向に伸びた基板装着溝５が形成されており、この基板装着溝５に、フレキシブル基板４が接着されている。そして、コイルのリード３をコア１の基板装着用溝５内のフレキシブル基板４上の接続ランド部へ半田付けしたものである。

[redacted] [redacted]

この実施例によれば、従来コイルのリードを引き出していたスリット溝を変更し、基板装着溝とし、そこへ基板を装着して、コイルのリードをその基板へ接続することにより、薄型化を達成できる。このとき、基板装着溝の深さは、基板の厚さ及びコイルリードを接続固定したときの厚さを考慮して決定される。

また、本考案の実施例では、コアの裏面に基板等を接着しないので、コア裏面の寸法精度が高くなり、また取り扱い性も良くなる。

また、本考案における基板装着溝及び基板は、上記実施例のものに限定されるものでなく、その他の形状、構造としても良い。

（考案の効果）

本考案によれば、従来コイルのリードを引き出していたスリット溝を変更し、基板装着溝とし、そこへ基板を装着し、コイルリードを接続する構成とすることにより、ロータリートランスの薄型

化を達成できるものである。

図面の簡単な説明

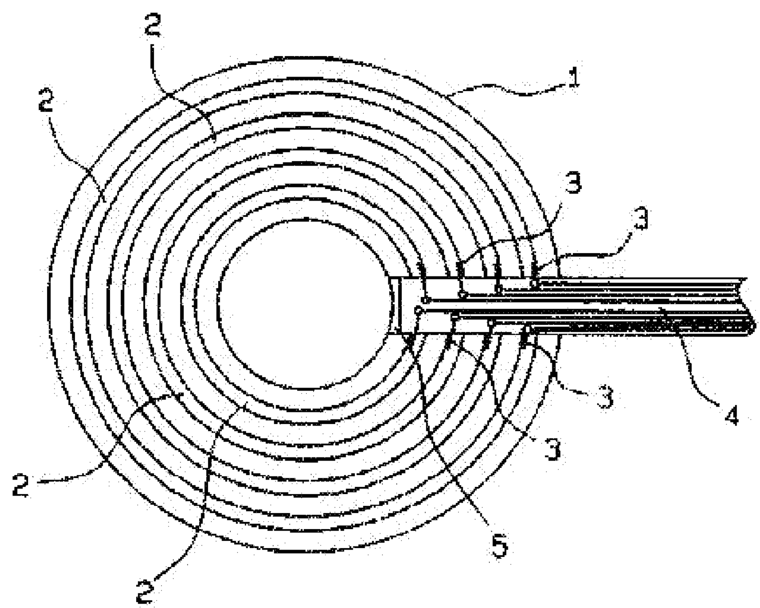
第1図は、本考案に係る一実施例の平面図であり、第2図は、本考案に係る一実施例の拡大断面図であり、第3図は、従来例の平面図であり、第4図は、第3図の裏面図である。

1…円板状フェライトコア、2…コイル配設用溝、3…コイルリード、4…フレキシブル基板、5…基板装着溝。

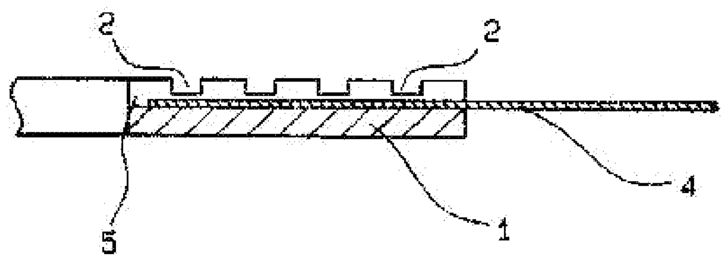
出願人　　日立フェライト株式会社

[redacted] [redacted]

第１図



第２図



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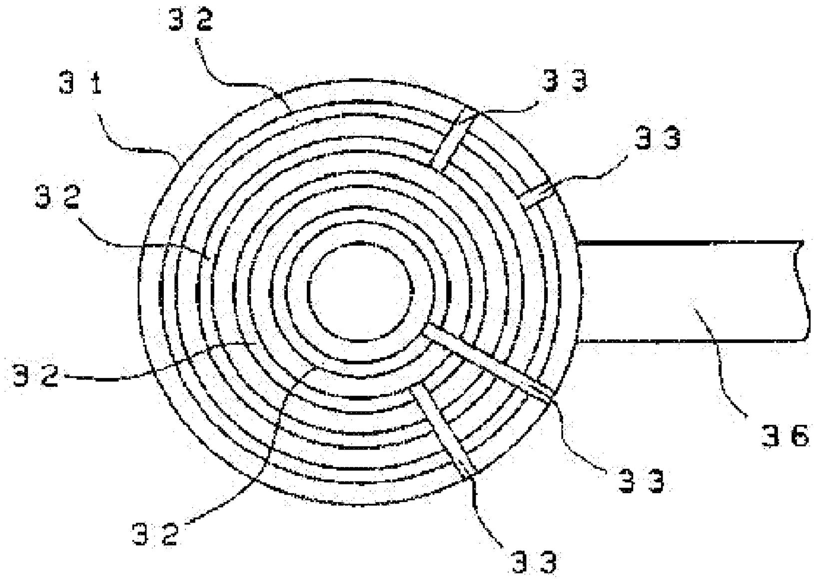
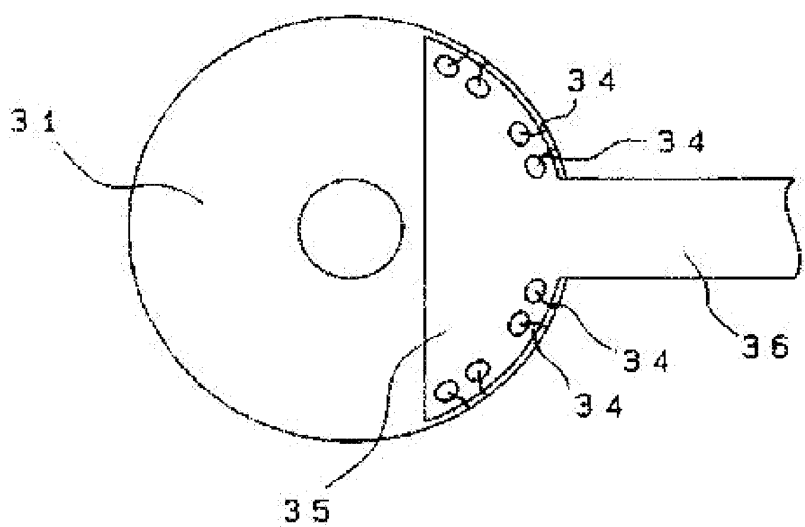
実用新案登録出願人　　日立フェライト株式会社

[redacted] [redacted]

第3図



第4図



実用新案登録出願人　　日立フェライト株式会社

168

PATENT ABSTRACTS OF JAPAN

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(43)Date of publication of application : **17.03.1995**

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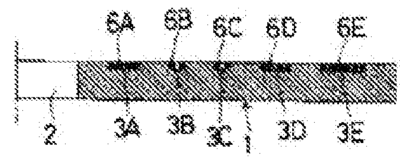
H01F 41/04

(21)Application number : **05-240308**
(22)Date of filing : **02.09.1993**

(71)Applicant : **TDK CORP**
(72)Inventor : **TAKAHASHI SHIGEYA**
SAITO YUTAKA
SHIMAZAKI TATSUYA
KAWAMURA JUNICHIRO
KINOSHITA KOJI

(54) **MANUFACTURE OF ROTARY TRANSFORMER**

(57)Abstract:
PURPOSE: To obtain a manufacturing method, of a rotary transformer, which can automate a manufacturing process, which can reduce manufacturing costs and which can accommodate the smaller size and the higher density of coils due to the smaller size of the rotary transformer.
CONSTITUTION: Ring-shaped recessed grooves 3A to 3E are formed on one face of a disc-shaped ferrite core 1, ring-shaped conductor metal foils are bonded to the ring-shaped recessed grooves 3A to 3E, and spiral coils 6A to 6E are formed of the ring-shaped conductor foils by an etching operation. Thereby, the higher density of the spiral coils is realized, and their manufacturing process can be automated.



CLAIMS

[Claim(s)]

[Claim 1]A manufacturing method of a rotary transformer providing at least one circular concave on the whole surface of a disc-like magnetic core, adhering circular conductor metal foil to this circular concave, and forming a conductive pattern with this circular conductor metal foil by etching.

[Claim 2]A manufacturing method of the rotary transformer according to claim 1 which forms a metal skin on the aforementioned conductive pattern.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]The present invention relates to the manufacturing method of a rotary transformer suitable although it is used when starting the manufacturing method of a rotary transformer, supplying a recording signal to the rotating magnetic head from outside in a magnetic recorder and reproducing device or deriving a recording signal outside from this.

[0002]

[Description of the Prior Art]Conventionally, the following is known as a rotary transformer.

[0003]In the rotary transformer assembly which these people proposed by JP,62-18013,Y, the annular groove of concentric circle shape is formed in the whole surface of the disc-like ferrite core which constitutes a rotor core or a stator core, and the composition which provided the winding which winds a wire rod around this annular groove is disclosed.

[0004]In JP,H2-308505,A which these people proposed, A core device for rotary transformers which fixed the sheet-shaped coil body which pierces highpolymer sheets, such as resin in which the conductive pattern was formed in the annular groove of the same disc-like ferrite core, the aforementioned annular groove and in the shape of isomorphism, and a manufacturing method for the same are disclosed.

[0005]In JP,59-127812,A, the concave which a desired coil pattern goes around is previously formed in a disc-like ferrite core. This concave is filled up with conductive paste and the manufacturing method of the rotary transformer which forms a coil by calcinating a disc-like ferrite core after that, and printing the aforementioned conductive paste is disclosed.

[0006]In JP,H4-42908,A, the concave of the spiral shape which is a desired coil pattern is previously formed in a disc-like ferrite core. After filling up this concave with a filling or metal powder and carrying out melting (sintering) of the molten metal to it, the manufacturing method of the rotary transformer which forms a coil is disclosed by cooling.

[0007]

[Problem to be solved by the invention]By the way, in the manufacturing method of the rotary transformer shown by each above-mentioned conventional example, there is a problem as follows, respectively.

[0008]First, automation is difficult, while formation of a coil takes time and effort and the working man hour by handicraft increases in the manufacturing method which forms a coil using a wire rod and is arranged to a concave.

[0009]When using the sheet-shaped coil body which forms a conductive pattern for highpolymer sheets, such as resin, there is a fault to which a manufacturing cost becomes high, and the correspondence to the miniaturization of a rotary transformer has a limit in the sheet-shaped coil body manufactured by punching.

[0010]When forming the concave of a coil pattern in a ferrite core previously, filling up this concave with conductive paste or molten metal and forming a coil, processing of the concave to which a coil pattern is made to correspond is difficult practically, and, under the present circumstances, is considered that commercial production is difficult.

[0011]In view of the above-mentioned point, the present invention can realize automation of a manufacturing process, and reduction of a manufacturing cost, and an object of the present invention is to provide the manufacturing method of the rotary transformer which can respond to the miniaturization or densification of a coil (conductive pattern) accompanying the miniaturization of a rotary transformer.

[0012]

[Means for solving problem]To achieve the above objects, the manufacturing method of the rotary transformer of the present invention provides at least one circular concave on the whole surface of a disc-like magnetic core, adheres circular conductor metal foil to this circular concave, and is characterized by forming a conductive pattern with this circular conductor metal foil by etching.

[0013]It is good also as composition which forms a metal skin on the aforementioned conductive pattern.

[0014]

[Function]In the manufacturing method of the rotary transformer of the present invention, By etching into the circular conductor metal foil adhered to the circular concave of the disc-like magnetic core, conductive patterns, such as spiral shape used as a coil, are formed in a circular concave, since automation of a process is possible, it is suitable for mass production, and reduction of a manufacturing cost is possible. The number of turns and line width of a conductive pattern used as a coil can be set up free by etching, and a miniaturization or densification of a coil is possible for them. Therefore, it compares with the method of filling up the concave of the method of arranging the conventional coil or sheet-shaped coil body which consists of a wire rod to a circular concave, or a coil pattern with conductive paste or molten metal, and forming a coil, Manufacture is easy, and there is at low lost, and it is suitable also for a miniaturization and thinning of the rotary transformer.

[0015]

[Working example]Hereafter, the working example of the manufacturing method of the rotary transformer concerning the present invention is described according to Drawings.

[0016]Fig.1 thru/or Fig.5 show the working example of the present invention.In Fig.1 and Fig.2, 1 is a disc-like ferrite core used as the rotor core of a rotary transformer, or a stator core, the through hole 2 is formed in the center, and the circular concaves 3A thru/or 3E of two or more concentric circle shape are formed in the whole surface.The flute width of these circular concaves 3A thru/or 3E is set as any width with the coil pattern of the request according to a use, respectively. A high resistance ferrite is used as a ferrite core.

[0017]Next, the circular copper foil 5A thru/or 5E which is the circular conductor metal foil corresponding to each size of the circular concaves 3A thru/or 3E of the aforementioned disc-like ferrite core 1 is prepared. Copper foil is united with each size of the above-mentioned circular concaves 3A thru/or 3E with an etching method, and this circular copper foil 5A thru/or 5E forms it in a circle (it forms the form and the shape of isomorphism of a circular concave). And as shown in Fig.3, adhesion fixing of the above-mentioned circular copper foil 5A thru/or 5E is inserted in and carried out to the bottom surface of the circular concaves 3A thru/or 3E corresponding to each. ******** application of the adhesives is carried out previously at the bottom surface or the circular copper foil 5A thru/or 5E of the circular concaves 3A thru/or 3E.

[0018]And as shown in Fig.4, etching by photo etching method is performed to the above-mentioned circular copper foil 5A thru/or 5E, and the spiral copper foil coils 6A thru/or 6E as a desired conductive pattern are formed in the circular concave 3A thru/or 3E bottom surface, respectively. Namely, photoresist is applied to the circular copper foil 5A thru/or 5E upper surface, The spiral shape pattern which carries out the number turn circumference is exposed to the photoresist layer, it removes except the portion covered with the photoresist layer of the spiral shape pattern by etching, and the spiral copper foil coils 6A thru/or 6E are formed, respectively. In the case of Fig.4, these spiral copper foil coils 6A thru/or 6E differed in the number of the circumference according to the flute width of the circular concaves 3A thru/or 3E, and their number of the circumference has increased, so that a flute width is wide.

[0019]Then, solder plating is performed to the exposed portion of the spiral copper foil coils 6A thru/or 6E, copper corrosion prevention is performed, and a final spiral coil is formed, respectively. Although Fig.5 expands and shows the spiral coil 8A portion which gave the solder metal skin 7 to the exposed portion of the spiral copper foil coil 6A, it is the same about other copper foil coils.

[0020]The stator or rotor of a rotary transformer which has the spiral coil which performed solder plating 7 at the spiral copper foil coils 6A thru/or 6E by the above, respectively on two or more circular concaves 3A thru/or 3E bottom surfaces is obtained. Close arrangement is carried out so that the surface in which the circular concave was formed may oppose mutually, a stator is attached to fixing, a rotor is attached to the axis of rotation, and the stator and rotor of a rotary transformer are set up rotatably.

[0021]a through hole penetrated at the back surface of the ferrite core 1 at the circular concaves 3A thru/or 3E of the disc-like ferrite core 1 from a bottom surface of these circular concaves 3A thru/or 3E although a graphic display was omitted -- every [a couple] -- it is formed, respectively.

This through hole is a drawer end of each spiral coil.

[0022]Since the circular copper foil 5A thru/or 5E which suits the form of the circular concaves 3A thru/or 3E with an etching method is formed according to the above working example, the correspondence to the form of the circular concaves 3A thru/or 3E is easy, and it can respond also to a small ferrite core. In order that each spiral coil (what was plated in the spiral copper foil coils 6A thru/or 6E) may be processed into a desired conductive pattern with photo etching method and may form the above-mentioned circular copper foil 5A thru/or 5E adhered to the circular concave 3A thru/or 3E bottom surface, The number of turns and line width of a coil can be set up free, and the densification of a spiral coil is also easy and it is suitable for a miniaturization and thinning of the rotary transformer. Since it is automatable, each aforementioned process is suitable for mass production, and it can aim at reduction of a manufacturing cost.

[0023]The circular copper foil 5A thru/or 5E can also be formed by methods, such as punching other than an etching method, with the size and the accuracy demanded of the circular concaves 3A thru/or 3E.

[0024]Although it had composition which provides five circular concaves to a disc-like ferrite core in the above-mentioned working example, the number of these circular concaves can be suitably changed according to the specification of a rotary transformer. Similarly, the number of the circumference and line width of a spiral coil can also be suitably changed according to the specification of a rotary transformer. Although copper foil was used as circular conductor metal foil, other conductor metal foil may be used. Although solder was used as plating material given to the spiral copper foil coils 6A thru/or 6E, other plating material may be sufficient.

[0025]Although described about the working example of the present invention above, probably, it will be obvious to a person skilled in the art for various kinds of deformation and change to be possible for the present invention within the limits of the description of a claim, without being limited to this.

[0026]

[Effect of the Invention]As described above, according to the manufacturing method of the rotary transformer of the present invention. Since at least one circular concave is provided on the whole surface of a disc-like magnetic core, circular conductor metal foil is adhered to this circular concave and the conductive pattern was formed with this circular conductor metal foil by etching, automation of a process is possible, it is suitable for mass production, and a manufacturing cost can also be reduced. A number of turns, line width, etc. of a conductive pattern used as a coil can be set up free, and a miniaturization or densification of a coil becomes possible. Therefore, small size and an inexpensive rotary transformer suitable for thinning can be obtained.

[Brief Description of the Drawings]

[Drawing 1]It is a plan view showing the disc-like ferrite core used in the working example of the manufacturing method of the rotary transformer concerning the present invention.

[Drawing 2]It is a cross sectional view showing a disc-like ferrite core.

[Drawing 3]It is a fragmentary sectional view showing the process of carrying out adhesion fixing of the circular copper foil to the bottom surface of the circular concave of a disc-like ferrite core.

[Drawing 4]It is a fragmentary sectional view showing the process of performing photo etching to circular copper foil, and forming a spiral copper foil coil in the bottom surface of the circular concave of a disc-like ferrite core.

[Drawing 5]It is a partial expanded sectional view showing the process of performing solder plating and forming a spiral coil on a spiral copper foil coil.

[Explanations of letters or numerals]

1 Disc-like ferrite core

2 Through hole

3A thru/or 3E -- a circular concave

5A thru/or 5E -- circular copper foil

6A thru/or 6E spiral copper foil coil

7 Solder metal skin

8A Spiral coil

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(71)出願人　000003067
ティーディーケイ株式会社
東京都中央区日本橋１丁目13番１号

(72)発明者　高橋　茂也
東京都中央区日本橋一丁目13番１号ティーディーケイ株式会社内

(72)発明者　斎藤　裕
東京都中央区日本橋一丁目13番１号ティーディーケイ株式会社内

(72)発明者　島崎　達也
東京都中央区日本橋一丁目13番１号ティーディーケイ株式会社内

(74)代理人　弁理士　村井　隆

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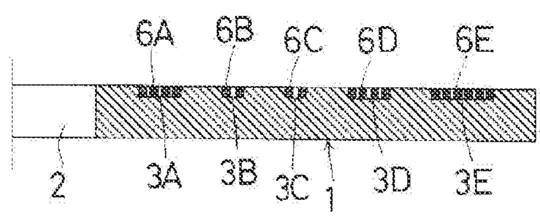
(54)【発明の名称】　ロータリートランスの製造方法

(57)【要約】
【目的】　製造工程の自動化及び製造コストの低減を実現可能で、ロータリートランスの小型化に伴うコイルの小型化又は高密度化に対応可能なロータリートランスの製造方法を得る。
【構成】　円板状フェライトコア１の一面に円環状凹溝３Ａ乃至３Ｅを設け、該円環状凹溝３Ａ乃至３Ｅに円環状導体金属箔を接着し、エッチングにより該円環状導体金属箔でスパイラルコイル６Ａ乃至６Ｅを形成し、これによりスパイラルコイルの高密度化、製造工程の自動化を実現している。



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【特許請求の範囲】

【請求項１】　円板状磁性コアの一面に円環状凹溝を少なくとも１個設け、該円環状凹溝に円環状導体金属箔を接着し、エッチングにより該円環状導体金属箔で導体パターンを形成することを特徴とするロータリートランスの製造方法。

【請求項２】　前記導体パターン上にメッキ層を形成する請求項１記載のロータリートランスの製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ロータリートランスの製造方法に係り、とくに磁気記録再生装置において、その回転磁気ヘッドに外部より録画信号を供給し又はこれより録画信号を外部に導出する場合等に使用するのに好適なロータリートランスの製造方法に関する。

【０００２】

【従来の技術】従来、ロータリートランスとして、以下のようなものが知られている。

【０００３】本出願人が実公昭６２－１８０１３号で提案したロータリートランス組立体では、ロータコアあるいはステータコアを構成する円板状フェライトコアの一面に同心円状の環状溝を形成し、該環状溝に線材を巻回してなる巻線を設けた構成が開示されている。

【０００４】また、本出願人が提案した特開平２－３０８５０５号では、同様の円板状フェライトコアの環状溝に、導体パターンが形成された樹脂等の高分子シートを前記環状溝と同形状に打ち抜いてなるシート状コイル体を固着したロータリートランス用コア装置及びその製造方法が開示されている。

【０００５】また、特開昭５９－１２７８１２号において、所望のコイルパターンの周回する凹溝を予め円板状フェライトコアに形成し、該凹溝に導体ペーストを充填し、その後円板状フェライトコアを焼成して前記導体ペーストを焼き付けることでコイルを形成するロータリートランスの製造方法が開示されている。

【０００６】さらに、特開平４－４２９０８号において、予め円板状フェライトコアに所望のコイルパターンであるスパイラル状の凹溝を形成し、該凹溝に溶融金属を充填あるいは金属粉末を充填して溶融（焼結）した後、冷却することによりコイルを形成するロータリートランスの製造方法が開示されている。

【０００７】

【発明が解決しようとする課題】ところで、上記各従来例で示したロータリートランスの製造方法では以下のようにそれぞれ問題点がある。

【０００８】まず、線材を用いてコイルを形成し凹溝に配設する製造方法では、コイルの形成に手間がかかり、手作業による作業工数が多くなるとともに、自動化が困難である。

【０００９】また、樹脂等の高分子シートに導体パターンを形成してなるシート状コイル体を用いる場合は、製造コストが高くなる欠点があり、打ち抜きにより製作されるシート状コイル体ではロータリートランスの小型化への対応に限界がある。

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【００１０】さらに、フェライトコアにコイルパターンの凹溝を予め形成し、この凹溝に導電性ペーストあるいは溶融金属を充填してコイルを形成する場合、コイルパターンに対応させる凹溝の加工が実用上困難であり、現状では製品化が難しいと考えられる。

【００１１】本発明は、上記の点に鑑み、製造工程の自動化及び製造コストの低減を実現可能で、ロータリートランスの小型化に伴うコイル（導体パターン）の小型化又は高密度化に対応可能なロータリートランスの製造方法を提供することを目的とする。

【００１２】

【課題を解決するための手段】上記目的を達成するために、本発明のロータリートランスの製造方法は、円板状磁性コアの一面に円環状凹溝を少なくとも１個設け、該円環状凹溝に円環状導体金属箔を接着し、エッチングにより該円環状導体金属箔で導体パターンを形成することを特徴としている。

【００１３】また、前記導体パターン上にメッキ層を形成する構成としてもよい。

【００１４】

【作用】本発明のロータリートランスの製造方法においては、円板状磁性コアの円環状凹溝に接着した円環状導体金属箔にエッチングを施すことにより、円環状凹溝にコイルとなるスパイラル状等の導体パターンを形成するものであり、工程の自動化が可能であるため量産に適し、製造コストの低減が可能である。また、コイルとなる導体パターンの巻き数や線幅はエッチングにより自在に設定可能であり、コイルの小型化又は高密度化が可能である。従って、従来の線材からなるコイル又はシート状コイル体を円環状凹溝に配設する方法やコイルパターンの凹溝に導電性ペーストあるいは溶融金属を充填してコイルを形成する方法と比較して、製造が容易で低コストであり、ロータリートランスの小型化や薄型化にも適している。

【００１５】

【実施例】以下、本発明に係るロータリートランスの製造方法の実施例を図面に従って説明する。

【００１６】図１乃至図５は本発明の実施例を示す。図１及び図２において、１はロータリートランスのロータコアあるいはステータコアとなる円板状フェライトコアであり、その中心には貫通穴２が形成されており、一面には複数の同心円状の円環状凹溝３Ａ乃至３Ｅが形成されている。この円環状凹溝３Ａ乃至３Ｅの溝幅は用途に応じた所望のコイルパターンによりそれぞれ任意の幅に設定する。なお、フェライトコアとしては高抵抗フェライトを使用する。

【0017】次に、前記円板状フェライトコア1の円環状凹溝3A乃至3Eのそれぞれの大きさに対応した円環状導体金属箔である円環状銅箔5A乃至5Eを用意する。該円環状銅箔5A乃至5Eは、銅箔をエッチング法により前記円環状凹溝3A乃至3Eのそれぞれの大きさにあわせて円環状に形成（円環状凹溝の形状と同形状に形成）したものである。そして、図3に示すように、前記円環状銅箔5A乃至5Eをそれぞれに対応する円環状凹溝3A乃至3Eの底面に嵌め込んで接着固定する。なお、円環状凹溝3A乃至3Eの底面又は円環状銅箔5A乃至5Eに予め接着剤をそれぞれ塗布しておく。

【0018】それから、図4に示すように、前記円環状銅箔5A乃至5Eにフォトエッチング法によるエッチングを施し、円環状凹溝3A乃至3E底面に所望の導体パターンとしてのスパイラル銅箔コイル6A乃至6Eをそれぞれ形成する。すなわち、円環状銅箔5A乃至5E上面にフォトレジストを塗布し、そのフォトレジスト層に数ターン周回するスパイラル状パターンを露光し、スパイラル状パターンのフォトレジスト層で被覆された部分以外をエッチングで除去してスパイラル銅箔コイル6A乃至6Eをそれぞれ形成する。図4の場合、該スパイラル銅箔コイル6A乃至6Eは、円環状凹溝3A乃至3Eの溝幅に応じて周回数が異なり、溝幅が広いほど周回数が多くなっている。

【0019】その後、スパイラル銅箔コイル6A乃至6Eの露出部分にはんだメッキを施して銅の腐食防止を行い、最終的なスパイラルコイルをそれぞれ形成する。図5ではスパイラル銅箔コイル6Aの露出部分にはんだメッキ層7を施したスパイラルコイル8A部分を拡大して示しているが、他の銅箔コイルについても同様である。

【0020】以上により、複数の円環状凹溝3A乃至3E底面に、スパイラル銅箔コイル6A乃至6Eにはんだメッキ7を施したスパイラルコイルをそれぞれ有するロータリートランスのステータ又はロータが得られる。ロータリートランスのステータとロータとは円環状凹溝が形成された面が相互に対向するように近接配置され、ステータは固定、ロータは回転軸に取り付けられて回転自在に設定される。

【0021】なお、図示は省略したが、円板状フェライトコア1の円環状凹溝3A乃至3Eには、該円環状凹溝3A乃至3Eの底面からフェライトコア1の裏面に貫通するスルーホールが一対ずつそれぞれ形成されており、該スルーホールがスパイラルコイルそれぞれの引き出し端になっている。

【0022】以上の実施例によると、エッチング法により円環状凹溝3A乃至3Eの形状に合う円環状銅箔5A乃至5Eを形成するため、円環状凹溝3A乃至3Eの形状への対応が容易で、小型のフェライトコアにも対応できる。また、各スパイラルコイル（スパイラル銅箔コイル6A乃至6Eにメッキしたもの）は円環状凹溝3A乃至3E底面に接着した前記円環状銅箔5A乃至5Eをフォトエッチング法により所望の導体パターンに加工して形成するため、コイルの巻き数や線幅を自在に設定でき、スパイラルコイルの高密度化も容易であり、ロータリートランスの小型化や薄型化に適している。さらに、前記各工程は自動化が可能であるため量産に適し、製造コストの低減を図ることができる。

【0023】なお、円環状銅箔5A乃至5Eは、円環状凹溝3A乃至3Eの大きさや要求される精度により、エッチング法以外の打ち抜き等の方法で形成することもできる。

【0024】なお、上記実施例では円板状フェライトコアに円環状凹溝を5個設ける構成としたが、該円環状凹溝の数はロータリートランスの仕様に応じて適宜変更できる。同様に、スパイラルコイルの周回数や線幅もロータリートランスの仕様に応じて適宜変更できる。また、円環状導体金属箔として銅箔を用いたが、他の導体金属箔を用いてもよい。また、スパイラル銅箔コイル6A乃至6Eに施すメッキ材としてはんだを用いたが、他のメッキ材でもよい。

【0025】以上本発明の実施例について説明してきたが、本発明はこれに限定されることなく請求項の記載の範囲内において各種の変形、変更が可能なことは当業者には自明であろう。

【0026】

【発明の効果】以上説明したように、本発明のロータリートランスの製造方法によれば、円板状磁性コアの一面に円環状凹溝を少なくとも1個設け、該円環状凹溝に円環状導体金属箔を接着し、エッチングにより該円環状導体金属箔で導体パターンを形成するようにしたので、工程の自動化が可能であって量産に適し、製造コストも低減できる。また、コイルとなる導体パターンの巻き数や線幅等を自在に設定可能であり、コイルの小型化又は高密度化が可能になる。従って、小型、薄型化に適した安価なロータリートランスを得ることができる。

【図面の簡単な説明】

【図1】本発明に係るロータリートランスの製造方法の実施例で用いる円板状フェライトコアを示す平面図である。

【図2】円板状フェライトコアを示す断面図である。

【図3】円板状フェライトコアの円環状凹溝の底面に円環状銅箔を接着固定する工程を示す部分断面図である。

【図4】円環状銅箔にフォトエッチングを施して円板状フェライトコアの円環状凹溝の底面にスパイラル銅箔コイルを形成する工程を示す部分断面図である。

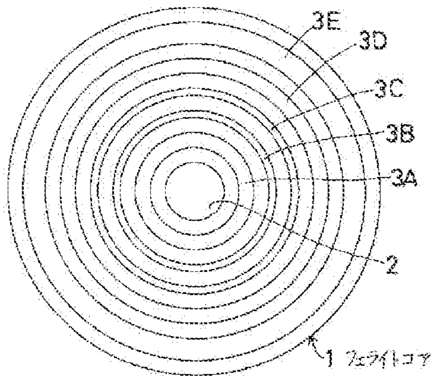
【図5】スパイラル銅箔コイル上にはんだメッキを施してスパイラルコイルを形成する工程を示す部分拡大断面図である。

【符号の説明】

1　円板状フェライトコア

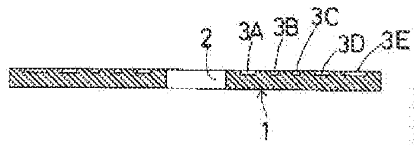
2　貫通穴
3A乃至3E　円環状凹溝
5A乃至5E　円環状銅箔
＊6A乃至6E　スパイラル銅箔コイル
7　はんだメッキ層
＊　8A　スパイラルコイル

【図1】

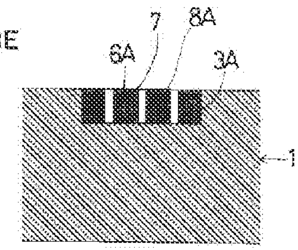


3A～3E：円環状凹溝

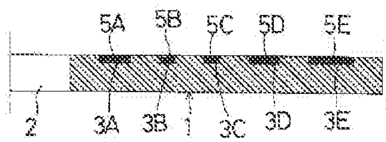
【図2】



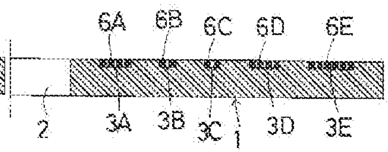
【図5】



【図3】



【図4】



フロントページの続き

(72)発明者　川村　純一郎
東京都中央区日本橋一丁目13番1号ティーディーケイ株式会社内

(72)発明者　木下　幸治
東京都中央区日本橋一丁目13番1号ティーディーケイ株式会社内

Application No. (Date): (Sho) 54-158612 (1979.11.14)
Publication No. (Date): (Sho) 56-78415 (1981.6.25)
Applicant: OMRON COPORATION

1. Title of the Invention: Coil Device

2. What is claimed is:

[Claim 1]

A coil device, comprising a coil spool with a coil wound therearound, a coil connector obtained by printing a conductive body on a base material, and a flexible printed circuit board including a drawn-out portion and a power connector, wherein ends of the coil are connected to the conductive body of the coil connector of the flexible printed circuit board and the flexible printed circuit board is used as a drawn-out line of the coil.

[Claim 2]

The coil device of claim 1, wherein a notch is provided on the outer circumference of the coil spool and the drawn-out portion of the flexible printed circuit board is drawn out by the notch.

3. Detailed Description of the Embodiments

The invention relates to the improvement of a coil device for use in a motor or an electromagnet.

In general, in a coil device, a vinyl sheath is soldered at the winding starting end and the winding terminated end of a coil wound around a coil spool, and the vinyl sheath is used as a drawn-out line. However, the vinyl sheath generally has a large diameter and thus increases the diameter of the coil device. This problem becomes more apparent especially when the size of the coil device decreases, and an increase in the ratio of the drawn-out line to the size of the coil device may result in a decrease in the volume efficiency of a small motor.

The invention provides a coil device capable of minimizing an increase in the diameter of a coil that may be caused by a drawn-out portion of the coil.

Embodiments of the invention will hereinafter be described with the accompanying drawings.

In FIGS. 1, 2, 3(a) and 3(b), reference numeral 1 denotes a coil spool with a coil 2 wound therearound, reference numeral 3 denotes a flexible printed circuit board (FPCB), which becomes a drawn-out line of the coil 2, is a base material 30 printed with conductive bodies 34 and 35, and includes a coil connecting portion 31, a drawn-out portion 32 and a power connecting portion 33. The coil connecting portion 31 and the power connecting portion 33 of the FPCB 3 are formed to be relatively wide to improve operability for, for example, soldering, but the drawn-out portion 32 is formed to be narrow to reduce the size of a hole for, for example, a motor case.

Both ends of each of the conductive bodies 34 and 35 are formed to be wide to facilitate soldering and increase the peel strength of the conductive bodies 34 and 35. A winding starting end 21 and a winding-terminated end 22 of the coil 2 are connected through soldering to the ends of the conductive bodies 34 and 35 of the coil connecting portion 31 of the FPCB 3. The coil connecting portion 31 of the FPCB 3 is bent almost perpendicularly with respect to the drawn-out portion 32, and a middle part of the coil 2 is placed on the coil connecting portion 31 and is taped with an adhesive tape, thereby completing the formation of a coil device. (For convenience, no such taping is illustrated in FIG. 1.)

The coil device with the FPCB 3 as a drawn-out line does not cause the diameter of the entire coil device to increase due to the middle part of the coil 2 because the FPCB 3 is very thin.

FIGS. 4 and 5 illustrate other exemplary embodiments of the invention. A notch 12 with the same width as or a slightly greater width than a drawn-out portion 32 of an FPCB 3 is provided on the outer circumference of a flange part 11, and the drawn-out portion 32 of the FPCB 3 is drawn out by the notch 12. In the exemplary embodiment of FIGS. 4 and 5, unlike in the previous exemplary embodiment, the FPCB 3 does not need to be bent.

FIG. 6 illustrates a modified example of the FPCB 3 in which a coil connecting portion 31 is stretched to have a smaller width than the width on the inside of a coil spool and engaging portions 36 and 37 are provided on either end of the coil connecting portion 31. The engaging portions 36 and 37 may be engaged together, as illustrated in FIG. 6(b). The coil connecting portion 31 may have a length that fits the outer circumference of a coil, in which case, the handling of an adhesive tape for insulation may be facilitated. The drawn-out portion 32 may be provided on one side of the coil connecting portion 31, as illustrated in FIG. 6(a), for an improved material yield.

FIGS. 7 and 8 illustrate modified examples of the power connecting portion 33 of the FPCB 3. More specifically, FIG. 7 illustrates a connector obtained by attaching an insulating member 4 with predetermined rigidity onto the power connecting portion 33, and FIG. 8 illustrates a power connecting portion 33 with the distance between the solder connecting portions of conductive bodies 34 and 35 widened.

FIGS. 9, 10 and 11 illustrate exemplary embodiments in which small holes or notches are provided near conductive bodies 34 and 35, respectively, to facilitate the soldering of a winding starting end and a winding-terminated end of a coil onto the coil connecting portion 31 of the FPCB 3 and thus to facilitate positioning. That is, FIG. 9 illustrates providing holes 5 and 6 on the soldering portions of the conductive bodies 34 and 35, respectively, FIG. 10 illustrates providing holes 7 and 8 on a base member 30 near the soldering portions of the conductive bodies 34 and 35, respectively, and FIG. 11 illustrates providing notches 9 and 10 near the base member 30 near the soldering portions of the conductive bodies 34 and 35, respectively. Referring to FIG. 11, the notches 9 and 10 may be formed as slits with a smaller size than the linear diameter of a coil to be able to be engaged with the winding starting end and the winding-terminated end of the coil.

The conductive bodies 34 and 35 may be buried in the base member 30 of the FPCB 3.

As is apparent from the above description, an FPCB can be used as a drawn-out line of a coil. Accordingly, a very small coil device can be provided without increasing the diameter of a coil.

Therefore, the volume efficiency of a device using a coil device, for example, a motor, may be improved.

4. Description of the Drawings

FIG. 1 is a perspective view of an exemplary embodiment of the invention.

FIG. 2 is a perspective view of a state in which a drawn-out line is yet to be mounted in a coil spool.

FIG. 3(a) is a plan view of a flexible printed circuit board (FPCB), which can become a drawn-out line.

FIG. 3(b) is a perspective view of a state in which a coil connecting portion is bent.

FIG. 4 is a perspective view of another exemplary embodiment of the invention.

FIG. 5 is a perspective view of a coil spool of FIG. 4.

FIG. 6(a) is a plan view of a modified example of the FPCB.

FIG. 6(b) is a perspective view of a state in which coil connecting portions are combined.

FIGS. 7, 8, 9, 10 and 11 are plan views of modified examples of the FPCB.

1: Coil spool, 2: Coil, 3: Flexible Printed Circuit Board (FPCB), 12: Notch, 21: Winding Starting End, 22: Winding Terminated End, 31: Coil Connecting Portion, 32: Drawn-Out Portion, 33: Power Connecting Portion, 34, 35: Conductive Bodies

(4,000 円)

実用新案登録願

昭和54年11月14日

特許庁長官殿

1. 考案の名称

コイル装置(ソウチ)

2. 考案者

住所 京都市右京区花園土堂町10番地
立石電機株式会社内

氏名 畑(ハタ) 公一(コウイチ)

3. 実用新案登録出願人

住所 〒616 京都市右京区花園土堂町10番地
名称 (294) 立石電機株式会社
代表者 立石孝雄
連絡先 電話 (075) 921 — 5111

4. 添付書類の目録

(1) 明細書 1通
(2) 図面 1通
(3) 願書副本 1通

73415

54 156612

明　　細　　書

1.考案の名称

コイル装置

2.実用新案登録請求の範囲

(1)　コイルが巻装されたコイルスプールと，ベース材に導電体が印刷されコイル接続部，引出部および電源接続部を備えたフレキシブル印刷基板とからなり，前記コイルの巻き始めおよび巻き終り端を前記フレキシブル印刷基板のコイル接続部の導電体に接続し，このフレキシブル印刷基板を前記コイルの引出線としてなるコイル装置。

(2)　コイルスプールの外周に切り欠きを設け，この切り欠きより前記フレキシブル印刷基板の引出部を引き出してなる実用新案登録請求の範囲第1項記載のコイル装置。

3.考案の詳細な説明

この考案は，モータや電磁石などに使用するコイル装置の改良に関するものである。

一般に，この種コイル装置にあつては，コイル

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スプールに巻回したコイルの巻き始め，および巻き終り端にビニール被覆線をハンダ付けし，このビニール被覆線を引出線としている。しかし，これによるとビニール被覆線の径が大きいがためにコイル装置全体の径が大きくなるという欠点がある。とくにコイル装置のサイズが小さくなるにつれ引出線の占める割合が大きくなり，小型モータ等では体積効率が悪くなる。

この考案は，コイルの引出線に起因するコイルの直径増加を極少にしたコイル装置を提供することを目的とする。

以下，この考案を図面に示す実施例にもとづいて説明する。

第1図，第2図および第3図(a)，(b)において，1はコイル2が巻回されたコイルスプール，3はコイル2が巻回されたコイルスプール，3はコイル2の引出線となるフレキシブル印刷基板で，ベース材30に導電体34，35を印刷してあり，コイル接続部31，引出部32および電源接続部33からなる。フレキシブル印刷基板3のコイル

接続部31および電源接続部33はハンダ付け等の作業性をよくするためある程度その巾を広くしてあるが，引出部32はモータケース等の引出穴の寸法を小さくするためその巾を狭くしてある。また，導電体34，35の両端はハンダ付けをやりやすくするため，および剥離強度を上げるため広くしてある。コイル2の巻き始め端21および巻き終り端22はフレキシブル印刷基板3のコイル接続部31の導電体34，35の端部にそれぞれハンダ接続してある。そして，フレキシブル印刷基板3のコイル接続部31は第3図(b)に示すよ引出部32に対しほゞ直角に折り曲げてコイル2の腹部に当てがい，その後，コイル2の腹部を粘着テープなどでテーピングすることにより，コイル装置を完成することができる。（第1図は理解を容易にするため，テーピングを省略した状態を示してある。）

このように，フレキシブル印刷基板3を引出線としたコイル装置は，フレキシブル位刷基板3が非常に肉薄であるために，コイル腹部が盛り上つ

てコイル装置全体の径が大きくなることはなくなる。

第4図および第5図はこの考案の他の実施例を示すもので，コイルスプール1の鍔部11の外周にフレキシブル印刷基板3の引出部32とほゞ同等か，やゝ大きめの巾をもつ切り欠き12を設けこの切り欠き12よりフレキシブル印刷基板3の引出部32を引き出すようにしたものである。このような構成にすればフレキシブル印刷基板3を上述した実施例のように折り曲げる必要はなくなる。

第6図はフレキシブル印刷基板3の変形例であつて，コイル接続部31をコイルスプールの内巾以下の巾で伸張し，その両端に係合部36，37を設け，両端をまるめて第6図(b)に示すように係合部36，37を係合するようにしてある。このときのコイル接続部31の長さはコイルの胴部外周に丁度抱きつく長さにしておくと，絶縁のための粘着テープ処理がしやすくなる。なお，引出部32は第6図(a)に示すようにコイル接続部31の

どちらか端部によせておいた方が材料の歩留りが良くなり有利である。

第７図および第８図はフレキシブル印刷基板３の電源接続部３３の変形列を示し，第７図は電源接続部３３に所定の強度をもつた絶縁部材４を貼着してコネクタ処理したものであり，第８図は導電体３４，３５のハンダ接続部間の間隙を大きく広げたものである。

第９図，第１０図，第１１図はフレキシブル印刷基板３のコイル接続部３１にコイルの巻き始め端および巻き終り端をハンダ付けしやすくするために，導電体３４，３５の近傍に小穴または切り欠きを設けてコイルの巻き始め端および巻き終り端を支持し，位置めしやすくしたものである。すなわち，第９図は導電体３４，３５のハンダ付け部に小穴５，６を，第１０図はハンダ付け部の近傍のベース材３０に小穴７，８を，また１１図はハンダ付け部の近傍のベース材３０に切り欠き９，１０を設けたものである。第１１図における切り欠き９，１０はコイルの線径より小さいスリ

ットにしておき，コイルの巻き始め，巻き終り端がかみ込む程度にしておくとよい。

なお，フレキシブル印刷基板3を構成する場合導電体34，35はベース材30中に埋設するようにしてもよい。

上記説明から明らかなように，この考案によればコイルの引出線としてフレキシブル印刷基板を用いているので，コイルの径は大きくならず，非常に小形のコイル装置を提供できる。
したがつて，このコイル装置を使用する機器，たとえばモータなどの体積効率の向上をはかることができる。

4.図面の簡単な説明

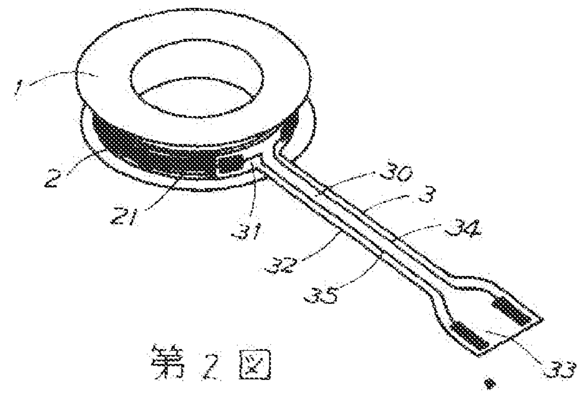
第1図はこの考案の一実施例を示す斜視図，第2図は引出線をコイルスプールに取り付ける前の状態を示す斜視図，第3図(a)は引出線となるフレキシブル印刷基板の平面図，第3図(b)はコイル接続部を折り曲げた状態を示す斜視図，第4図はこの考案の他の実施例を示す要部斜視図，第5図は第4図におけるコイルスプールの斜視図，第6図

(a)はフレキシブル印刷基板の変形例を示す平面図第６図(b)はコイル接続部をまるめた状態を示す斜視図，第７図，第８図，第９図，第１０図，第１１図はフレキシブル印刷基板のさらに他の変形例を示す要部平面図である。

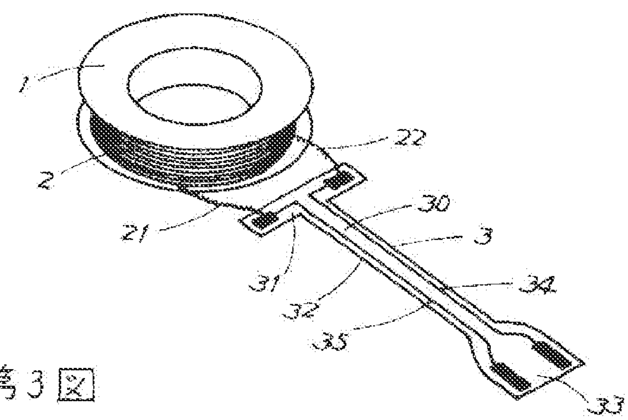
１；コイルスプール，２；コイル，３；フレキシブル印刷基板，１２；切り欠き，２１；巻き始め端，２２；巻き終り端，３１；コイル接続部，３２；引出部，３３；電源接続部，３４，３５；導電体。

実用新案登録出願人　　立石電機株式会社

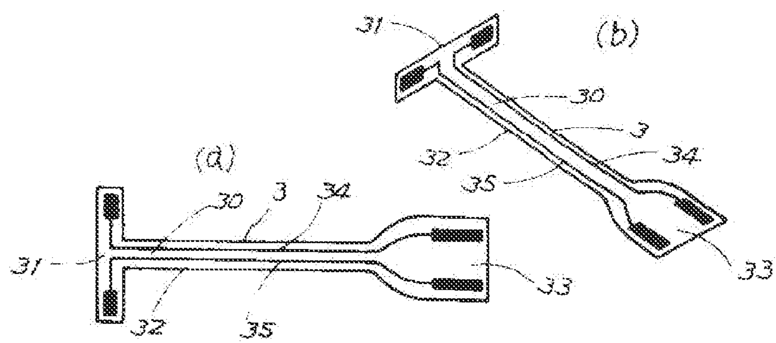
第1図



第2図



第3図



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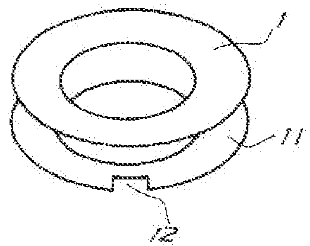
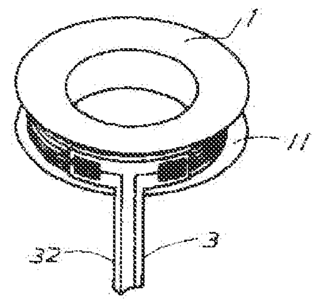
実用新案登録出願人 立石電機株式会社

[redacted] [redacted]

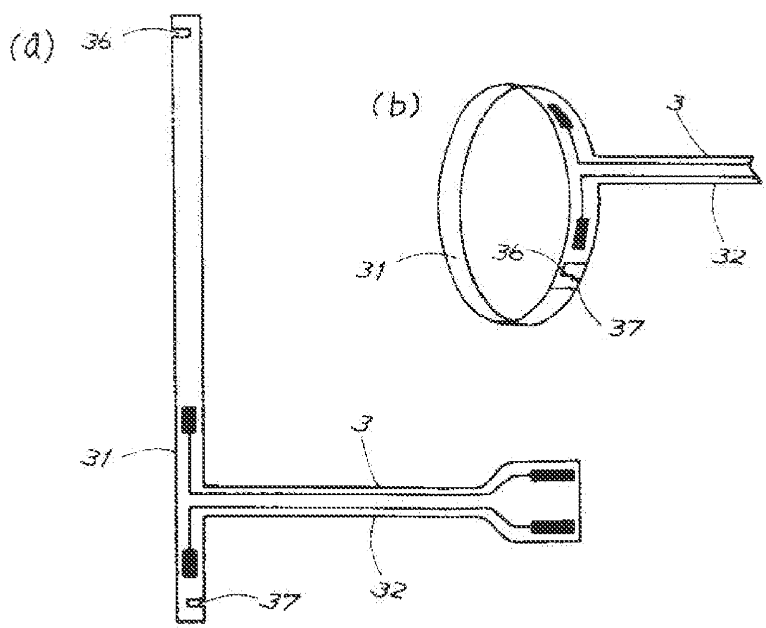
第5図



第4図



第6図



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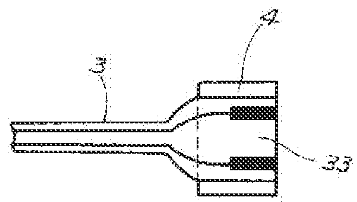
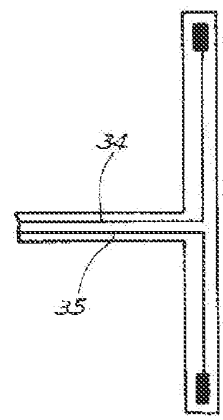
実用新案登録出願人　[illegible]式会社

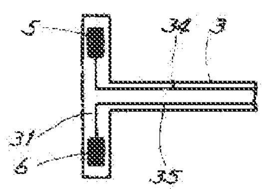
第7図



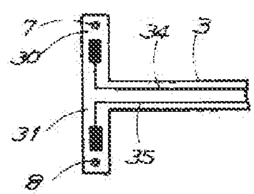
第8図



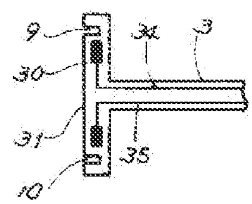
第9図



第10図



第11図



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実用新案登録出願人　立石電機株式会社

Electronic Acknowledgement Receipt

EFS ID:	21076375
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/KENDRA MCKENZIE
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	29-DEC-2014
Filing Date:	29-OCT-2012
Time Stamp:	15:21:26
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		SIDS2-AF.pdf	4455462 870d949d91846f535863d5e9dc4863b01cded0a4	yes	4

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**		**End**
	Transmittal Letter		1		2
	Information Disclosure Statement (IDS) Form (SB08)		3		4
Warnings:					
Information:					
2	Foreign Reference	F1.pdf	2090080 a9e4da973684e463ded5cd1ac929801156050404	no	12
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3	Foreign Reference	F2.pdf	6377316 a3dea408e8d013bc79b3aebd4fd1d230db8a3df1	no	11
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Information:					
4	Foreign Reference	F3.pdf	3670337 f09b71fda539c20578a66a52018459b7c1f48e5f	no	14
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	R1.pdf	2929254 75fbe1ffee3103e28228efa0de965e085be28263	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	19522449		

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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.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on December 29, 2014.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2681
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	2681
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

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

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached.

Applicants note that Japanese Publication Nos. 04-51115, 07-74038, 56-78415 cited as F1 through F3, respectively, on the attached form PTO/SB/08, were written in a foreign language; however, English language Abstracts are provided herewith. Applicants respectfully request that the references be made of record and considered in the examination of the subject application.

The undersigned hereby certifies that each item of information contained in this Supplemental Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Supplemental Information Disclosure Statement. Applicants are attaching a copy of the Japanese Office Action.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/bdt

Attachments: Form PTO/SB/08; copies of references cited.

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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2014
First Named Inventor	Jeong Wook An
Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	2010/0277004-A1	11-04-2010	Suzuki *et al.*	ALL
	U2	2005/0046573-A1	03-03-2005	Velasco *et al.*	ALL
	U3	2008/0197957-A1	08-21-2008	Kondo *et al.*	ALL
	U4	2009/0058358-A1	03-05-2009	Inoue *et al.*	ALL
	U5	2012/0057322-A1	03-08-2012	Eberhard Waffenschmidt	ALL
	U6	2008/0154178-A1	06-26-2008	Carter *et al.*	ALL
	U7	2008/0122570-A1	05-29-2008	Konomu Takaishi	ALL
	U8	6,008,622	12-28-1999	Norio Nakawatase	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2006-042519-A	02-09-2006	Seiko Epson Corp.	ALL	
	F2	JP-2012-010533-A	01-12-2012	Murata MFG Co., Ltd.	ALL	
	F3	JP-H08-79976-A	03-22-1996	TDK Corp.	ALL	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kind Codes of USPTO Patent Documents at www.uspto.gov or MPEP901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard T.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

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PTO/SB/08B (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet	2	of	2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2014
First Named Inventor	Jeong Wook An
Group Art Unit	2681
Examiner Name	
Attorney Docket Number	SUN.LGI.420

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	European Search Report dated July 1, 2014 in European Application No. 12190583.0.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

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PATENT ABSTRACTS OF JAPAN

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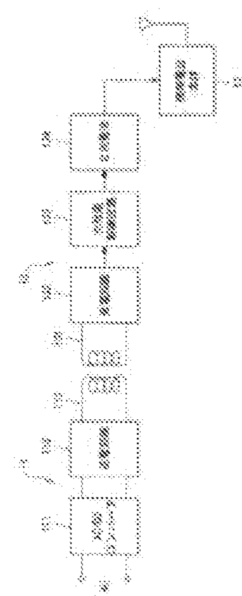
(71)Applicant : SEIKO EPSON CORP
(72)Inventor : ISHIZAWA KOJI
TAKAGI TSUTOMU

(54) CONTACTLESS POWER TRANSMISSION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To suppress unnecessary radiation from coils and to transmit electric power efficiently when electric power transmitting and receiving coils that are used for contactless power transmission are made thinner.
SOLUTION: This power transmission device of this invention, which comprises an electric-power-transmitting device 11 and an electric-power-receiving device 13, is configured to perform contact power transmission by electromagnetically connecting an electric power transmitting coil 113 and an electric power receiving coil 131. Both coils 113, 131 are of a spiral shape and comprises planer coils whose planes are made to face each other. Furthermore, on each of the opposite side surfaces of the surfaces that both planer coils face is provided in such a way as to cover the entire surface a magnetic sheet that suppresses unnecessary radiation by the magnetic field generated by both coils.



[Claim(s)]

[Claim 1]

It has power transmission equipment containing the 1st coil and power receiving equipment containing the 2nd coil and a rechargeable battery,

When said 1st coil carries out inductive coupling of the aforementioned power transmission equipment to said 2nd coil, it has a power transmission means to generate exchange supplied to said 1st coil,

When said 2nd coil carries out inductive coupling of the aforementioned power receiving equipment to said 1st coil, it converts exchange induced by said 2nd coil to a direct current, and has a receiving means which charges the aforementioned rechargeable battery according to this converted direct current,

It consists of the 1st plane coil and the 2nd plane coil in which said 1st coil and said 2nd coil are spiral, and the plane opposes,

And non-contact transfer-of-power equipment, wherein said 1st plane coil and said 2nd plane coil provide a magnetic sheet to a surface of an opposite side of a surface where the both oppose, respectively.

[Claim 2]

The non-contact transfer-of-power equipment according to claim 1 further characterized by providing a metal sheet in piles, respectively in an outer side surface of each magnetic sheet provided to said 1st plane coil and said 2nd plane coil.

[Claim 3]

The non-contact transfer-of-power equipment according to claim 1 or 2 unifying said 2nd coil and the aforementioned rechargeable battery at least among said 2nd coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and the aforementioned rechargeable battery.

[Claim 4]

The non-contact transfer-of-power equipment according to claim 1 or 2 characterized by accommodating said 2nd coil and the aforementioned rechargeable battery in a predetermined case, or solidifying them at least among said 2nd coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and the aforementioned rechargeable battery.

[Claim 5]

Claim 1 making the aforementioned power receiving equipment mount on a cellular phone thru/or non-contact transfer-of-power equipment of a description to any 1 claim of Claim 4.

[Claim 6]

It has power transmission equipment containing the 1st coil, power transmission and power receiving combination equipment containing the 2nd coil and a first rechargeable battery, and power receiving equipment containing the 3rd coil and a second rechargeable battery,

The aforementioned power transmission equipment,

When said 1st coil carries out inductive coupling to said 2nd coil or said 3rd coil, it has a power transmission means to generate exchange supplied to said 1st coil,

The aforementioned power transmission and power receiving combination equipment,

A power transmission means to generate exchange which uses said first rechargeable battery as a power supply, and is supplied to said 2nd coil when said 2nd coil carries out inductive coupling to said 3rd coil,

When said 2nd coil carries out inductive coupling to said 1st coil, exchange induced by that 2nd coil is converted to a direct current, and it has a receiving means which charges said first rechargeable battery according to this converted direct current,

The aforementioned power receiving equipment,

When said 3rd coil carries out inductive coupling to said 1st coil or said 2nd coil, exchange induced by that 3rd coil is converted to a direct current, and it has a receiving means which charges said second rechargeable battery according to this converted direct current,

Said 1st coil, said 2nd coil, and said 3rd coil are spiral, and the plane consists of the 1st plane coil, the 2nd plane coil, and the 3rd plane coil which oppose mutually,

And non-contact transfer-of-power equipment, wherein said 1st plane coil, the 2nd plane coil, and said 3rd plane coil provide a magnetic sheet to a surface of an opposite side of a surface which opposes, respectively.

[Claim 7]

The non-contact transfer-of-power equipment according to claim 6 further characterized by providing a metal sheet in piles, respectively in an outer side surface of each magnetic sheet provided to said 1st plane coil, said 2nd plane coil, and said 3rd plane coil.

[Claim 8]

Said 2nd coil and said first rechargeable battery are unified at least among said 2nd coil that constitutes the aforementioned power transmission and power receiving combination equipment, the aforementioned power transmission means, the aforementioned receiving means, and said first rechargeable battery,

And the non-contact transfer-of-power equipment according to claim 6 or 7 unifying said 3rd coil and said second rechargeable battery at least among said 3rd coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and said second rechargeable battery.

[Claim 9]

Among said 2nd coil that constitutes the aforementioned power transmission and power receiving combination equipment, the aforementioned power transmission means, the aforementioned receiving means, and said first rechargeable battery, said 2nd coil and said first rechargeable battery are accommodated in a predetermined case, or are solidified, [at least]

And at least among said 3rd coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and said second rechargeable battery said 3rd coil and said second rechargeable battery, The non-contact transfer-of-power equipment according to claim 6 or 7 characterized by accommodating in a predetermined case or making it solidify.

[Claim 10]

Claim 6 making the aforementioned power transmission and power receiving combination equipment, and the aforementioned power receiving equipment mount on a cellular phone, respectively thru/or non-contact transfer-of-power equipment of a description to any 1 claim of Claim 9.

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

The present invention is between the personal digital assistants and battery chargers like a cellular phone etc., and relates to the non-contact transfer-of-power equipment which can perform non-contact transfer of power, for example.

[Background of the Invention]

[0002]

Conventionally, as this kind of non-contact transfer-of-power equipment, what planned improve efficiency of the non-contact transfer of power by the electromagnetic induction between the power transmission coil of a live part and the receiving coil of a live part is known regardless of the form of the main body bottom part of a portable transmitter (see a Patent document 1 and the Patent document 2).

And a power transmission coil is wound around the core for power transmission coils, and the receiving coil is wound around the core for receiving coils. Each of cores for power transmission coils and cores for receiving coils comprises a rod-like structure, and the end faces of both the core oppose at the time of use.

[Patent document 1] JP,H10-4639,A

[Patent document 2] JP,H10-14124,A

[Description of the Invention]

[Problem to be solved by the invention]

[0003]

By the way, each power transmission coils and receiving coils which are used for conventional non-contact transfer-of-power equipment are wound around the core. In this case, in order that that most may concentrate the magnetic field generated from a coil on a core, the unnecessary radiation by a magnetic field is very slight, and the measure in particular that stops spurious radiation is not required for it. However, in order to centralize the magnetic field generated from a coil on a core, it is necessary to make it structure which opposes the end-face coincidence of both the core at the time of use as mentioned above.

[0004]

For this reason, since the form and structure of both coils have restrictions in using it like before, winding a power transmission coil and a receiving coil around a different core, there is fault that it is difficult to attain slimming down and flattening.

Then, in order to realize slimming down of a power transmission coil and a receiving coil, it is possible to attain flattening of both the coil, but since use of a core cannot be performed when it is flattened, it is necessary to attain inhibition of the spurious radiation by the magnetic field generated from a coil, and the increase in efficiency of transfer of power.

[0005]

When the object of this invention attains flattening of the power transmission coil and receiving coil which are used for non-contact transfer of power in view of the above-mentioned point, there is in providing the non-contact transfer-of-power equipment which can attain inhibition of the spurious radiation from the coil, and the increase in efficiency of transfer of power.

[Means for solving problem]

[0006]

In order to solve the above-mentioned problem and to attain the object of this invention, each invention consists of the following composition.

Namely, first invention is provided with the power transmission equipment containing the 1st coil and the power receiving equipment containing the 2nd coil and a rechargeable battery, and the aforementioned power transmission equipment, When the 1st above-mentioned coil carries out inductive coupling to the 2nd above-mentioned coil, have a power transmission means to generate the exchange supplied to the 1st above-mentioned coil, and the aforementioned power receiving equipment, When the 2nd above-mentioned coil carries out inductive coupling to the 1st above-mentioned coil, the exchange induced by the 2nd above-mentioned coil is converted to a direct current, Have a receiving means which charges the aforementioned rechargeable battery according to this converted direct current, and further the 1st above-mentioned coil and the 2nd above-mentioned coil, Consisting [and] of the 1st plane coil and the 2nd plane coil in which it is spiral and the plane opposes, the 1st above-mentioned plane coil and the 2nd above-mentioned plane coil provided the magnetic sheet to the surface of the opposite side of the surface where the both oppose, respectively.

[0007]

Second invention provided the metal sheet in piles further in first invention, respectively to the outer side surface of each magnetic sheet provided to the 1st above-mentioned plane coil and the 2nd above-mentioned plane coil.

The 3rd invention unified the 2nd above-mentioned coil and the aforementioned rechargeable battery at least in the 1st or second invention among the 2nd above-mentioned coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and the aforementioned rechargeable battery.

[0008]

Among the 2nd above-mentioned coil from which the 4th invention constitutes the aforementioned power receiving equipment in the 1st or second invention, the aforementioned receiving means, and the aforementioned rechargeable battery, the 2nd above-mentioned coil and the aforementioned rechargeable battery are accommodated in a predetermined case, or were solidified. [at least]

It was made for fifth invention to make the aforementioned power receiving equipment mount on a cellular phone in invention of either the 1st thru/or the 4th inside.

[0009]

Power transmission equipment with which sixth invention contains the 1st coil, and power transmission and power receiving combination equipment containing the 2nd coil and a first rechargeable battery, Have power receiving equipment containing the 3rd coil and a second rechargeable battery, and the aforementioned power transmission equipment, When the 1st above-mentioned coil carries out inductive coupling to the 2nd above-mentioned coil or the 3rd above-mentioned coil, have a power transmission means to generate the exchange supplied to the 1st above-mentioned coil, and the aforementioned power transmission and power receiving combination equipment, A power transmission means to generate the exchange which uses the above-mentioned first rechargeable battery as a power supply, and is supplied to the 2nd above-mentioned coil when the 2nd above-mentioned coil carries out inductive coupling to the 3rd above-mentioned coil, and when the 2nd above-mentioned coil carries out inductive coupling to the 1st above-mentioned coil, Convert the exchange induced by that 2nd coil to a direct current, have a receiving means which charges the above-mentioned first rechargeable battery according to this converted direct current, and the aforementioned power receiving equipment, When the 3rd above-mentioned coil carries out inductive coupling to the 1st above-mentioned coil or the 2nd above-mentioned coil, Convert the exchange induced by that 3rd coil to a direct current, and it has a receiving means which charges the above-mentioned second rechargeable battery according to this converted direct current, The 1st plane coil, the 2nd plane coil in which the 1st above-mentioned coil, the 2nd above-mentioned coil, and the 3rd above-mentioned coil are spiral, and the plane opposes mutually, And it consists of the 3rd plane coil, and the 1st above-mentioned plane coil, the 2nd plane coil, and the 3rd above-mentioned plane coil provided the magnetic sheet to the surface of the opposite side of the surface which opposes, respectively.

[0010]

Seventh invention provided the metal sheet in piles further in sixth invention, respectively to the outer side surface of each magnetic sheet provided to the 1st above-mentioned plane coil, the 2nd above-mentioned plane coil, and the 3rd above-mentioned plane coil.

The 2nd above-mentioned coil from which eighth invention constitutes the aforementioned power transmission and power receiving combination equipment in the 6th or seventh invention, The 2nd above-mentioned coil and the above-mentioned first rechargeable battery are unified at least among the aforementioned power transmission means, the aforementioned receiving means, and the above-mentioned first rechargeable battery, And the 3rd above-mentioned coil and the above-mentioned second rechargeable battery were unified at least among the 3rd above-mentioned coil that constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and the above-mentioned second rechargeable battery.

[0011]

The 2nd above-mentioned coil from which ninth invention constitutes the aforementioned power transmission and power receiving combination equipment in the 6th or seventh invention, Among the aforementioned power transmission means, the aforementioned receiving means, and the above-mentioned first rechargeable battery, at least the 2nd above-mentioned coil and the above-mentioned first rechargeable battery, Among the 3rd above-mentioned coil that accommodates in a predetermined case, or it is made to solidify, and constitutes the aforementioned power receiving equipment, the aforementioned receiving means, and the above-mentioned second rechargeable battery, the 3rd above-mentioned coil and the above-mentioned second rechargeable battery are accommodated in a predetermined case, or were solidified. [at least]

[0012]

It was made for tenth invention to make the aforementioned power transmission and power receiving combination equipment, and the aforementioned power receiving equipment mount on a cellular phone in invention of either the 6th thru/or ninth inside, respectively.

According to the present invention which consists of the above composition, the spurious radiation by the magnetic field etc. which both coils generate by a coil for power transmission, a coil for power receiving, etc. which are used for non-contact transfer of power consisting of plane coils although they form a transformer in the case of use can be inhibited, and the increase in efficiency of transfer of power can be attained.

[Best Mode of Carrying Out the Invention]

[0013]

Hereafter, with reference to Drawings, it describes about the embodiment of the present invention.

[0014]

(A 1st embodiment)

It describes about the composition of a 1st embodiment of the non-contact transfer-of-power equipment of the present invention, referring to Fig.1.

Non-contact transfer-of-power equipment concerning this 1st embodiment is provided with the following.

For example, power transmission equipment 11 which functions as a battery charger as it applies to a cellular phone and is shown in Fig.1.

Power receiving equipment 13 containing a rechargeable battery used as a power supply of the portable telephone body 12.

[0015]

The power transmission equipment 11 and the power receiving equipment 13 form the non-contact transfer-of-power equipment which performs transfer of power by non-contact like the after-mentioned by combining with an electromagnetic target.

The power transmission equipment 11 is provided with the following.

As shown in Fig.1, they are AC / DC converter 111.

Power transmission circuit 112.

Power transmission coil 113.

AC / DC converter 111 converts the volts alternating current of 100 [V]s supplied, for example to a home to predetermined direct current voltage, and supplies the converted direct current voltage to the power transmission circuit 112. The power transmission circuit 112 is a circuit which generates the volts alternating current of predetermined frequency using the direct current voltage from AC / DC converter 111, and supplies this generated volts alternating current to the power transmission coil 113.

[0016]

The power receiving equipment 13 is provided with the following.

As shown in Fig.1, it is the receiving coil 131.

Incoming circuit 132.

Charge-and-discharge control circuit 133.

Rechargeable battery 134.

This power receiving equipment 13 the receiving coil 131, the incoming circuit 132, the charge-and-discharge control circuit 133, and the rechargeable battery 134 which are components, Make it accommodate in one container integrally, or it is made to modularize integrally using a thermosetting synthetic resin etc. (solidification), and was made to form as a power receiving equipment module (battery pack).

[0017]

When using it, making the receiving coil 131 approach with the power transmission coil 113 of the power transmission equipment 11, both the coils 131 and 113 carry out inductive coupling of it, and it forms a transformer among both. The volts alternating current induced by the receiving coil 131 by inductive coupling is supplied to the incoming circuit 132.

The incoming circuit 132 is a circuit which rectifies the volts alternating current induced by the receiving coil 131, and outputs direct current voltage. The direct current voltage outputted from the incoming circuit 132 is supplied to the rechargeable battery 134 via the charge-and-discharge control circuit 133, and charges the rechargeable battery 134.

[0018]

The charge-and-discharge control circuit 133 is a circuit which controls the charge in charging the rechargeable battery 134 with the output from the incoming circuit 132, and controls discharge in operating the portable telephone body 12 which is load with the rechargeable battery 134.

The rechargeable battery 134 is a cell which can be repeatedly used, for example like a lithium ion battery by charge after discharge.

[0019]

Next, with reference to Fig.2 and Fig.3, it describes about a specific structure of the power transmission coil 113 of the power transmission equipment 11, and the receiving coil 131 of the power receiving equipment 13.

The power transmission coil 113 consists of the plane whorl type coil 113a, the magnetic sheet 113b, and the metal sheet 113c so that it may be shown figure 2. And as shown in Fig.3, after the magnetic sheet 113b and the metal sheet 113c have put on the outer surface side of the plane whorl type coil 113a so that the whole outer surface side may be covered, it provides.

[0020]

Therefore, as the component of the power transmission coil 113 is shown in Fig.3, it is constituted so that it may become largely in an order of the plane whorl type coil 113a, the magnetic sheet 113b, and the metal sheet 113c, and, as for these, adhesives etc. are suitably stuck or fixed integrally by the means.

The receiving coil 131 consists of the plane whorl type coil 131a, the magnetic sheet 131b, and the metal sheet 131c, as shown in Fig.2. And as shown in Fig.3, after the magnetic sheet 131b and the metal sheet 131c have put on the outer surface side of the plane whorl type coil 131a so that the whole outer surface side may be covered, it provides.

[0021]

Therefore, as the component of the receiving coil 131 is shown in Fig.3, it is constituted so that it may become largely in an order of the plane whorl type coil 131a, the magnetic sheet 131b, and the metal sheet 131c, and, as for these, adhesives etc. are suitably stuck or fixed integrally by the means.

As it is indicated in Fig.3 as the plane whorl type coil 113a by the side of the power transmission coil 113, and the plane whorl type coil 131a by the side of the receiving coil 131 at the time of use, the inner surface sides oppose and a transformer is formed. For this reason, at the time of use the magnetic sheets 113b and 131b, The spurious radiation by the magnetic field which the plane whorl type coils 113a and 131a generate can be inhibited, and the metal sheets 113c and 131c can inhibit now the spurious radiation by the electric field which the plane whorl type coils 113a and 131a generate.

[0022]

Here, the plane whorl type coils 113a and 131a consist of single track or an insulated electric wire like a stranded wire, and as shown in Fig.2 and Fig.3, they coil the electric wire spirally in the same plane.

The magnetic sheets 113b and 131b consist of a magnetic material of tabular or a sheet shaped, and the magnetic sheet of a silicon steel plate and an amorphous metal, etc. are used.

[0023]

The metal sheets 113c and 131c consist of a metallic material of tabular or a sheet shaped, and aluminum etc. are used.

Next, the power transmission equipment 11 and the power receiving equipment 13 which consists of composition as shown in Fig.1 - Fig.3 are described with reference to Fig.4 about the example at the time of including in the case of a battery charger, and the case of a cellular phone, respectively.

[0024]

Each element which constitutes the power transmission equipment 11 shown in Fig.1 is incorporated in the case 21 of the battery charger shown in Fig.4, and each element which constitutes the power receiving equipment 13 shown in Fig.1 is incorporated in the case 31 of the cellular phone shown in Fig.4.

The case 21 of the battery charger equips the upper it side with the cellular-phone accommodation part 211 in which the case 31 of a cellular phone is accommodated at the time of charge of a cellular phone, as shown in Fig.4. The case 21 of a battery charger equips the lower part side of the cellular-phone accommodation part 211 with the power transmission coil storage part 212, and where the power transmission coil 113 shown in Fig.3 in the power transmission coil storage part 212 is sealed, for example, it is stored. In the case 21 of a battery charger, the circuit board 22 which mounted component parts, such as AC / DC converter 111 of the power transmission equipment 11, and the power transmission circuit 112, is accommodated.

[0025]

The case 31 of the cellular phone is provided with the accommodation part 311 which accommodates the power receiving equipment module 32 which modularized the power receiving equipment 13 shown in Fig.1 in the lower part side, and the lid 312 which opens and closes the accommodation part 311 in the case of exchange of the power receiving equipment module 32 as shown in Fig.4.

Here, as mentioned above, the receiving coil 131, the incoming circuit 132, the charge-and-discharge control circuit 133, and the rechargeable battery 134 which constitute the power receiving equipment 13 are integrally accommodated in one container, or the power receiving equipment module 32 modularizes them integrally using a thermosetting synthetic resin etc.

[0026]

As the power receiving equipment module 32 shown in Fig.4 is shown in the figure, the incoming circuit 132, the charge-and-discharge control circuit 133, and the rechargeable battery 134 are stored in the case 321 of the thin Naokata type, and the receiving coil 131 is integrally attached to the lower surface of the case 321 at the case 321.

In the case 31 of a cellular phone, the circuit board 33 which mounted the component parts of various kinds of electronic circuits which constitute the portable telephone body 12 is accommodated.

[0027]

Next, with reference to Fig.1 and Fig.3, it describes about the example of a 1st embodiment which consists of such composition of operation.

The rechargeable battery 134 of the power receiving equipment 13 is described about the case where it charges using the power transmission equipment 11. In this case, the receiving coil 131 of the power receiving equipment 13 is made to approach the power transmission coil 113 of the power transmission equipment 11, and it changes into the state of carrying out inductive coupling of both the coils 131 and 113. It will be in the state of indicating it, for example in Fig.3 or Fig.4 as the power transmission coil 113 and the receiving coil 131 at this time.

[0028]

Thus, if inductive coupling of the power transmission coil 113 and the receiving coil 131 is carried out, charge according [the rechargeable battery 134 of the power receiving equipment 13] to the power transmission equipment 11 will be started. Charge of the rechargeable battery 134 is performed by the incoming circuit 132 at the time of this charge.

At the time of this charge, a magnetic field and electric field occur in the power transmission coil 113 and the receiving coil 131, and that spurious radiation exists. However, as shown in Fig.3, the magnetic sheets 113b and 131b inhibit the spurious radiation by the magnetic field which the plane whorl type coils 113a and 131a generate, and the metal sheets 113c and 131c inhibit the spurious radiation by the electric field which the plane whorl type coils 113a and 131a generate.

[0029]

After the charge-and-discharge control circuit 133 supervises the charging state of the rechargeable battery 134 and the charge is completed, charge of the rechargeable battery 134 by the incoming circuit 132 is stopped.

Thus, when charge is completed to the rechargeable battery 134, the receiving coil 131 of the power receiving equipment 13 is separated from the power transmission coil 113 of the power transmission equipment 11, and, thereby, the charged rechargeable battery 134 can be used for the portable telephone body 12 as a power supply.

[0030]

As described above, in this 1st embodiment, the power transmission coil 113 and the receiving coil 131 which are used for non-contact transfer of power consist of plane coils, and they form a transformer in the case of use, but. The spurious radiation by the magnetic field and electric field from both coils can be inhibited, and efficient transfer of power can be performed.

[0031]

(A 2nd embodiment)

It describes about the composition of a 2nd embodiment of the non-contact transfer-of-power equipment of the present invention, referring to Fig.5.

[0032]

Non-contact transfer-of-power equipment concerning this 2nd embodiment is provided with the following.

For example, power transmission equipment 11 which functions as a battery charger as it applies to a cellular phone and is shown in Fig.5.

Power receiving equipment 13 containing a rechargeable battery used as a power supply of the portable telephone body 12.

Power transmission and power receiving combination equipment 14 containing a rechargeable battery which serves as a power supply of the portable telephone body 15 while functioning as a battery charger

And the power transmission equipment 11 forms non-contact transfer-of-power equipment, respectively by combining with power transmission and the power receiving combination equipment 14 or the power receiving equipment 13, and an electromagnetic target. When it combines with power transmission and the power receiving combination equipment 14, two cells contained in it can be charged, and when it combines with the power receiving equipment 13, the rechargeable battery contained in it can be charged. By combining with the power receiving equipment 13 and an electromagnetic target, power transmission and the power receiving combination equipment 14 form non-contact transfer-of-power equipment, and can charge now two cells contained in the power receiving equipment 13 at this time.

[0033]

Next, with reference to Fig.5, it describes about the specific composition of each part of this 2nd embodiment.

Since the power transmission equipment 11 and the power receiving equipment 13 are constituted like the power transmission equipment 11 and the power receiving equipment 13 which are shown in Fig.1, they give identical codes to the same component, and the description of the composition omits them here.

Power transmission and the power receiving combination equipment 14 are provided with the following.

As shown in Fig.5, it is the power transmission circuit 141.

Incoming circuit 142.

Rechargeable battery 143.

The charge-and-discharge control circuit 144, power transmission and a receiving coil 145, the change over switches SW1-SW3, the setting device 146, the control circuit 147, and the indicator 148.

[0034]

The power transmission circuit 141 in which this power transmission and power receiving combination equipment 14 are components, the incoming circuit 142, the rechargeable battery 143, the charge-and-discharge control circuit 144, power transmission and a receiving coil 145, the change over switches SW1-SW3, the setting device 146, the control circuit 147, and the inside of the indicator 148, Make each of other component except the setting device 146 and the indicator 148 accommodate in one container integrally, or it is made to modularize integrally using a thermosetting synthetic resin etc. (solidification), and was formed as power transmission and a power receiving combination equipment module.

[0035]

Here, its power transmission and power receiving combination equipment module are formed like [are the same as that of the power receiving equipment module which modularized the power receiving equipment 13 shown in Fig.1 fundamentally, for example,] the power receiving equipment module 32 shown in Fig.4.

The power transmission circuit 141 is a circuit which generates the volts alternating current of predetermined frequency using the direct current voltage supplied from the rechargeable battery 143 at the time of operation, and supplies this generated volts alternating current to power transmission and the receiving coil 145. The incoming circuit 142 is the circuit which rectifies the volts alternating current induced by power transmission and the receiving coil 145, and generates direct current voltage, i.e., an ac and dc conversion circuit, when power transmission and the receiving coil 145 carry out inductive coupling to the power transmission coil 113 of the power transmission equipment 11 and electric power is transmitted from the power transmission equipment 11. The direct current voltage generated by the incoming circuit 142 is supplied to the rechargeable battery 143 via the charge-and-discharge control circuit 144, and charges the rechargeable battery 143.

[0036]

The rechargeable battery 143 is a cell which can be repeatedly used, for example like a lithium ion battery by charge after discharge. The charge-and-discharge control circuit 144 is a circuit which controls the charge in charging the rechargeable battery 143 by the incoming circuit 142 (surveillance), and controls discharge in operating the portable telephone body 15 which are the power transmission circuit 141 and load with the rechargeable battery 143 (surveillance).

[0037]

In using it, making power transmission and the receiving coil 145 approach with the power transmission coil 113 of the power transmission equipment 11, inductive coupling of both the coils 145 and 113 is carried out, and they form a transformer among both. In using it, making power transmission and the receiving coil 145 approach with the receiving coil 131 of the power receiving equipment 13, inductive coupling of both the coils 145 and 131 is carried out, and they form a transformer among both. Namely, the power transmission coil 113, power transmission and a receiving coil 145, and the receiving coil 131 can carry out inductive coupling mutually, and can be mutually separated now.

[0038]

Change over switch SW1 and SW2 make alternative connection between power transmission and the receiving coil 145, and the power transmission circuit 141 or the incoming circuit 142. Change over switch SW3 makes alternative connection between the rechargeable battery 143, and the power transmission circuit 141 or the incoming circuit 142. Each contact of these change over switches SW1-SW3 is connected to the incoming-circuit 142 side like a graphic display usually, for example.

[0039]

As for the setting device 146, a user sets up selectively use of the power transmission circuit 141 or the incoming circuit 142, and the information set is input into the control circuit 147. The control circuit 147 is a circuit which controls the change of the contact of the change over switches SW1-SW3 while displaying the indicator 148 for the operating state according to the information set from the setting device 146. The indicator 148 consists of liquid crystal displays etc., and predetermined information is displayed as mentioned above.

[0040]

Next, with reference to Fig.3, it describes about the specific composition of the power transmission coil 113 and the receiving coil 131 which are shown in Fig.5, and power transmission and a receiving coil 145.

The power transmission coil 113 shown in Fig.5 and the receiving coil 131 are constituted like the power transmission coil 113 of a 1st embodiment and the receiving coil 131 which are shown in Fig.3.The power transmission and the receiving coil 145 shown in Fig.5 are constituted like the power transmission coil 113 or the receiving coil 131 shown, for example in Fig.3.

[0041]

By such composition, the power transmission coil 113 shown in Fig.5, power transmission and a receiving coil 145, and the receiving coil 131, At the time of use, two coils of them carry out inductive coupling mutually, a transformer is formed, the spurious radiation by electric field and the magnetic field which are generated with each coil in that case is inhibited, and efficient transfer of power can be performed.

Next, with reference to Fig.5, it describes about the example of a 2nd embodiment which consists of such composition of operation.

[0042]

Here, in a 2nd embodiment, like the case of a 1st embodiment, although the rechargeable battery 134 of the power receiving equipment 13 may be charged with the power transmission equipment 11, since it is already ending with a description in this case, it describes about the operation in other below.

First, the rechargeable battery 143 of the power transmission and the power receiving combination equipment 14 mounted on the portable telephone body 15 is described about the case where it charges using the power transmission equipment 11. In this case, power transmission and the receiving coil 145 of power transmission and the power receiving combination equipment 14 are made to approach the power transmission coil 113 of the power transmission equipment 11, and it changes into the state where both the coils 145 and 113 carry out inductive coupling.

[0043]

If it sets up charging the rechargeable battery 143 using the power transmission equipment 11 by the setting device 146 in this state, that information set will be input into the control circuit 147. The control circuit 147 is connected to the position [which shows the contact of the change over switches SW1-SW3 to Fig.5] 142, i.e., incoming circuit, side while it displays a display to that effect on the indicator 148 according to the information set.

[0044]

As a result, charge according [the rechargeable battery 143 of power transmission and the power receiving combination equipment 14] to the power transmission equipment 11 is started. Charge of the rechargeable battery 143 is performed by the incoming circuit 142 at the time of this charge.

At the time of this charge, a magnetic field and electric field are generated by the power transmission coil 113, and power transmission and a receiving coil 145, and that spurious radiation exists. However, at this time, it is constituted like the power transmission coil 113 and the receiving coil 131 which are indicated to be the power transmission coil 113, and power transmission and a receiving coil 145 to Fig.3 as mentioned above. For this reason, the power transmission coil 113, and power transmission and a receiving coil 145 can inhibit the spurious radiation by the magnetic field and electric field which a coil generates like the power transmission coil 113 and the receiving coil 131 which are shown in Fig.3.

[0045]

After the charge-and-discharge control circuit 144 supervises the charging state of the rechargeable battery 143 and the charge is completed, charge of the rechargeable battery 143 by the incoming circuit 142 is stopped.

Next, it becomes impossible using the rechargeable battery 134 of the power receiving equipment 13 mounted on the portable telephone body 12, and charge of the rechargeable battery 134 is described about the case where it charges using the power transmission and the power receiving combination equipment 14 mounted on the portable telephone body 15.

[0046]

In this case, the receiving coil 131 of the power receiving equipment 13 is made to approach power transmission and the receiving coil 145 of power transmission and the power receiving combination equipment 14, and it changes into the state where both the coils 131 and 145 carry out inductive coupling. In this state, if it sets up making the rechargeable battery 134 charge with power transmission and the power receiving combination equipment 14 by the setting device 146, that information set will be input into the control circuit 147. The control circuit 147 switches the contact of the change over switches SW1-SW3 to the position 141, i.e., power transmission circuit, side opposite to the position shown in a figure while displaying a display to that effect on the indicator 148 according to the information set.

[0047]

As a result, charge according [the rechargeable battery 134 of the power receiving equipment 13] to power transmission and the power receiving combination equipment 14 is started. Charge of the rechargeable battery 134 is performed by the incoming circuit 132 at the time of this charge.

At the time of this charge, a magnetic field and electric field are generated by the receiving coil 131, and power transmission and a receiving coil 145, and that spurious radiation exists. However, at this time, it is constituted like the power transmission coil 113 and the receiving coil 131 which are indicated to be the receiving coil 131, and power transmission and a receiving coil 145 to Fig.3 as mentioned above. For this reason, the receiving coil 131, and power transmission and a receiving coil 145 can inhibit the spurious radiation by the magnetic field and electric field which a coil generates like the power transmission coil 113 and the receiving coil 131 which are shown in Fig.3.

[0048]

After the charge-and-discharge control circuit 133 supervises the charging state of the rechargeable battery 134 and the charge is completed, charge of the rechargeable battery 134 by the incoming circuit 132 is stopped.

As described above, although a transformer is formed of two coils of them from a plane coil in the case of ** and use, the power transmission coil 113 used for non-contact transfer of power in this 2nd embodiment, power transmission and a receiving coil 145, and the receiving coil 131, The spurious radiation by the magnetic field and electric field from a coil which form the transformer can be inhibited, and the increase in efficiency of transfer of power can be attained.

[0049]

In this 2nd embodiment, it carried out as [mount / while functioning as a battery charger mount the power transmission and the power receiving combination equipment 14 containing the rechargeable battery 143 on the portable telephone body 15, and / on the portable telephone body 12 / the power receiving equipment 13 containing the rechargeable battery 134].

For this reason, since according to a 2nd embodiment the rechargeable battery 134 of the power receiving equipment 13 can be charged using the cellular phone which mounts power transmission and the power receiving combination equipment 14 even if the cellular phone which mounts the power receiving equipment 13 becomes use impossible, it is dramatically expedient.

[0050]

In power transmission and the power receiving combination equipment 14 of a 2nd embodiment, since the use can be set up arbitrarily and also a user can recognize the established state easily with an indicator when using it as a rechargeable battery, or when using it as a battery charger, malfunction by the setting error can be prevented.

(Other embodiments)

As shown in Fig.2 and Fig.3, in a 1st embodiment the power transmission coil 113,Constituting from the plane whorl type coil 113a, the magnetic sheet 113b, and the metal sheet 113c, the receiving coil 131 consisted of the plane whorl type coil 131a, the magnetic sheet 131b, and the metal sheet 131c. However, it may be made for the power transmission coil 113 and the receiving coil 131 to omit the metal sheets 113c and 131c, respectively.

[0051]

The same can be said for each composition of the power transmission coil [in / composition / of this point / a 2nd embodiment] 113, power transmission and a receiving coil 145, and the receiving coil 131.

Although the power receiving equipment 13 unifies the receiving coil 131, the incoming circuit 132, the charge-and-discharge control circuit 133, and the rechargeable battery 134 which are components and it was made to form as a power receiving equipment module in a 1st embodiment, This unification should just be the receiving coil 131 and the rechargeable battery 134 at least.

[0052]

In a 2nd embodiment, power transmission and the power receiving combination equipment 14, The power transmission circuit 141 which is a component, the incoming circuit 142, the rechargeable battery 143, the charge-and-discharge control circuit 144, power transmission and a receiving coil 145, the change over switches SW1-SW3, the setting device 146, the control circuit 147, and the inside of the indicator 148, Each of other component except the setting device 146 and the indicator 148 is unified, and it was made to form as power transmission and a power receiving combination equipment module. However, this unification should just be power transmission and the receiving coil 131, and the rechargeable battery 143 at least.

[0053]

Although described about the case where it applies to a cellular phone, in a 1st embodiment and a 2nd embodiment, it replaces with this and can apply to personal digital assistants, such as a portable computer, or a portable device like a video camera.

[Brief Description of the Drawings]

[0054]

[Drawing 1]It is a block diagram showing the composition of a 1st embodiment of the present invention.

[Drawing 2]It is the perspective view which decomposed each component of a power transmission coil and a receiving coil.

[Drawing 3]It is a cross sectional view showing the composition of a power transmission coil and a receiving coil.

[Drawing 4]It is a cross sectional view showing the state where power transmission equipment and power receiving equipment were built into the case of a battery charger, and the case of a cellular phone.

[Drawing 5]It is a block diagram showing the composition of a 2nd embodiment of the present invention.

[Explanations of letters or numerals]

[0055]

11 ... power transmission equipment and 12, 15 ... portable telephone body, 13 ... power receiving equipment, 14 ... power transmission and power receiving combination equipment, 32 ... power receiving equipment module, 113 ... power transmission coil, 113a, 131a ... A plane whorl type coil, 113b, 131b ... Magnetic sheet, 113c, 131c [... An incoming circuit 134, 143 / ... A rechargeable battery 145 / ... Power transmission and receiving coil.] ... A metal sheet, 112, 141 ... A power transmission circuit, 131 ... A receiving coil, 132, 142

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(71)出願人　000002369
セイコーエプソン株式会社
東京都新宿区西新宿２丁目４番１号
(74)代理人　100066980
弁理士　森　哲也
(74)代理人　100075579
弁理士　内藤　嘉昭
(74)代理人　100103850
弁理士　崔　秀▲てつ▼
(72)発明者　石澤　孝二
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内
(72)発明者　高木　勉
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

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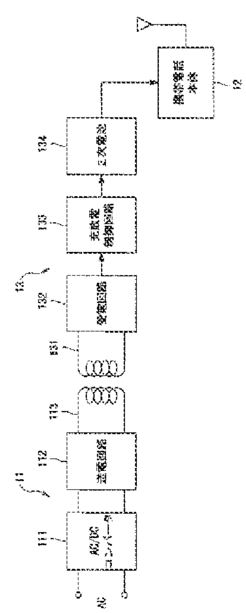
(54)【発明の名称】非接触電力伝送装置

(57)【要約】
【課題】非接触電力伝送に使用される送電コイルと受電コイルの薄型化を図る際に、そのコイルからの不要輻射を抑制し、かつ、電力伝送の効率化を図ること。
【解決手段】この発明は、送電装置１１と受電装置１３からなり、動作時に、送電コイル１１３と受電コイル１３１とが電磁的に結合することにより、非接触で電力伝送を行うようになっている。両コイル１１３、１３１は、渦巻き状であってその平面が対向するようになっている平面コイルからなる。さらに、その両平面コイルは、両者が対向する面の反対側の面に、両コイルの発生する磁界による不要輻射を抑える磁性シートが、その面全体を覆うようにそれぞれ設けられている。
【選択図】　図１



【特許請求の範囲】
【請求項1】
第１コイルを含む送電装置と、第２コイルおよび２次電池を含む受電装置とを備え、
前記送電装置は、前記第１コイルが前記第２コイルと電磁結合するときに、前記第１コイルに供給する交流を生成する送電手段を有し、
前記受電装置は、前記第２コイルが前記第１コイルと電磁結合するときに、前記第２コイルに誘起される交流を直流に変換し、この変換された直流により前記２次電池の充電を行う受電手段を有し、
さらに、前記第１コイルおよび前記第２コイルは、渦巻き状であってその平面が対向するようになっている第１平面コイルおよび第２平面コイルからなり、
かつ、前記第１平面コイルおよび前記第２平面コイルは、その両者が対向する面の反対側の面に、磁性シートをそれぞれ設けたことを特徴とする非接触電力伝送装置。
【請求項2】
前記第１平面コイルおよび前記第２平面コイルに設けた各磁性シートの外側面に、さらに、金属シートをそれぞれ重ねて設けたことを特徴とする請求項１に記載の非接触電力伝送装置。
【請求項3】
前記受電装置を構成する前記第２コイル、前記受電手段、および前記２次電池のうち、少なくとも前記第２コイルと前記２次電池を一体化したことを特徴とする請求項１または請求項２に記載の非接触電力伝送装置。
【請求項4】
前記受電装置を構成する前記第２コイル、前記受電手段、および前記２次電池のうち、少なくとも前記第２コイルと前記２次電池は、所定のケース内に収容し又は固形化するようにしたことを特徴とする請求項１または請求項２に記載の非接触電力伝送装置。
【請求項5】
前記受電装置は、携帯電話に搭載させたことを特徴とする請求項１乃至請求項４のうちのいずれか１の請求項に記載の非接触電力伝送装置。
【請求項6】
第１コイルを含む送電装置と、第２コイルおよび第１の２次電池を含む送電・受電兼用装置と、第３コイルおよび第２の２次電池を含む受電装置とを備え、
前記送電装置は、
前記第１コイルが前記第２コイルまたは前記第３コイルと電磁結合するときに、前記第１コイルに供給する交流を生成する送電手段を有し、
前記送電・受電兼用装置は、
前記第２コイルが前記第３コイルと電磁結合するときに、前記第１の２次電池を電源として用いて前記第２コイルに供給する交流を生成する送電手段と、
前記第２コイルが前記第１コイルと電磁結合するときに、その第２コイルに誘起される交流を直流に変換し、この変換された直流により前記第１の２次電池の充電を行う受電手段とを有し、
前記受電装置は、
前記第３コイルが前記第１コイルまたは前記第２コイルと電磁結合するときに、その第３コイルに誘起される交流を直流に変換し、この変換された直流により前記第２の２次電池の充電を行う受電手段を有し、
さらに、前記第１コイル、前記第２コイル、および前記第３コイルは、渦巻き状であってその平面が相互に対向するようになっている第１平面コイル、第２平面コイル、および第３平面コイルからなり、
かつ、前記第１平面コイル、第２平面コイル、および前記第３平面コイルは、それぞれ対向する面の反対側の面に、磁性シートを設けたことを特徴とする非接触電力伝送装置。
【請求項7】

前記第１平面コイル、前記第２平面コイル、および前記第３平面コイルに設けた各磁性シートの外側面に、さらに、金属シートをそれぞれ重ねて設けたことを特徴とする請求項６に記載の非接触電力伝送装置。

【請求項8】

前記送電・受電兼用装置を構成する前記第２コイル、前記送電手段、前記受電手段、および前記第１の２次電池のうち、少なくとも前記第２コイルと前記第１の２次電池を一体化し、

かつ、前記受電装置を構成する前記第３コイル、前記受電手段、および前記第２の２次電池のうち、少なくとも前記第３コイルと前記第２の２次電池を一体化したことを特徴とする請求項６または請求項７に記載の非接触電力伝送装置。

【請求項9】

前記送電・受電兼用装置を構成する前記第２コイル、前記送電手段、前記受電手段、および前記第１の２次電池のうち、少なくとも前記第２コイルと前記第１の２次電池は、所定のケース内に収容し又は固形化するようにし、

かつ、前記受電装置を構成する前記第３コイル、前記受電手段、および前記第２の２次電池のうち、少なくとも前記第３コイルと前記第２の２次電池は、所定のケース内に収容し又は固形化するようにしたことを特徴とする請求項６または請求項７に記載の非接触電力伝送装置。

【請求項10】

前記送電・受電兼用装置および前記受電装置は、それぞれ携帯電話に搭載させたことを特徴とする請求項６乃至請求項９のうちのいずれか１の請求項に記載の非接触電力伝送装置。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、例えば携帯電話のような携帯端末と充電器との間などで、非接触電力伝送を行うことができる非接触電力伝送装置に関するものである。

【背景技術】

【0002】

従来、この種の非接触電力伝送装置としては、携帯用通信機の本体底部の形状に関係なく、充電部の送電コイルと被充電部の受電コイルとの間の電磁誘導による非接触電力伝送の効率向上を図るようにしたものが知られている（例えば、特許文献１、特許文献２を参照）。

そして、送電コイルは送電コイル用コアに巻かれ、受電コイルは受電コイル用コアに巻かれている。また、送電コイル用コアと受電コイル用コアとはいずれも棒状体で構成され、使用時には、その両コアの端面同士が対向するようになっている。

【特許文献1】特開平１０－４６３９号公報

【特許文献2】特開平１０－１４１２４号公報

【発明の開示】

【発明が解決しようとする課題】

【0003】

ところで、従来の非接触電力伝送装置に使用される送電コイルと受電コイルは、いずれもコアに巻かれている。この場合には、コイルから発生する磁界はその殆どがコアに集中するため、磁界による不要な輻射はごくわずかであり、不要輻射を抑える対策が特に必要ではない。しかし、コイルから発生する磁界をコアに集中させるためには、上記のように、使用時にその両コアの端面同時を対向するような構造にする必要がある。

【0004】

このため、従来のように、送電コイルと受電コイルとを異なるコアに巻いて使用する場合には、両コイルの形態や構造に制約があるので、薄型化や平面化を図るのが困難であるという不具合がある。

そこで、送電コイルと受電コイルの薄型化を実現するには、その両コイルの平面化を図

ることが考えられるが、それを平面化した場合にはコアの使用ができないので、コイルから発生する磁界による不要輻射の抑制、および電力伝送の効率化を図る必要がある。

【0005】

本発明の目的は、上記の点に鑑み、非接触電力伝送に使用される送電コイルと受電コイルの平面化を図る際に、そのコイルからの不要輻射の抑制、および電力伝送の効率化を図ることができる非接触電力伝送装置を提供することにある。

【課題を解決するための手段】

【0006】

上記の課題を解決し本発明の目的を達成するために、各発明は、以下のような構成からなる。

すなわち、第１の発明は、第１コイルを含む送電装置と、第２コイルおよび２次電池を含む受電装置とを備え、前記送電装置は、前記第１コイルが前記第２コイルと電磁結合するときに、前記第１コイルに供給する交流を生成する送電手段を有し、前記受電装置は、前記第２コイルが前記第１コイルと電磁結合するときに、前記第２コイルに誘起される交流を直流に変換し、この変換された直流により前記２次電池の充電を行う受電手段を有し、さらに、前記第１コイルおよび前記第２コイルは、渦巻き状であってその平面が対向するようになっている第１平面コイルおよび第２平面コイルからなり、かつ、前記第１平面コイルおよび前記第２平面コイルは、その両者が対向する面の反対側の面に、磁性シートをそれぞれ設けるようにした。

【0007】

第２の発明は、第１の発明において、前記第１平面コイルおよび前記第２平面コイルに設けた各磁性シートの外側面に、さらに、金属シートをそれぞれ重ねて設けるようにした。

第３の発明は、第１または第２の発明において、前記受電装置を構成する前記第２コイル、前記受電手段、および前記２次電池のうち、少なくとも前記第２コイルと前記２次電池を一体化した。

【0008】

第４の発明は、第１または第２の発明において、前記受電装置を構成する前記第２コイル、前記受電手段、および前記２次電池のうち、少なくとも前記第２コイルと前記２次電池は、所定のケース内に収容し又は固形化するようにした。

第５の発明は、第１乃至第４のうちのいずれかの発明において、前記受電装置は、携帯電話に搭載させるようにした。

【0009】

第６の発明は、第１コイルを含む送電装置と、第２コイルおよび第１の２次電池を含む送電・受電兼用装置と、第３コイルおよび第２の２次電池を含む受電装置とを備え、前記送電装置は、前記第１コイルが前記第２コイルまたは前記第３コイルと電磁結合するときに、前記第１コイルに供給する交流を生成する送電手段を有し、前記送電・受電兼用装置は、前記第２コイルが前記第３コイルと電磁結合するときに、前記第１の２次電池を電源として用いて前記第２コイルに供給する交流を生成する送電手段と、前記第２コイルが前記第１コイルと電磁結合するときに、その第２コイルに誘起される交流を直流に変換し、この変換された直流により前記第１の２次電池の充電を行う受電手段とを有し、前記受電装置は、前記第３コイルが前記第１コイルまたは前記第２コイルと電磁結合するときに、その第３コイルに誘起される交流を直流に変換し、この変換された直流により前記第２の２次電池の充電を行う受電手段を有し、さらに、前記第１コイル、前記第２コイル、および前記第３コイルは、渦巻き状であってその平面が相互に対向するようになっている第１平面コイル、第２平面コイル、および第３平面コイルからなり、かつ、前記第１平面コイル、第２平面コイル、および前記第３平面コイルは、それぞれ対向する面の反対側の面に、磁性シートを設けるようにした。

【0010】

第７の発明は、第６の発明において、前記第１平面コイル、前記第２平面コイル、およ

び前記第３平面コイルに設けた各磁性シートの外側面に、さらに、金属シートをそれぞれ重ねて設けるようにした。

第８の発明は、第６または第７の発明において、前記送電・受電兼用装置を構成する前記第２コイル、前記送電手段、前記受電手段、および前記第１の２次電池のうち、少なくとも前記第２コイルと前記第１の２次電池を一体化し、かつ、前記受電装置を構成する前記第３コイル、前記受電手段、および前記第２の２次電池のうち、少なくとも前記第３コイルと前記第２の２次電池を一体化した。

【0011】

第９の発明は、第６または第７の発明において、前記送電・受電兼用装置を構成する前記第２コイル、前記送電手段、前記受電手段、および前記第１の２次電池のうち、少なくとも前記第２コイルと前記第１の２次電池は、所定のケース内に収容し又は固形化するようにし、かつ、前記受電装置を構成する前記第３コイル、前記受電手段、および前記第２の２次電池のうち、少なくとも前記第３コイルと前記第２の２次電池は、所定のケース内に収容し又は固形化するようにした。

【0012】

第１０の発明は、第６乃至第９のうちのいずれかの発明において、前記送電・受電兼用装置および前記受電装置は、それぞれ携帯電話に搭載させるようにした。

以上のような構成からなる本発明によれば、非接触電力伝送に使用される送電用コイルや受電用コイルなどが平面コイルからなり、使用の際には、それらは変圧器を形成するが、両コイルが発生する磁界等による不要輻射を抑制でき、かつ、電力伝送の効率化が図れる。

【発明を実施するための最良の形態】

【0013】

以下、本発明の実施形態について、図面を参照して説明する。

【0014】

（第１実施形態）

本発明の非接触電力伝送装置の第１実施形態の構成について、図１を参照しながら説明する。

この第１実施形態に係る非接触電力伝送装置は、例えば携帯電話に適用したものであり、図１に示すように、充電器として機能する送電装置１１と、携帯電話本体１２の電源となる２次電池を含む受電装置１３とを備えている。

【0015】

送電装置１１と受電装置１３とは、電磁的に結合することにより、後述のように非接触で電力伝送を行う非接触電力伝送装置を形成するようになっている。

送電装置１１は、図１に示すように、ＡＣ／ＤＣコンバータ１１１と、送電回路１１２と、送電コイル１１３とを備えている。

ＡＣ／ＤＣコンバータ１１１は、例えば家庭に供給される１００〔Ｖ〕の交流電圧を所定の直流電圧に変換するものであり、その変換された直流電圧を送電回路１１２に供給するようになっている。送電回路１１２は、ＡＣ／ＤＣコンバータ１１１からの直流電圧を使用して所定の周波数の交流電圧を生成する回路であり、この生成した交流電圧を送電コイル１１３に供給するようになっている。

【0016】

受電装置１３は、図１に示すように、受電コイル１３１と、受電回路１３２と、充放電制御回路１３３と、２次電池１３４とを備えている。

この受電装置１３は、構成要素である受電コイル１３１、受電回路１３２、充放電制御回路１３３、および２次電池１３４を、一体に１つの容器に収容させたり、または熱硬化性の合成樹脂などを用いて一体にモジュール化（固形化）させ、受電装置モジュール（電池パック）として形成するようにした。

【0017】

受電コイル１３１は、送電装置１１の送電コイル１１３と接近させて使用する場合には

、その両コイル１３１、１１３が、電磁結合して両者の間で変圧器を形成するようになっている。電磁結合により受電コイル１３１に誘起される交流電圧は、受電回路１３２に供給されるようになっている。

受電回路１３２は、受電コイル１３１に誘起される交流電圧を整流して直流電圧を出力する回路である。受電回路１３２から出力される直流電圧は、充放電制御回路１３３を介して２次電池１３４に供給され、２次電池１３４を充電するようになっている。

【0018】

充放電制御回路１３３は、受電回路１３２からの出力により２次電池１３４を充電する場合にはその充電の制御を行い、２次電池１３４で負荷である携帯電話本体１２を動作させる場合には放電の制御を行う回路である。

２次電池１３４は、例えばリチウムイオン電池のように、放電後に充電により繰り返して使用できる電池である。

【0019】

次に、送電装置１１の送電コイル１１３、および受電装置１３の受電コイル１３１の具体的な構造について、図２および図３を参照して説明する。

送電コイル１１３は、図２示すように、平面渦巻き型コイル１１３ａと、磁性シート１１３ｂと、金属シート１１３ｃとからなる。そして、図３に示すように、平面渦巻き型コイル１１３ａの外面側に、その外面側全体を覆うように、磁性シート１１３ｂと金属シート１１３ｃとが重ねた状態で設けられている。

【0020】

従って、送電コイル１１３の構成要素は、図３に示すように、平面渦巻き型コイル１１３ａ、磁性シート１１３ｂ、および金属シート１１３ｃの順序で大きくなるように構成され、これらは接着剤などの適宜手段で一体に密着、または固定されている。

また、受電コイル１３１は、図２に示すように、平面渦巻き型コイル１３１ａと、磁性シート１３１ｂと、金属シート１３１ｃとからなる。そして、図３に示すように、平面渦巻き型コイル１３１ａの外面側に、その外面側全体を覆うように、磁性シート１３１ｂと金属シート１３１ｃとが重ねた状態で設けられている。

【0021】

従って、受電コイル１３１の構成要素は、図３に示すように、平面渦巻き型コイル１３１ａ、磁性シート１３１ｂ、および金属シート１３１ｃの順序で大きくなるように構成され、これらは接着剤などの適宜手段で一体に密着または固定されている。

さらに、送電コイル１１３側の平面渦巻き型コイル１１３ａと、受電コイル１３１側の平面渦巻き型コイル１３１ａとは、使用時には、図３に示すようにその内面側同士が対向して変圧器を形成するようになっている。このため、使用時には、磁性シート１１３ｂ、１３１ｂは、平面渦巻き型コイル１１３ａ、１３１ａが発生する磁界による不要輻射を抑制でき、金属シート１１３ｃ、１３１ｃは、平面渦巻き型コイル１１３ａ、１３１ａが発生する電界による不要輻射を抑制できるようになっている。

【0022】

ここで、平面渦巻き型コイル１１３ａ，１３１ａは、単線または撚り線のような絶縁された電線からなり、その電線を図２および図３に示すように同一平面内で渦巻き状に巻いたものである。

また、磁性シート１１３ｂ，１３１ｂは、板状またはシート状の磁性材料からなり、けい素鋼板、アモルファス金属の磁性シートなどが使用される。

【0023】

さらに、金属シート１１３ｃ，１３１ｃは、板状またはシート状の金属材料からなり、アルミニウムなどが使用される。

次に、図１～図３に示すような構成からなる送電装置１１と受電装置１３とを、充電器のケースと携帯電話のケースにそれぞれ組み込んだ場合の具体例について、図４を参照して説明する。

【0024】

図１に示す送電装置１１を構成する各要素は、図４に示す充電器のケース２１内に組み込まれ、図１に示す受電装置１３を構成する各要素は、図４に示す携帯電話のケース３１内に組み込まれている。

充電器のケース２１は、図４に示すように、その上部側に、携帯電話の充電時に携帯電話のケース３１が収容される携帯電話収容部２１１を備えている。また、充電器のケース２１は、その携帯電話収容部２１１の下部側に送電コイル収納部２１２を備え、その送電コイル収納部２１２内に、図３に示す送電コイル１１３が例えば密封された状態で収納されている。さらに、充電器のケース２１内には、送電装置１１のＡＣ／ＤＣコンバータ１１１や送電回路１１２などの構成部品を搭載した回路基板２２が収容されている。

【0025】

携帯電話のケース３１は、図４に示すように、その下部側に、図１に示す受電装置１３をモジュール化した受電装置モジュール３２を収容する収容部３１１と、その受電装置モジュール３２の交換の際にその収容部３１１の開閉を行う蓋３１２と、を備えている。

ここで、受電装置モジュール３２は、上記のように、受電装置１３を構成する、受電コイル１３１、受電回路１３２、充放電制御回路１３３、および２次電池１３４を、一体に１つの容器に収容し、または熱硬化性の合成樹脂などを用いて一体にモジュール化したものである。

【0026】

図４に示す受電装置モジュール３２は、同図に示すように、例えば薄型の直方形のケース３２１内に受電回路１３２、充放電制御回路１３３、および２次電池１３４が収納され、かつそのケース３２１の下面に受電コイル１３１がケース３２１に一体に取り付けられている。

また、携帯電話のケース３１内には、携帯電話本体１２を構成する各種の電子回路の構成部品を搭載した回路基板３３が収容されている。

【0027】

次に、このような構成からなる第１実施形態の動作例について、図１および図３を参照して説明する。

受電装置１３の２次電池１３４を、送電装置１１を用いて充電する場合について説明する。この場合には、受電装置１３の受電コイル１３１を送電装置１１の送電コイル１１３に接近させて、両コイル１３１、１１３を電磁結合する状態にさせる。このときには、送電コイル１１３と受電コイル１３１とは、例えば図３または図４に示す状態になる。

【0028】

このように、送電コイル１１３と受電コイル１３１が電磁結合されると、受電装置１３の２次電池１３４は、送電装置１１による充電が開始される。この充電時には、受電回路１３２により２次電池１３４の充電が行われる。

この充電時には、送電コイル１１３と受電コイル１３１には磁界や電界が発生し、その不要輻射がある。しかし、図３に示すように、磁性シート１１３ｂ、１３１ｂは、平面渦巻き型コイル１１３ａ、１３１ａが発生する磁界による不要輻射を抑制し、金属シート１１３ｃ、１３１ｃは、平面渦巻き型コイル１１３ａ、１３１ａが発生する電界による不要輻射を抑制する。

【0029】

充放電制御回路１３３は、２次電池１３４の充電状態を監視し、その充電が終了すると、受電回路１３２による２次電池１３４の充電を停止させる。

このようにして、２次電池１３４に充電が終了した場合には、受電装置１３の受電コイル１３１を送電装置１１の送電コイル１１３から離し、これにより、携帯電話本体１２は、その充電された２次電池１３４を電源として使用できる。

【0030】

以上説明したように、この第１実施形態では、非接触電力伝送に使用される送電コイル１１３および受電コイル１３１が平面コイルからなり、使用の際には、それらは変圧器を形成するが、両コイルからの磁界や電界による不要輻射を抑制でき、かつ効率的な電力伝

送ができる。
【0031】
（第２実施形態）
本発明の非接触電力伝送装置の第２実施形態の構成について、図５を参照しながら説明する。
【0032】
この第２実施形態に係る非接触電力伝送装置は、例えば携帯電話に適用したものであり、図５に示すように、充電器として機能する送電装置１１と、携帯電話本体１２の電源となる２次電池を含む受電装置１３と、充電器として機能するとともに携帯電話本体１５の電源となる２次電池を含む送電・受電兼用装置１４とを備えている。
そして、送電装置１１は、送電・受電兼用装置１４または受電装置１３と電磁的に結合することにより非接触電力伝送装置をそれぞれ形成し、送電・受電兼用装置１４と結合した場合にはそれに含まれる２電池を充電でき、受電装置１３と結合した場合にはそれに含まれる２次電池を充電できるようになっている。また、送電・受電兼用装置１４は、受電装置１３と電磁的に結合することにより非接触電力伝送装置を形成し、このときには受電装置１３に含まれる２電池を充電できるようになっている。
【0033】
次に、この第２実施形態の各部の具体的な構成について、図５を参照して説明する。
送電装置１１および受電装置１３は、図１に示す送電装置１１および受電装置１３と同様に構成されるので、同一の構成要素には同一符号を付して、ここではその構成の説明は省略する。
送電・受電兼用装置１４は、図５に示すように、送電回路１４１と、受電回路１４２と、２次電池１４３と、充放電制御回路１４４と、送電・受電コイル１４５と、切り換えスイッチＳＷ１～ＳＷ３と、設定器１４６と、制御回路１４７と、表示器１４８とを備えている。
【0034】
この送電・受電兼用装置１４は、構成要素である送電回路１４１、受電回路１４２、２次電池１４３、充放電制御回路１４４、送電・受電コイル１４５、切り換えスイッチＳＷ１～ＳＷ３、設定器１４６、制御回路１４７、および表示器１４８のうち、設定器１４６および表示器１４８を除く他の各構成要素を、一体に１つの容器に収容させたり、または熱硬化性の合成樹脂などを用いて一体にモジュール化（固形化）させ、送電・受電兼用装置モジュールとして形成するようにした。
【0035】
ここで、その送電・受電兼用装置モジュールは、図１に示す受電装置１３をモジュール化した受電装置モジュールと基本的に同様のものであり、例えば図４に示す受電装置モジュール３２と同様に形成される。
送電回路１４１は、動作時に、２次電池１４３から供給される直流電圧を使用して所定の周波数の交流電圧を生成し、この生成した交流電圧を送電・受電コイル１４５に供給する回路である。受電回路１４２は、送電・受電コイル１４５が送電装置１１の送電コイル１１３と電磁結合して送電装置１１から電力が送電される場合に、送電・受電コイル１４５に誘起される交流電圧を整流して直流電圧を生成する回路、すなわち交流－直流変換回路である。受電回路１４２で生成される直流電圧は、充放電制御回路１４４を介して２次電池１４３に供給され、２次電池１４３を充電するようになっている。
【0036】
２次電池１４３は、例えばリチウムイオン電池のように、放電後に充電により繰り返して使用できる電池である。充放電制御回路１４４は、受電回路１４２により２次電池１４３を充電する場合にはその充電の制御（監視）を行い、２次電池１４３で送電回路１４１や負荷である携帯電話本体１５を動作させる場合には放電の制御（監視）を行う回路である。
【0037】

送電・受電コイル１４５は、送電装置１１の送電コイル１１３と接近させて使用する場合には、その両コイル１４５、１１３は、電磁結合して両者の間で変圧器を形成するようになっている。また、送電・受電コイル１４５は、受電装置１３の受電コイル１３１と接近させて使用する場合には、その両コイル１４５、１３１は、電磁結合して両者の間で変圧器を形成するようになっている。すなわち、送電コイル１１３、送電・受電コイル１４５、および受電コイル１３１は、相互に電磁結合でき、かつ相互に分離できるようになっている。

【0038】

切り換えスイッチＳＷ１，ＳＷ２は、送電・受電コイル１４５と、送電回路１４１または受電回路１４２との選択的な接続を行うものである。また、切り換えスイッチＳＷ３は、２次電池１４３と、送電回路１４１または受電回路１４２との選択的な接続を行うものである。これらの切り換えスイッチＳＷ１～ＳＷ３の各接点は、通常は、例えば図示のように受電回路１４２側に接続されている。

【0039】

設定器１４６は、使用者が、送電回路１４１または受電回路１４２の使用を選択的に設定するものであり、その設定データが制御回路１４７に入力されるようになっている。制御回路１４７は、その設定器１４６からの設定データに従って、その動作状態を表示器１４８を表示させるとともに、切り換えスイッチＳＷ１～ＳＷ３の接点の切り換えを制御する回路である。表示器１４８は、液晶表示器などからなり、上記のように所定の情報が表示されるようになっている。

【0040】

次に、図５に示す送電コイル１１３、受電コイル１３１、および送電・受電コイル１４５の具体的な構成について、図３を参照して説明する。

図５に示す送電コイル１１３および受電コイル１３１は、図３に示す第１実施形態の送電コイル１１３および受電コイル１３１と同様に構成される。また、図５に示す送電・受電コイル１４５は、例えば図３に示す送電コイル１１３または受電コイル１３１と同様に構成される。

【0041】

このような構成により、図５に示す送電コイル１１３、送電・受電コイル１４５、および受電コイル１３１は、使用時に、そのうちの２つのコイルが相互に電磁結合して変圧器を形成し、その際に各コイルで生成される電界や磁界による不要輻射を抑制して効率的な電力伝送ができる。

次に、このような構成からなる第２実施形態の動作例について、図５を参照して説明する。

【0042】

ここで、第２実施形態では、第１実施形態の場合と同様に、受電装置１３の２次電池１３４を送電装置１１で充電する場合があるが、この場合はすでに説明済みであるので、以下では他の場合の動作について説明する。

まず、携帯電話本体１５に搭載される送電・受電兼用装置１４の２次電池１４３を、送電装置１１を用いて充電する場合について説明する。この場合には、送電・受電兼用装置１４の送電・受電コイル１４５を送電装置１１の送電コイル１１３に接近させて、両コイル１４５、１１３が電磁結合する状態にさせる。

【0043】

この状態で、設定器１４６により、送電装置１１を用いて２次電池１４３の充電を行う旨の設定を行うと、その設定データが制御回路１４７に入力される。制御回路１４７は、その設定データに従い、その旨の表示を表示器１４８に表示させるとともに、切り換えスイッチＳＷ１～ＳＷ３の接点を、図５に示す位置、すなわち、受電回路１４２側に接続させる。

【0044】

この結果、送電・受電兼用装置１４の２次電池１４３は、送電装置１１による充電が開

始される。この充電時には、受電回路１４２により２次電池１４３の充電が行われる。

　また、この充電時には、送電コイル１１３と送電・受電コイル１４５により磁界や電界が生成され、その不要輻射がある。しかし、このときには、送電コイル１１３と送電・受電コイル１４５とは、上記のように図3に示す送電コイル１１３および受電コイル１３１と同様に構成される。このため、送電コイル１１３と送電・受電コイル１４５は、図3に示す送電コイル１１３および受電コイル１３１と同様に、コイルが発生する磁界や電界による不要輻射を抑制できる。

【0045】

　充放電制御回路１４４は、２次電池１４３の充電状態を監視し、その充電が終了すると、受電回路１４２による２次電池１４３の充電を停止させる。

　次に、携帯電話本体１２に搭載される受電装置１３の２次電池１３４が使用不能となり、その２次電池１３４の充電を、携帯電話本体１５に搭載される送電・受電兼用装置１４を用いて充電する場合について説明する。

【0046】

　この場合には、受電装置１３の受電コイル１３１を送電・受電兼用装置１４の送電・受電コイル１４５に接近させて、両コイル１３１、１４５が電磁結合する状態にさせる。この状態で、送電・受電兼用装置１４により２次電池１３４を充電させる旨の設定を設定器１４６で行うと、その設定データが制御回路１４７に入力される。制御回路１４７は、その設定データに従い、その旨の表示を表示器１４８に表示させるとともに、切り換えスイッチＳＷ１～ＳＷ３の接点を、図に示す位置とは反対の位置、すなわち、送電回路１４１側に切り換える。

【0047】

　この結果、受電装置１３の２次電池１３４は、送電・受電兼用装置１４による充電が開始される。この充電時には、受電回路１３２により２次電池１３４の充電が行われる。

　また、この充電時には、受電コイル１３１と送電・受電コイル１４５により磁界や電界が生成され、その不要輻射がある。しかし、このときには、受電コイル１３１と送電・受電コイル１４５とは、上記のように図3に示す送電コイル１１３および受電コイル１３１と同様に構成される。このため、、受電コイル１３１と送電・受電コイル１４５は、図3に示す送電コイル１１３および受電コイル１３１と同様に、コイルが発生する磁界や電界による不要輻射を抑制できる。

【0048】

　充放電制御回路１３３は、２次電池１３４の充電状態を監視し、その充電が終了すると、受電回路１３２による２次電池１３４の充電を停止させる。

　以上説明したように、この第２実施形態では、非接触電力伝送に使用される送電コイル１１３、送電・受電コイル１４５、および受電コイル１３１が平面コイルからり、使用の際には、そのうちの２つのコイルにより変圧器が形成されるが、その変圧器を形成するコイルからの磁界や電界による不要輻射を抑制でき、かつ、電力伝送の効率化を図ることができる。

【0049】

　また、この第２実施形態では、充電器として機能するとともに２次電池１４３を含む送電・受電兼用装置１４を携帯電話本体１５に搭載し、２次電池１３４を含む受電装置１３を携帯電話本体１２に搭載するようした。

　このため、第２実施形態によれば、受電装置１３を搭載する携帯電話が使用不能になっても、送電・受電兼用装置１４を搭載する携帯電話を使用して受電装置１３の２次電池１３４を充電できるので、非常に便宜である。

【0050】

　さらに、第２実施形態の送電・受電兼用装置１４では、２次電池として使用する場合または充電器として使用する場合に、その使用を任意に設定できる上に、その設定状態を使用者が表示器により容易に認識できるので、その設定ミスによる誤動作を防止できる。

（その他の実施形態）

第１実施形態では、図２および図３に示すように、送電コイル１１３は、平面渦巻き型コイル１１３ａ、磁性シート１１３ｂ、および金属シート１１３ｃから構成し、受電コイル１３１は、平面渦巻き型コイル１３１ａ、磁性シート１３１ｂ、および金属シート１３１ｃから構成するようにした。しかし、送電コイル１１３および受電コイル１３１は、金属シート１１３ｃ、１３１ｃをそれぞれ省略するようにしても良い。

【0051】

この点の構成については、第２実施形態における送電コイル１１３、送電・受電コイル１４５、および受電コイル１３１の各構成についても同様である。

また、第１実施形態では、受電装置１３は、構成要素である受電コイル１３１、受電回路１３２、充放電制御回路１３３、および２次電池１３４を一体化し、受電装置モジュールとして形成するようにしたが、この一体化は少なくとも受電コイル１３１と２次電池１３４であれば良い。

【0052】

さらに、第２実施形態では、送電・受電兼用装置１４は、構成要素である送電回路１４１、受電回路１４２、２次電池１４３、充放電制御回路１４４、送電・受電コイル１４５、切り換えスイッチＳＷ１～ＳＷ３、設定器１４６、制御回路１４７、および表示器１４８のうち、設定器１４６および表示器１４８を除く他の各構成要素を一体化し、送電・受電兼用装置モジュールとして形成するようにした。しかし、この一体化は少なくとも送電・受電コイル１３１と２次電池１４３であれば良い。

【0053】

また、第１実施形態および第２実施形態では、携帯電話に適用した場合について説明したが、これに代えて携帯用のコンピュータなどの携帯端末、またはビデオカメラのような携帯機器に適用できる。

【図面の簡単な説明】

【0054】

【図1】本発明の第１実施形態の構成を示すブロック図である。

【図2】送電コイルと受電コイルの各構成要素を分解した斜視図である。

【図3】送電コイルと受電コイルの構成を示す断面図である。

【図4】送電装置と受電装置とを、充電器のケースと携帯電話のケースに組み込んだ状態を表す断面図である。

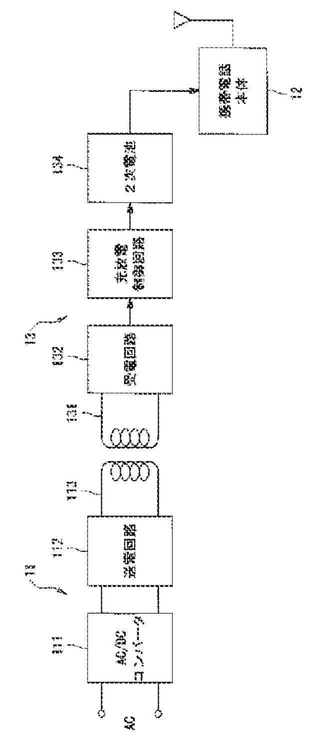
【図5】本発明の第２実施形態の構成を示すブロック図である。

【符号の説明】

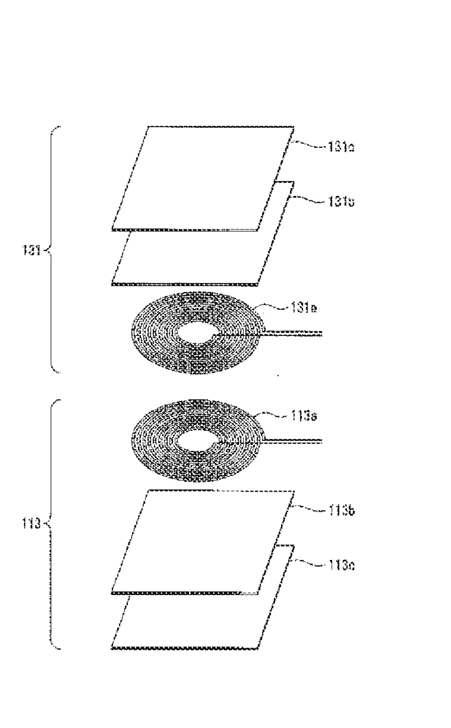
【0055】

１１・・・送電装置、１２、１５・・・携帯電話本体、１３・・・受電装置、１４・・・送電・受電兼用装置、３２・・・受電装置モジュール、１１３・・・送電コイル、１１３ａ、１３１ａ・・・平面渦巻き型コイル、１１３ｂ、１３１ｂ・・・磁性シート、１１３ｃ、１３１ｃ・・・金属シート、１１２、１４１・・・送電回路、１３１・・・受電コイル、１３２、１４２・・・受電回路、１３４、１４３・・・２次電池、１４５・・・送電・受電コイル。

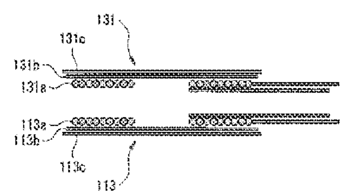
【図1】


AC
AC/DC
コンバータ
送電回路
受電回路
充放電
制御回路
2次電池
携帯電話
本体
111
112
113
131
132
133
134
11
13
12

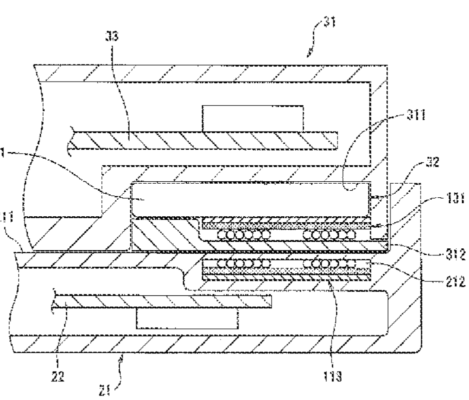
【図2】


131c
131b
131a
131
113a
113b
113c
113

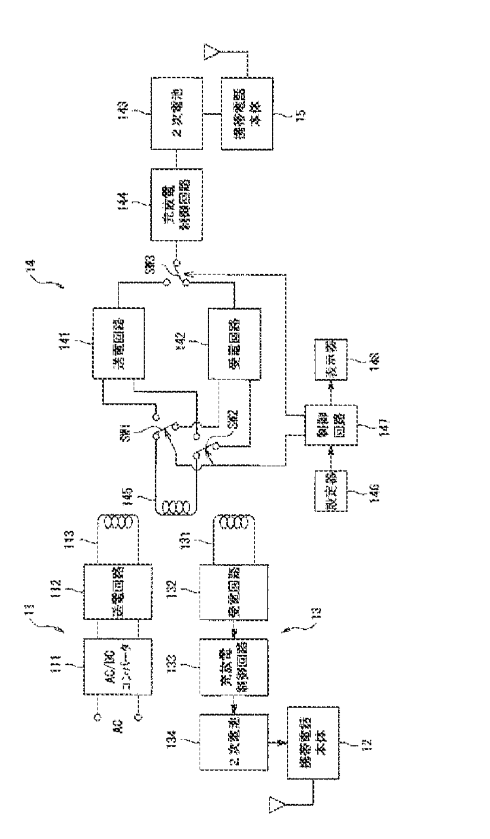
【図3】


131
131c
131b
131a
113a
113b
113c
113

【図4】


31
33
311
321
32
131
211
312
212
113
22
21

【図5】


送電回路
受電回路
制御回路
表示器
測定器
充放電
制御回路
2次電池
携帯電話
本体
AC/DC
コンバータ
SW1
SW2
SW3
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142
143
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PATENT ABSTRACTS OF JAPAN

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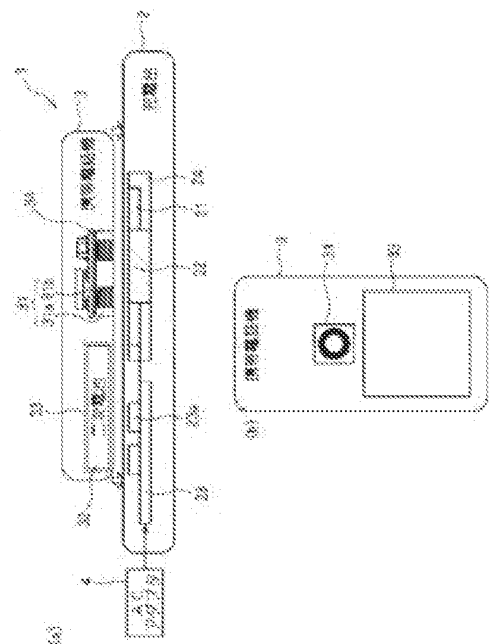
(72)Inventor : GOMA SHINJI
SHINODA SATOSHI

(54) POWER TRANSMISSION SYSTEM, AND POWER SUPPLY DEVICE AND PORTABLE APPARATUS THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a power transmission system capable of attaining miniaturization of a coil on a power reception side while maintaining capability of transmitting electric power, and to provide a power supply device and a portable apparatus therefor.
SOLUTION: The power transmission system 1 comprises a charging station (a power supply device) 2 that supplies electric power and a mobile phone (a power reception device) 3 that receives supply of the electric power. The charging station 2 includes a flat plate-like coil (a first coil) 21 and a magnet 22 disposed on an inside-diameter portion of the coil 21. The mobile phone 3 has a spiral inductor (a second coil) 31 whose outside diameter is substantially the same as or smaller than an inside diameter of the coil 21. The spiral inductor 31 is constituted of a soft magnetic substance layer 31a and a coil conductor 31b.



[Claim(s)]

[Claim 1]

In a transfer-of-power system provided with a feeder system which supplies electric power, and power receiving equipment which receives supply of electric power,

The aforementioned feeder system,

A plate-like first coil,

A magnet arranged at an inner diameter part of this first coil

A preparation,

The aforementioned power receiving equipment,

an inner diameter of said first coil -- abbreviated -- having a second coil of the same or outer diameter smaller than this inner diameter

A transfer-of-power system, wherein this second coil is the spiral inductor which comprised a soft magnetic material layer and a coil conductor.

[Claim 2]

The transfer-of-power system according to claim 1 characterized by making it have become largely from leakage flux by the side of a surface where the aforementioned spiral inductor has leakage flux opposite to this surface side that is opposing by the side of a surface which is opposing to the aforementioned feeder system.

[Claim 3]

The transfer-of-power system according to claim 1 or 2, wherein the aforementioned spiral inductor has mounted a circuit board in the surface side opposite to the surface side which is opposing to the aforementioned feeder system.

[Claim 4]

It is a feeder system which supplies electric power to power receiving equipment provided with a spiral inductor which comprised a soft magnetic material layer and a coil conductor,

A plate-like coil,

A magnet arranged at an inner diameter part of this coil

A preparation,

an inner diameter of the aforementioned coil -- an outer diameter of the aforementioned coil conductor of the aforementioned power receiving equipment -- abbreviated -- a feeder system which is the same or is characterized by being larger than this outer diameter.

[Claim 5]

A plate-like coil,

A magnet arranged at an inner diameter part of this coil

It is a portable device which receives supply of electric power from preparation **********,

A spiral inductor which comprised a soft magnetic material layer and a coil conductor,

A battery holder which was separated with this spiral inductor, has been arranged and has stored a rechargeable battery

A preparation,

an outer diameter of the aforementioned coil conductor -- an inner diameter of the aforementioned coil of the aforementioned feeder system -- abbreviated -- a portable device which is the same or is characterized by being smaller than this inner diameter.

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

The present invention relates to the feeder system and portable device of a transfer-of-power system and this transfer-of-power system which transmit electric power, without connecting physically.

[Background of the Invention]

[0002]

In recent years, electronic devices, such as a transmitter which transmit electric power and is charged by non-contact, are developed. In order to transmit electric power by non-contact in an electronic device, it is necessary to provide the coil for noncontact transfer of power to the both sides of the electronic device by the side of electric supply of electric power, and the electronic device by the side of the power receiving of electric power.

[0003]

With the coil by the side of electric supply of electric power, and the coil by the side of the power receiving of electric power, unless it performs alignment, electric power cannot be transmitted effectively. Then, the magnet has been arranged to the center section of the coil of the both sides of the electronic device by the side of electric supply of electric power, and the electronic device by the side of power receiving, and alignment was performed at the Patent document 1 using the power between both magnets paying well with the coil by the side of electric supply of electric power, and the coil by the side of the power receiving of electric power, for example.

[Citation list]

[Patent literature]

[0004]

[Patent document 1] JP,2009-095072,A

[Summary of Invention]

[Problem to be solved by the invention]

[0005]

However, in order to arrange a magnet to the center section of the coil of the both sides of the electronic device by the side of electric supply of electric power, and the electronic device by the side of power receiving, the coil itself needed to be made into a certain amount of size, and there was a problem that miniaturizing became difficult. When including in the electronic device by the side of power receiving, for example, a cellular phone, especially, since a coil requires a more-than-certain-level size, the proposal made to unite with a rear lid is leading, but there are a problem of generation of heat [/ near the cell], etc., and the size of the coil serves as big design constraints of the cellular phone.

[0006]

In light of the above-mentioned circumstances, the present invention is a thing.

It is providing a feeder system and a portable device of a transfer-of-power system and this transfer-of-power system which can miniaturize a coil by the side of power receiving, maintaining capability [purpose].

[Means for solving problem]

[0007]

To achieve the above objects, the transfer-of-power system concerning the 1st invention, In the transfer-of-power system which it has, the feeder system which supplies electric power, and the power receiving equipment which receives supply of electric power the aforementioned feeder system, having a magnet arranged at a plate-like first coil and the inner diameter part of this first coil -- the aforementioned power receiving equipment -- the inner diameter of the above-mentioned first coil -- abbreviated -- having a second coil of the same or outer diameter smaller than this inner diameter, this second coil is the spiral inductor which comprised a soft magnetic material layer and a coil conductor.

[0008]

It is made to have become largely from the leakage flux by the side of the surface where the transfer-of-power system concerning the 2nd invention is opposite to this surface side where the leakage flux by the side of the surface where the aforementioned spiral inductor is opposing to the aforementioned feeder system in the 1st invention is opposing.

[0009]

The transfer-of-power system concerning the 3rd invention has been made to mount the circuit board in the 1st or 2nd invention in the surface side where the aforementioned spiral inductor is opposite to the surface side which is opposing to the aforementioned feeder system.

[0010]

To achieve the above objects, the feeder system concerning the 4th invention, As opposed to power receiving equipment provided with the spiral inductor which comprised a soft magnetic material layer and a coil conductor, being a feeder system which supplies electric power and having a magnet arranged at a plate-like coil and the inner diameter part of this coil -- the inner diameter of the aforementioned coil -- the outer diameter of the aforementioned coil conductor of the aforementioned power receiving equipment -- abbreviated -- it is the same or larger than this outer diameter.

[0011]

To achieve the above objects, the portable device concerning the 5th invention, The spiral inductor which is a portable device which receives supply of electric power from a feeder system provided with the magnet arranged at a plate-like coil and the inner diameter part of this coil, and comprised a soft magnetic material layer and a coil conductor, it being separated with this spiral inductor, being arranged, and having the battery holder which has stored the rechargeable battery -- the outer diameter of the aforementioned coil conductor -- the inner diameter of the aforementioned coil of the aforementioned feeder system -- abbreviated -- it is the same or smaller than this inner diameter.

[0012]

a feeder system is provided with the magnet arranged at a plate-like first coil and the inner diameter part of this first coil in the 1st invention -- power receiving equipment -- the inner diameter of a first coil -- abbreviated, since it has a second coil of the same or outer diameter smaller than this inner diameter, Although the coupling coefficient of the first coil of a feeder system and the second coil of power receiving equipment is deteriorated, since Q value which is an index which shows the relation between holding of energy and a loss can be made high with the magnet arranged at the inner diameter part of a first coil, the capability to transmit electric power is maintainable. Alignment of the first coil of a feeder system and the second coil of power receiving equipment can be easily performed using the power between the magnet arranged at the inner diameter part of a first coil, and the soft magnetic material layer of power receiving equipment paying well. The coil (second coil) by the side of power receiving (power receiving equipment) can be miniaturized by making the second coil of power receiving equipment into a spiral inductor.

[0013]

In the 2nd invention, since it is made to have become largely rather than the leakage flux by the side of the surface where the leakage flux by the side of the surface which is opposing to the feeder system is opposite to this surface side that is opposing, a spiral inductor, Leakage of the magnetic flux from the surface side opposite to the surface side which is opposing to the feeder system can be suppressed, the magnetic flux used for inductive coupling with the first coil of a feeder system can be enlarged, and the capability to transmit electric power can be maintained.

[0014]

In the 3rd invention, since the spiral inductor has been made to mount the circuit board in the surface side opposite to the surface which is opposing to the feeder system, it can miniaturize the coil module which comprises a spiral inductor and a circuit board, and can miniaturize power receiving equipment.

[0015]

As opposed to the power receiving equipment provided with the spiral inductor which comprised a soft magnetic material layer and a coil conductor in the 4th invention, being a feeder system which supplies electric power and having a magnet arranged at a plate-like coil and the inner diameter part of this coil -- the inner diameter of a coil -- the outer diameter of the coil conductor of power receiving equipment -- abbreviated -- it being the same, or the coupling coefficient of the coil of a feeder system and the coil conductor of power receiving equipment being deteriorated, since it is larger than this outer diameter, but. With the magnet arranged at the inner diameter part of a coil, since Q value can be made high, the capability to transmit electric power is maintainable. Alignment of the coil of a feeder system and the coil conductor of power receiving equipment can be easily performed using the power between the magnet arranged at the inner diameter part of a coil, and the soft magnetic material layer of power receiving equipment paying well.

[0016]

The spiral inductor which is a portable device which receives supply of electric power from a feeder system provided with the magnet arranged at a plate-like coil and the inner diameter part of this coil, and comprised the 5th invention by the soft magnetic material layer and the coil conductor, Since it has the battery holder which was separated with this spiral inductor, has been arranged and has stored the rechargeable battery, even if a spiral inductor generates heat in response to supply of electric power from a feeder system, heat is not transmitted to a battery holder easily, and degradation of a rechargeable battery can be suppressed. the outer diameter of the coil conductor of a spiral inductor -- the inner diameter of the coil of a feeder system -- abbreviated -- it is the same, or since it is smaller than this inner diameter, a portable device can be miniaturized. Alignment of the coil of a feeder system and the coil conductor of a spiral inductor can be easily performed using the power between the magnet of a feeder system, and the soft magnetic material layer of a spiral inductor paying well.

[Effect of the Invention]

[0017]

A feeder system in the transfer-of-power system concerning the present invention A plate-like first coil, having a magnet arranged at the inner diameter part of this first coil -- power receiving equipment -- the inner diameter of a first coil -- abbreviated, although the coupling coefficient of the first coil of a feeder system and the second coil of power receiving equipment is deteriorated since it has a second coil of the same or outer diameter smaller than this inner diameter, Since Q value which is an index which shows the relation between holding of energy and a loss can be made high with the magnet arranged at the inner diameter part of a first coil, the capability to transmit electric power is maintainable. Alignment of the first coil of a feeder system and the second coil of power receiving equipment can be easily performed using the power between the magnet arranged at the inner diameter part of a first coil, and the soft magnetic material layer of power receiving equipment paying well. The coil (second coil) by the side of power receiving (power receiving equipment) can be miniaturized by making the second coil of power receiving equipment into a spiral inductor.

[0018]

The feeder system concerning the present invention receives power receiving equipment provided with the spiral inductor which comprised a soft magnetic material layer and a coil conductor, being a feeder system which supplies electric power and having a magnet arranged at a plate-like coil and the inner diameter part of this coil -- the inner diameter of a coil -- the outer diameter of the coil conductor of power receiving equipment -- abbreviated -- it being the same, or the coupling coefficient of the coil of a feeder system and the coil conductor of power receiving equipment being deteriorated, since it is larger than this outer diameter, but. With the magnet arranged at the inner diameter part of a coil, since Q value can be made high, the capability to transmit electric power is maintainable.

[0019]

The spiral inductor which the portable device concerning the present invention is a portable device which receives supply of electric power from a feeder system provided with the magnet arranged at a plate-like coil and the inner diameter part of this coil, and comprised a soft magnetic material layer and a coil conductor, Since it has the battery holder which was separated with this spiral inductor, has been arranged and has stored the rechargeable battery, even if a spiral inductor generates heat in response to supply of electric power from a feeder system, heat is not transmitted to a battery holder easily, and degradation of a rechargeable battery can be suppressed.

[Brief Description of the Drawings]

[0020]

[Drawing 1]It is a mimetic diagram showing the composition of the transfer-of-power system concerning an embodiment of the invention.

[Drawing 2]They are a coil with which the charging stand concerning an embodiment of the invention is provided, a magnet, and a mimetic diagram showing the composition of a circuit board.

[Drawing 3]It is a cross sectional view showing the composition of the spiral inductor concerning an embodiment of the invention.

[Drawing 4]It is a plan view decomposing and showing the composition of the spiral inductor concerning an embodiment of the invention.

[Drawing 5]It is a circuit diagram showing a part of circuit configuration of the transfer-of-power system concerning an embodiment of the invention.

[Description of Embodiments]

[0021]

Hereafter, it describes specifically using Drawings about the feeder system and portable device of the transfer-of-power system in an embodiment of the invention, and this transfer-of-power system. It cannot be overemphasized that not all the combination of the characteristic matter which following embodiments do not limit invention described in Claims, and is described in the embodiment is necessarily the indispensable matters of a solving means.

[0022]

Although a music player, a cellular phone, the portable apparatus of a keyless system, etc. are contained in the portable device of the transfer-of-power system concerning an embodiment of the invention, for example, in the following descriptions, it describes about the case where a portable device is a cellular phone.

[0023]

Fig.1 is a mimetic diagram showing the composition of the transfer-of-power system concerning an embodiment of the invention. The mimetic diagram showing the section in the state where Fig.1 (a) placed the cellular phone on the charging stand, and Fig.1 (b) are the mimetic diagrams showing the section of the near surface placed on the charging stand of a cellular phone. The transfer-of-power system 1 concerning an embodiment of the invention is provided with the charging stand 2 which is a feeder system which supplies electric power, and the cellular phone 3 which is power receiving equipment which receives supply of electric power. The charging stand 2 is provided with the circuit board 23 which mounted two or more electronic parts 23a which control the magnet 22 arranged at the inner diameter part of the plate-like coil (first coil) 21 and the coil 21, and the electric power supplied from the coil 21. The circuit board 23 is connected with AC adapter 4 which is a power supply.

[0024]

Fig.2 is the coil 21 with which the charging stand 2 concerning an embodiment of the invention is provided, the magnet 22, and a mimetic diagram showing the composition of the circuit board 23. The coil 21 forms conductors, such as copper wire, spirally at the same plane. Although the outside of the coil 21 is formed in approximate circular form, it may be formed in approximately elliptical type, or may be formed in an approximately quadrangle. The coil 21 is built in the resin structure 24 formed with the hardening resin which used magnetic substance materials, such as a ferrite, as powder, and mulled them. However, the coil 21 is exposed from the resin structure 24 in respect of the side which places the cellular phone 3. It may replace with the resin structure 24 and a magnetic substance sheet may be fixed to the whole surface of the coil 21.

[0025]

The magnet 22 is arranged at the inner diameter part of the coil 21 using permanent magnets, such as an alnico magnet, a ferrite magnet, and a neodymium magnet. The outer diameters of the magnet 22 constitute about 80% or less of the inner diameters of the coil 21, and the magnet 22 is arranged at the inner diameter of the coil 21 including the center of the coil 21. When performing alignment of the charging stand 2 and the cellular phone 3 mentioned later, the outer diameter of the magnet 22 is limited to about 80% or less of the inner diameters of the coil 21 in order to draw the spiral inductor 31 of the cellular phone 3 in the center of the coil 21.

[0026]

The circuit board 23 has mounted the electronic parts 23a which have mounted two or more electronic parts 23a which control the electric power transmitted with the coil 21, for example, constitute a power control circuit and an inverter circuit at least. The circuit board 23 has provided the connector 23b for connection with the coil 21, and the connector 23c for connection with AC adapter 4.

[0027]

It returns to Fig.1, and the cellular phone 3 is separated with the spiral inductor (second coil) 31 and the spiral inductor 31, is arranged, and is provided with the battery holder 33 which has stored the rechargeable battery 32. the spiral inductor 31 comprises the soft magnetic material layer 31a and the coil conductor 31b -- the outer diameter of the coil conductor 31b -- the inner diameter of the coil 21 of the charging stand 2 -- abbreviated -- it is the same or smaller than this inner diameter. the outer diameter of the coil conductor 31b -- the inner diameter of the coil 21 of the charging stand 2 -- abbreviated -- the spiral inductor 31 can be miniaturized by the same or thing made smaller than this inner diameter, and the cellular phone 3 incorporating the spiral inductor 31 can be miniaturized. If the coil conductor 31b of the spiral inductor 31 is made small to the coil 21 of the charging stand 2, The coupling coefficient in the case of carrying out inductive coupling of the coil 21 of the charging stand 2 and the spiral inductor 31 of the cellular phone 3, and transmitting electric power is deteriorated, and the capability (transmission efficiency) to transmit electric power is deteriorated. However, in the transfer-of-power system 1 concerning an embodiment of the invention, since Q value which is an index which shows the relation between holding of energy and a loss by arranging the magnet 22 to the inner diameter part of the coil 21 of the charging stand 2 can be made high, the capability to transmit electric power is maintainable.

[0028]

It becomes possible to be separated with the battery holder 33 which has stored the rechargeable battery 32, and to arrange the spiral inductor 31 by miniaturizing the spiral inductor 31. That is, by arranging the spiral inductor 31, without contacting the battery holder 33, even if the spiral inductor 31 generates heat in response to supply of electric power from the charging stand 2, heat is not transmitted to the battery holder 33 easily, and degradation of the rechargeable battery 32 can be suppressed.

[0029]

It describes in detail about the spiral inductor 31. Fig.3 is a cross sectional view showing the composition of the spiral inductor 31 concerning an embodiment of the invention. Fig.4 is a plan view decomposing and showing the composition of the spiral inductor 31 concerning an embodiment of the invention. Fig.4 (a) -- the first pass 311 -- Fig.4 (b) -- the secondary layer 312 -- Fig.4 (c) -- the third -- layer 313 -- Fig.4 (d) -- the fourth -- layer 314 -- Fig.4 (e) -- the fifth -- layer 315 -- Fig.4 (f) shows 316, Fig.4 (g) shows 317, and Fig.4 (h) shows 318 [layer / sixth / layer / seventh / layer / eighth], respectively. As shown in Fig.3, the spiral inductor 31 comprises the land electrode 320 formed in one surface of the eight layers 311-318 and the first pass 311. The first pass 311 is the nonmagnetic body whorl 31c which consists of a nonmagnetic ferrite. The secondary layer 312 is the soft magnetic material layer 31a which consists of soft magnetic materials with high amplitude permeability (for example, ferrite series materials, such as a nickel-Zn-Cu ferrite). the third of the soft magnetic material layer 31a which consists of soft magnetic materials with high amplitude permeability -- layer 313 and the fourth -- layer 314 and the sixth -

- layer 316 -- and the seventh layer of the coil conductor 31b which consists of conductive materials (for example, Cu etc.) is formed in 317. The nonmagnetic body whorl 31c which consists of a nonmagnetic ferrite reaches fifth layer 315, and the eighth layer of the coil conductor 31b which consists of a conductive material is formed in 318.

[0030]

The coil conductor 31b currently formed in the soft magnetic material layer 31a and the nonmagnetic body whorl 31c has the form lacking in a part of circular radius r1, it is electrically connected mutually and the coil conductor 31b formed in each layer constitutes one coil. The third layer is pulled out to 313 and the coil conductor 31b currently formed in 318 the eighth layer, and the wiring 31d is provided. The first pass 311 thru/or the coil conductor 31b by which 318 [layer / eighth] was formed in each layer are laminated so that the normal which passes along a center may be shared, and it constitutes the spiral inductor 31. The drawer wiring 31d provided by the third layer of the coil conductor 31b of 313 is an end of one coil, and while is connected to the land electrode 320. The drawer wiring 31d provided by the coil conductor 31b currently formed in 318 the eighth layer is the other end of one coil, and is connected to the land electrode 320 of another side. The composition of the spiral inductor 31 shown by Fig.3 and Fig.4 is illustration, and if it is the spiral inductor 31 which comprised the soft magnetic material layer 31a and the coil conductor 31b, it will not be limited in particular.

[0031]

The spiral inductor 31 shown in Fig.3, By having the secondary layer 312 of the soft magnetic material layer 31a in which the coil conductor 31b is not formed, magnetic flux which leaks from the surface side in which the land electrode 320 is formed can be made small compared with the magnetic flux which leaks from the surface side in which the land electrode 320 is not formed. Since the surface side in which the land electrode 320 is not formed becomes the surface side which is opposing to the charging stand 2, the spiral inductor 31 has been enlarged compared with the leakage flux by the side of the surface where the leakage flux by the side of the surface which is opposing to the charging stand 2 is opposite to this surface side that is opposing. Therefore, the transfer-of-power system 1 concerning an embodiment of the invention, Leakage of the magnetic flux from the surface side opposite to the surface side which is opposing to the charging stand 2 of the spiral inductor 31 can be suppressed, the magnetic flux used for inductive coupling with the coil 21 of the charging stand 2 can be enlarged, and the capability to transmit electric power can be maintained.

[0032]

It returns to Fig.1 and the spiral inductor 31 has been made to mount the circuit board 34 in the surface side opposite to the surface side which is opposing to the charging stand 2. The circuit board 34 mounts two or more electronic parts which control the electric power transmitted by the spiral inductor 31, and the electronic parts which constitute a rectification circuit, a regulator circuit, and a charging control circuit at least are mounted. Fig.5 is a circuit diagram showing a part of circuit configuration of the transfer-of-power system 1 concerning an embodiment of the invention. In the transfer-of-power system 1 shown in Fig.5, when carrying out inductive coupling of the coil 21 of the charging stand 2, and the spiral inductor 31 of the cellular phone 3 and transmitting electric power, the circuit configuration connected to the spiral inductor 31 is illustrated. Specifically, the diode D which constitutes a rectification circuit, and the capacitor C are mounted in the circuit board 34, and are mounted in the surface side opposite to the surface side which is opposing this circuit board 34 to the charging stand 2 of the spiral inductor 31. Therefore, the coil module which comprises the spiral inductor 31 and the circuit board 34 can be miniaturized, and the cellular phone 3 can be miniaturized.

[0033]

As mentioned above, in the transfer-of-power system 1 concerning an embodiment of the invention, the charging stand 2 is provided with the magnet 22 arranged at the plate-like coil (first coil) 21 and the inner diameter part of the coil 21 -- the cellular phone 3 -- the inner diameter of the coil 21 -- abbreviated -- it has the spiral inductor (second coil) 31 of the same or outer diameter smaller than this inner diameter. Since the spiral inductor 31 is smaller than the coil 21, the coupling coefficient of the coil 21 of the charging stand 2 and the spiral inductor 31 of the cellular phone 3 is deteriorated, but. Since Q value which is an index which shows the relation between holding of energy and a loss can be made high with the magnet 22 arranged at the inner diameter part of the coil 21, the capability to transmit electric power is maintainable. If the electric power of the charging stands 2-2.5W is specifically supplied when the outer diameter of 4 cm and the coil conductor 31b of the spiral inductor 31 is the outer diameter of the coil 21 1 cm, The cellular phone 3 can receive supply of the electric power of 1W, and the capability (transmission efficiency) to transmit the electric power of the transfer-of-power system 1 concerning an embodiment of the invention will be 40%.

[0034]

In the transfer-of-power system 1 concerning an embodiment of the invention, Alignment of the coil 21 of the charging stand 2 and the spiral inductor 31 of the cellular phone 3 can be easily performed using the power between the magnet 22 arranged at the inner diameter part of the coil 21 of the charging stand 2, and the soft magnetic material layer 31a of the spiral inductor 31 of the cellular phone 3 paying well. In the transfer-of-power system 1 concerning an embodiment of the invention, the coil by the side of the cellular phone 3 can be miniaturized by making the coil of the cellular phone 3 into the spiral inductor 31.

[0035]

The charging stand 2 concerning an embodiment of the invention is a charging stand which supplies electric power to the cellular phone 3 provided with the spiral inductor 31 which comprised the soft magnetic material layer 31a and the coil conductor 31b. And the charging stand 2 is provided with the following.

The plate-like coil 21.

The magnet 22 arranged at an inner diameter part of this coil 21.

the inner diameter of the coil 21 -- the outer diameter of the coil conductor 31b of the cellular phone 3 -- abbreviated -- it being the same, or the coupling coefficient of the coil 21 of the charging stand 2 and the coil conductor 31b of the cellular phone 3 being deteriorated, since it is larger than this outer diameter, but. With the magnet 22 arranged at the inner diameter part of the coil 21, since Q value can be made high, the capability to transmit electric power is maintainable.

[0036]

The cellular phone 3 concerning an embodiment of the invention is the cellular phone 3 which receives supply of electric power from the charging stand 2 provided with the magnet 22 arranged at the plate-like coil 21 and the inner diameter part of this coil 21. And since the cellular phone 3 is provided with the spiral inductor 31 which comprised the soft magnetic material layer 31a and the coil conductor 31b, and the battery holder 33 which was separated with the spiral inductor 31, has been arranged and has stored the rechargeable battery 32, Even if the spiral inductor 31 generates heat in response to supply of electric power from the charging stand 2, heat is not transmitted to the battery holder 33 easily, and degradation of the rechargeable battery 32 can be suppressed.

[Explanations of letters or numerals]

[0037]

1 Transfer-of-power system

2 Charging stand

3 Cellular phone

4 AC adapter

21 Coil

22 Magnet

23 and 34 Circuit board

23a Electronic parts

23b and 23c Connector

24 Resin structure

31 Spiral inductor

31a Soft magnetic material layer

31b Coil conductor

31c Nonmagnetic body whorl

31d drawer wiring

32 Rechargeable battery

33 Battery holder

320 Land electrode

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(71)出願人　000006231
株式会社村田製作所
京都府長岡京市東神足１丁目１０番１号
(74)代理人　100117260
弁理士　福永　正也
(72)発明者　郷間　真治
京都府長岡京市東神足１丁目１０番１号
株式会社村田製作所内
(72)発明者　篠田　悟史
京都府長岡京市東神足１丁目１０番１号
株式会社村田製作所内

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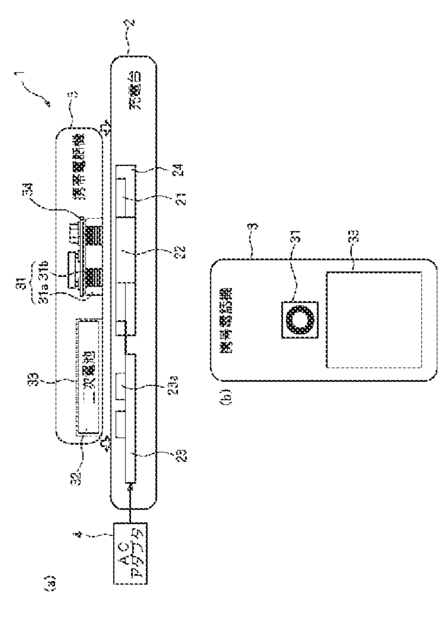
(54)【発明の名称】電力伝送システム、該電力伝送システムの給電装置及び携帯機器

(57)【要約】
【課題】本発明は、電力を伝送する能力を維持しつつ、受電側のコイルを小型化することができる電力伝送システム、該電力伝送システムの給電装置及び携帯機器を提供する。
【解決手段】本発明に係る電力伝送システム１は、電力を供給する充電台（給電装置）２と、電力の供給を受ける携帯電話機（受電装置）３とを備える。充電台２は、平板状のコイル（第一のコイル）２１と、該コイル２１の内径部分に配置された磁石２２とを備えている。携帯電話機３は、コイル２１の内径と略同じ又は該内径より小さい外径のスパイラルインダクタ（第二のコイル）３１を備え、該スパイラルインダクタ３１は、軟磁性体層３１ａとコイル導体３１ｂとで構成されている。
【選択図】図１



【特許請求の範囲】
【請求項１】
電力を供給する給電装置と、電力の供給を受ける受電装置とを備える電力伝送システムにおいて、
前記給電装置は、
平板状の第一のコイルと、
該第一のコイルの内径部分に配置された磁石と
を備え、
前記受電装置は、
前記第一のコイルの内径と略同じ又は該内径より小さい外径の第二のコイルを備え、
該第二のコイルは、軟磁性体層とコイル導体とで構成されたスパイラルインダクタであることを特徴とする電力伝送システム。
【請求項２】
前記スパイラルインダクタは、前記給電装置に対向している面側の漏れ磁束が、対向している該面側とは反対の面側の漏れ磁束より大きくなるようにしてあることを特徴とする請求項１記載の電力伝送システム。
【請求項３】
前記スパイラルインダクタは、前記給電装置に対向している面側とは反対の面側に、回路基板を実装するようにしてあることを特徴とする請求項１又は２に記載の電力伝送システム。
【請求項４】
軟磁性体層とコイル導体とで構成されたスパイラルインダクタを備える受電装置に対して、電力を供給する給電装置であって、
平板状のコイルと、
該コイルの内径部分に配置された磁石と
を備え、
前記コイルの内径は、前記受電装置の前記コイル導体の外径と略同じ又は該外径より大きいことを特徴とする給電装置。
【請求項５】
平板状のコイルと、
該コイルの内径部分に配置された磁石と
を備える給電装置から電力の供給を受ける携帯機器であって、
軟磁性体層とコイル導体とで構成されたスパイラルインダクタと、
該スパイラルインダクタと離隔して配置され、二次電池を収納している電池収納部と
を備え、
前記コイル導体の外径は、前記給電装置の前記コイルの内径と略同じ又は該内径より小さいことを特徴とする携帯機器。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、物理的に接続することなく電力を伝送する電力伝送システム、該電力伝送システムの給電装置及び携帯機器に関する。
【背景技術】
【０００２】
近年、非接触で電力を伝送して充電する通信機等の電子機器が開発されている。電子機器において非接触で電力を伝送するためには、電力の給電側の電子機器と、電力の受電側の電子機器との双方に非接触型電力伝送用のコイルを設ける必要がある。
【０００３】
また、電力の給電側のコイルと、電力の受電側のコイルとで、位置合わせを行わないと、効果的に電力を伝送することができない。そこで、例えば特許文献１では、電力の給電

側の電子機器、受電側の電子機器の双方のコイルの中心部分に磁石を配置し、両磁石間の引き合う力を利用して電力の給電側のコイルと、電力の受電側のコイルとで、位置合わせを行っていた。

【先行技術文献】

【特許文献】

【０００４】

【特許文献１】特開２００９－０９５０７２号公報

【発明の概要】

【発明が解決しようとする課題】

【０００５】

しかし、電力の給電側の電子機器、受電側の電子機器の双方のコイルの中心部分に磁石を配置するためには、コイル自体をある程度の大きさにする必要があり、小型化することが困難になるという問題点があった。特に受電側の電子機器、例えば携帯電話機に組み込む場合、コイルが一定以上の大きさを要することから、裏蓋と一体化させる案が有力であるが、電池近傍における発熱の問題等があり、コイルの大きさが携帯電話機の設計上の大きな制約条件となっている。

【０００６】

本発明は、上記事情に鑑みてなされたものであり、電力を伝送する能力を維持しつつ、受電側のコイルを小型化することができる電力伝送システム、該電力伝送システムの給電装置及び携帯機器を提供することを目的とする。

【課題を解決するための手段】

【０００７】

上記目的を達成するために第１発明に係る電力伝送システムは、電力を供給する給電装置と、電力の供給を受ける受電装置とを備える電力伝送システムにおいて、前記給電装置は、平板状の第一のコイルと、該第一のコイルの内径部分に配置された磁石とを備え、前記受電装置は、前記第一のコイルの内径と略同じ又は該内径より小さい外径の第二のコイルを備え、該第二のコイルは、軟磁性体層とコイル導体とで構成されたスパイラルインダクタである。

【０００８】

また、第２発明に係る電力伝送システムは、第１発明において、前記スパイラルインダクタは、前記給電装置に対向している面側の漏れ磁束が、対向している該面側とは反対の面側の漏れ磁束より大きくなるようにしてある。

【０００９】

また、第３発明に係る電力伝送システムは、第１又は第２発明において、前記スパイラルインダクタは、前記給電装置に対向している面側とは反対の面側に、回路基板を実装するようにしてある。

【００１０】

上記目的を達成するために第４発明に係る給電装置は、軟磁性体層とコイル導体とで構成されたスパイラルインダクタを備える受電装置に対して、電力を供給する給電装置であって、平板状のコイルと、該コイルの内径部分に配置された磁石とを備え、前記コイルの内径は、前記受電装置の前記コイル導体の外径と略同じ又は該外径より大きい。

【００１１】

上記目的を達成するために第５発明に係る携帯機器は、平板状のコイルと、該コイルの内径部分に配置された磁石とを備える給電装置から電力の供給を受ける携帯機器であって、軟磁性体層とコイル導体とで構成されたスパイラルインダクタと、該スパイラルインダクタと離隔して配置され、二次電池を収納している電池収納部とを備え、前記コイル導体の外径は、前記給電装置の前記コイルの内径と略同じ又は該内径より小さい。

【００１２】

第１発明では、給電装置が、平板状の第一のコイルと、該第一のコイルの内径部分に配置された磁石とを備え、受電装置が、第一のコイルの内径と略同じ又は該内径より小さい

外径の第二のコイルを備えるので、給電装置の第一のコイルと受電装置の第二のコイルとの結合係数は低下するが、第一のコイルの内径部分に配置された磁石により、エネルギーの保持と損失との関係を示す指標であるQ値を高くすることができるため、電力を伝送する能力を維持することができる。また、第一のコイルの内径部分に配置された磁石と受電装置の軟磁性体層との間の引き合う力を利用して、給電装置の第一のコイルと受電装置の第二のコイルとの位置合わせを容易に行うことができる。さらに、受電装置の第二のコイルをスパイラルインダクタとすることで、受電側（受電装置）のコイル（第二のコイル）を小型化することができる。

【００１３】

第２発明では、スパイラルインダクタは、給電装置に対向している面側の漏れ磁束が、対向している該面側とは反対の面側の漏れ磁束よりも大きくなるようにしてあるので、給電装置に対向している面側とは反対の面側からの磁束の漏れを抑えて、給電装置の第一のコイルとの電磁結合に利用される磁束を大きくすることができ、電力を伝送する能力を維持することができる。

【００１４】

第３発明では、スパイラルインダクタは、給電装置に対向している面とは反対の面側に、回路基板を実装するようにしてあるので、スパイラルインダクタと回路基板とで構成されるコイルモジュールを小型化して、受電装置を小型化することができる。

【００１５】

第４発明では、軟磁性体層とコイル導体とで構成されたスパイラルインダクタを備える受電装置に対して、電力を供給する給電装置であって、平板状のコイルと、該コイルの内径部分に配置された磁石とを備え、コイルの内径は、受電装置のコイル導体の外径と略同じ又は該外径より大きいので、給電装置のコイルと受電装置のコイル導体との結合係数は低下するが、コイルの内径部分に配置された磁石により、Q値を高くすることができるため、電力を伝送する能力を維持することができる。また、コイルの内径部分に配置された磁石と受電装置の軟磁性体層との間の引き合う力を利用して、給電装置のコイルと受電装置のコイル導体との位置合わせを容易に行うことができる。

【００１６】

第５発明では、平板状のコイルと、該コイルの内径部分に配置された磁石とを備える給電装置から電力の供給を受ける携帯機器であって、軟磁性体層とコイル導体とで構成されたスパイラルインダクタと、該スパイラルインダクタと離隔して配置され、二次電池を収納している電池収納部とを備えるので、給電装置から電力の供給を受けてスパイラルインダクタが発熱しても電池収納部に熱が伝わりにくく、二次電池の劣化を抑えることができる。また、スパイラルインダクタのコイル導体の外径は、給電装置のコイルの内径と略同じ又は該内径より小さいので、携帯機器を小型化することができる。さらに、給電装置の磁石とスパイラルインダクタの軟磁性体層との間の引き合う力を利用して、給電装置のコイルとスパイラルインダクタのコイル導体との位置合わせを容易に行うことができる。

【発明の効果】

【００１７】

本発明に係る電力伝送システムでは、給電装置が、平板状の第一のコイルと、該第一のコイルの内径部分に配置された磁石とを備え、受電装置が、第一のコイルの内径と略同じ又は該内径より小さい外径の第二のコイルを備えるので、給電装置の第一のコイルと受電装置の第二のコイルとの結合係数は低下するが、第一のコイルの内径部分に配置された磁石により、エネルギーの保持と損失との関係を示す指標であるQ値を高くすることができるため、電力を伝送する能力を維持することができる。また、第一のコイルの内径部分に配置された磁石と受電装置の軟磁性体層との間の引き合う力を利用して、給電装置の第一のコイルと受電装置の第二のコイルとの位置合わせを容易に行うことができる。さらに、受電装置の第二のコイルをスパイラルインダクタとすることで、受電側（受電装置）のコイル（第二のコイル）を小型化することができる。

【００１８】

また、本発明に係る給電装置は、軟磁性体層とコイル導体とで構成されたスパイラルインダクタを備える受電装置に対して、電力を供給する給電装置であって、平板状のコイルと、該コイルの内径部分に配置された磁石とを備え、コイルの内径は、受電装置のコイル導体の外径と略同じ又は該外径より大きいので、給電装置のコイルと受電装置のコイル導体との結合係数は低下するが、コイルの内径部分に配置された磁石により、Q値を高くすることができるため、電力を伝送する能力を維持することができる。

【００１９】

さらに、本発明に係る携帯機器は、平板状のコイルと、該コイルの内径部分に配置された磁石とを備える給電装置から電力の供給を受ける携帯機器であって、軟磁性体層とコイル導体とで構成されたスパイラルインダクタと、該スパイラルインダクタと離隔して配置され、二次電池を収納している電池収納部とを備えるので、給電装置から電力の供給を受けてスパイラルインダクタが発熱しても電池収納部に熱が伝わりにくく、二次電池の劣化を抑えることができる。

【図面の簡単な説明】

【００２０】

【図１】本発明の実施の形態に係る電力伝送システムの構成を示す模式図である。

【図２】本発明の実施の形態に係る充電台が備えるコイル、磁石、回路基板の構成を示す模式図である。

【図３】本発明の実施の形態に係るスパイラルインダクタの構成を示す断面図である。

【図４】本発明の実施の形態に係るスパイラルインダクタの構成を分解して示す平面図である。

【図５】本発明の実施の形態に係る電力伝送システムの回路構成の一部を示す回路図である。

【発明を実施するための形態】

【００２１】

以下、本発明の実施の形態における電力伝送システム、該電力伝送システムの給電装置及び携帯機器について、図面を用いて具体的に説明する。以下の実施の形態は、特許請求の範囲に記載された発明を限定するものではなく、実施の形態の中で説明されている特徴的事項の組み合わせの全てが解決手段の必須事項であるとは限らないことは言うまでもない。

【００２２】

なお、本発明の実施の形態に係る電力伝送システムの携帯機器には、例えばミュージックプレイヤー、携帯電話機、キーレスシステムの携帯機等が含まれるが、以下の説明では、携帯機器が携帯電話機である場合について説明する。

【００２３】

図１は、本発明の実施の形態に係る電力伝送システムの構成を示す模式図である。図１（ａ）は、充電台に携帯電話機を載置した状態の断面を示す模式図、図１（ｂ）は、携帯電話機の充電台に載置する側の面の断面を示す模式図である。本発明の実施の形態に係る電力伝送システム１は、電力を供給する給電装置である充電台２、電力の供給を受ける受電装置である携帯電話機３を備える。充電台２は、平板状のコイル（第一のコイル）２１、コイル２１の内径部分に配置された磁石２２、コイル２１から供給する電力を制御する複数の電子部品２３ａを実装した回路基板２３を備える。回路基板２３は、電源であるＡＣアダプタ４と接続されている。

【００２４】

図２は、本発明の実施の形態に係る充電台２が備えるコイル２１、磁石２２、回路基板２３の構成を示す模式図である。コイル２１は、銅線等の導体を、同一平面で渦巻状に形成している。コイル２１の外形は、略円形に形成しているが、略楕円形に形成しても、略四角形に形成しても良い。コイル２１は、フェライト等の磁性体材料を粉体にして混練した硬化性樹脂で形成された樹脂構造体２４に内蔵されている。ただし、コイル２１は、携帯電話機３を載置する側の面にて、樹脂構造体２４から露出している。なお、樹脂構造体

２４に代えて、コイル２１の一面に磁性体シートを固着しても良い。
【００２５】
磁石２２は、アルニコ磁石、フェライト磁石、ネオジム磁石等の永久磁石を用いて、コイル２１の内径部分に配置されている。磁石２２の外径は、コイル２１の内径の約８０％以下で、コイル２１の中心を含むコイル２１の内径に磁石２２が配置されている。なお、磁石２２の外径をコイル２１の内径の約８０％以下に限定しているのは、充電台２と後述する携帯電話機３との位置合わせを行う場合に、携帯電話機３のスパイラルインダクタ３１をコイル２１の中心に引き込むためである。
【００２６】
回路基板２３は、コイル２１で伝送する電力を制御する複数の電子部品２３ａが実装してあり、例えば、少なくとも電力制御回路、インバータ回路を構成する電子部品２３ａを実装してある。回路基板２３は、コイル２１との接続のためのコネクタ２３ｂと、ＡＣアダプタ４との接続のためのコネクタ２３ｃとを設けてある。
【００２７】
図１に戻って、携帯電話機３は、スパイラルインダクタ（第二のコイル）３１、スパイラルインダクタ３１と離隔して配置され、二次電池３２を収納している電池収納部３３を備える。スパイラルインダクタ３１は、軟磁性体層３１ａ、コイル導体３１ｂとで構成され、コイル導体３１ｂの外径は、充電台２のコイル２１の内径と略同じであるか、又は該内径より小さい。コイル導体３１ｂの外径を、充電台２のコイル２１の内径と略同じ又は該内径より小さくすることでスパイラルインダクタ３１を小型化することができ、スパイラルインダクタ３１を組み込んだ携帯電話機３を小型化することができる。なお、充電台２のコイル２１に対してスパイラルインダクタ３１のコイル導体３１ｂを小さくすると、充電台２のコイル２１と携帯電話機３のスパイラルインダクタ３１とを電磁結合させて電力を伝送する場合の結合係数が低下して、電力を伝送する能力（伝送効率）が低下する。しかし、本発明の実施の形態に係る電力伝送システム１では、充電台２のコイル２１の内径部分に磁石２２を配置することにより、エネルギーの保持と損失との関係を示す指標であるＱ値を高くすることができるため、電力を伝送する能力を維持することができる。
【００２８】
また、スパイラルインダクタ３１を小型化することで、スパイラルインダクタ３１を、二次電池３２を収納している電池収納部３３と離隔して配置することが可能となる。つまり、スパイラルインダクタ３１を電池収納部３３に接触することなく配置することで、充電台２から電力の供給を受けてスパイラルインダクタ３１が発熱しても電池収納部３３に熱が伝わりにくく、二次電池３２の劣化を抑えることができる。
【００２９】
さらに、スパイラルインダクタ３１について詳しく説明する。図３は、本発明の実施の形態に係るスパイラルインダクタ３１の構成を示す断面図である。図４は、本発明の実施の形態に係るスパイラルインダクタ３１の構成を分解して示す平面図である。図４（ａ）は第一層３１１を、図４（ｂ）は第二層３１２を、図４（ｃ）は第三層３１３を、図４（ｄ）は第四層３１４を、図４（ｅ）は第五層３１５を、図４（ｆ）は第六層３１６を、図４（ｇ）は第七層３１７を、図４（ｈ）は第八層３１８を、それぞれ示している。図３に示すように、スパイラルインダクタ３１は、八つの層３１１〜３１８、第一層３１１の一方の面に形成されたランド電極３２０で構成されている。第一層３１１は、非磁性フェライトからなる非磁性体層３１ｃである。第二層３１２は、透磁率の高い軟磁性材料（例えば、Ｎｉ−Ｚｎ−Ｃｕフェライト等のフェライト系材料）からなる軟磁性体層３１ａである。透磁率の高い軟磁性材料からなる軟磁性体層３１ａの第三層３１３、第四層３１４、第六層３１６及び第七層３１７に、導電性材料（例えば、Ｃｕ等）からなるコイル導体３１ｂが形成されている。非磁性フェライトからなる非磁性体層３１ｃの第五層３１５及び第八層３１８に、導電性材料からなるコイル導体３１ｂが形成されている。
【００３０】
軟磁性体層３１ａ及び非磁性体層３１ｃに形成されているコイル導体３１ｂは、半径ｒ

１の円形の一部を欠いた形状を有し、それぞれの層に形成されたコイル導体３１ｂは、互いに電気的に接続されて一つのコイルを構成している。第三層３１３及び第八層３１８に形成されているコイル導体３１ｂには引き出し配線３１ｄが設けられている。第一層３１１乃至第八層３１８は、それぞれの層に形成されたコイル導体３１ｂは、中心を通る法線を共有するように積層され、スパイラルインダクタ３１を構成している。第三層３１３のコイル導体３１ｂに設けられた引き出し配線３１ｄが一つのコイルの一端であり一方のランド電極３２０に接続されている。第八層３１８に形成されているコイル導体３１ｂに設けられた引き出し配線３１ｄが一つのコイルの他端であり他方のランド電極３２０に接続されている。なお、図３及び図４で示したスパイラルインダクタ３１の構成は例示であり、軟磁性体層３１ａとコイル導体３１ｂとで構成されたスパイラルインダクタ３１であれば、特に限定されない。

【００３１】

また、図３に示すスパイラルインダクタ３１は、コイル導体３１ｂが形成されていない軟磁性体層３１ａの第二層３１２を備えることで、ランド電極３２０が形成されている面側から漏れる磁束を、ランド電極３２０が形成されていない面側から漏れる磁束に比べて小さくすることができる。ランド電極３２０が形成されていない面側が、充電台２に対向している面側となるので、スパイラルインダクタ３１は、充電台２に対向している面側の漏れ磁束が、対向している該面側とは反対の面側の漏れ磁束に比べて大きくしてある。そのため、本発明の実施の形態に係る電力伝送システム１は、スパイラルインダクタ３１の、充電台２に対向している面側とは反対の面側からの磁束の漏れを抑えて、充電台２のコイル２１との電磁結合に利用される磁束を大きくすることができ、電力を伝送する能力を維持することができる。

【００３２】

図１に戻って、スパイラルインダクタ３１は、充電台２に対向している面側とは反対の面側に、回路基板３４を実装するようにしてある。回路基板３４は、スパイラルインダクタ３１で伝送する電力を制御する複数の電子部品を実装しており、少なくとも整流回路、レギュレータ回路、充電制御回路を構成する電子部品が実装されている。図５は、本発明の実施の形態に係る電力伝送システム１の回路構成の一部を示す回路図である。図５に示す電力伝送システム１では、充電台２のコイル２１と携帯電話機３のスパイラルインダクタ３１とを電磁結合させて電力を伝送する場合に、スパイラルインダクタ３１に接続される回路構成が図示されている。具体的には、整流回路を構成するダイオードＤ及びコンデンサＣが回路基板３４に実装され、該回路基板３４を、スパイラルインダクタ３１の、充電台２に対向している面側とは反対の面側に実装してある。そのため、スパイラルインダクタ３１と回路基板３４とで構成されるコイルモジュールを小型化して、携帯電話機３を小型化することができる。

【００３３】

以上のように、本発明の実施の形態に係る電力伝送システム１では、充電台２が、平板状のコイル（第一のコイル）２１と、コイル２１の内径部分に配置された磁石２２とを備え、携帯電話機３が、コイル２１の内径と略同じ又は該内径より小さい外径のスパイラルインダクタ（第二のコイル）３１を備える。スパイラルインダクタ３１がコイル２１より小さいため、充電台２のコイル２１と携帯電話機３のスパイラルインダクタ３１との結合係数は低下するが、コイル２１の内径部分に配置された磁石２２により、エネルギーの保持と損失との関係を示す指標であるＱ値を高くすることができるため、電力を伝送する能力を維持することができる。具体的に、コイル２１の外径を４ｃｍ、スパイラルインダクタ３１のコイル導体３１ｂの外径を１ｃｍとした場合、充電台２から２．５Ｗの電力を供給すると、携帯電話機３で１Ｗの電力の供給を受けることができ、本発明の実施の形態に係る電力伝送システム１の電力を伝送する能力（伝送効率）は４０％となる。

【００３４】

また、本発明の実施の形態に係る電力伝送システム１では、充電台２のコイル２１の内径部分に配置された磁石２２と、携帯電話機３のスパイラルインダクタ３１の軟磁性体層

３１ａとの間の引き合う力を利用して、充電台２のコイル２１と携帯電話機３のスパイラルインダクタ３１との位置合わせを容易に行うことができる。さらに、本発明の実施の形態に係る電力伝送システム１では、携帯電話機３のコイルをスパイラルインダクタ３１とすることで、携帯電話機３側のコイルを小型化することができる。

【００３５】

また、本発明の実施の形態に係る充電台２は、軟磁性体層３１ａとコイル導体３１ｂとで構成されたスパイラルインダクタ３１を備える携帯電話機３に対して、電力を供給する充電台である。そして、充電台２は、平板状のコイル２１と、該コイル２１の内径部分に配置された磁石２２とを備える。コイル２１の内径は、携帯電話機３のコイル導体３１ｂの外径と略同じ又は該外径より大きいので、充電台２のコイル２１と携帯電話機３のコイル導体３１ｂとの結合係数は低下するが、コイル２１の内径部分に配置された磁石２２により、Ｑ値を高くすることができるため、電力を伝送する能力を維持することができる。

【００３６】

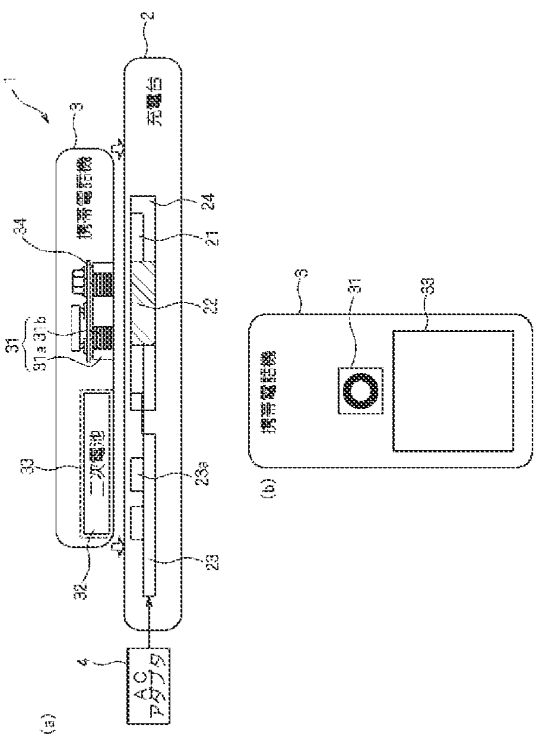
さらに、本発明の実施の形態に係る携帯電話機３は、平板状のコイル２１と、該コイル２１の内径部分に配置された磁石２２とを備える充電台２から電力の供給を受ける携帯電話機３である。そして、携帯電話機３は、軟磁性体層３１ａとコイル導体３１ｂとで構成されたスパイラルインダクタ３１と、スパイラルインダクタ３１と離隔して配置され、二次電池３２を収納している電池収納部３３とを備えるので、充電台２から電力の供給を受けてスパイラルインダクタ３１が発熱しても電池収納部３３に熱が伝わりにくく、二次電池３２の劣化を抑えることができる。

【符号の説明】

【００３７】

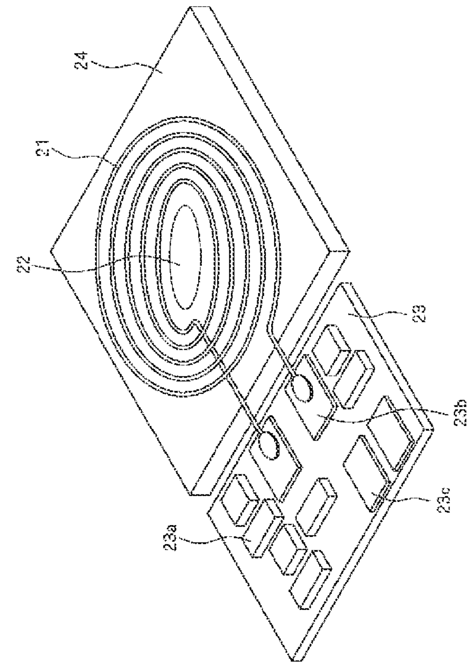
１　電力伝送システム
２　充電台
３　携帯電話機
４　ＡＣアダプタ
２１　コイル
２２　磁石
２３、３４　回路基板
２３ａ　電子部品
２３ｂ、２３ｃ　コネクタ
２４　樹脂構造体
３１　スパイラルインダクタ
３１ａ　軟磁性体層
３１ｂ　コイル導体
３１ｃ　非磁性体層
３１ｄ　引き出し配線
３２　二次電池
３３　電池収納部
３２０　ランド電極

【図１】



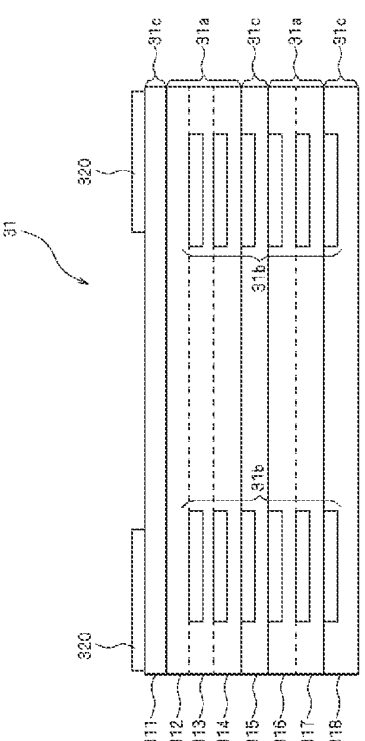
(a)
(b)
充電台
携帯電話機
二次電池
ACアダプタ
1
2
3
4
21
22
23
23a
24
31
31a
31b
32
33
34

【図２】



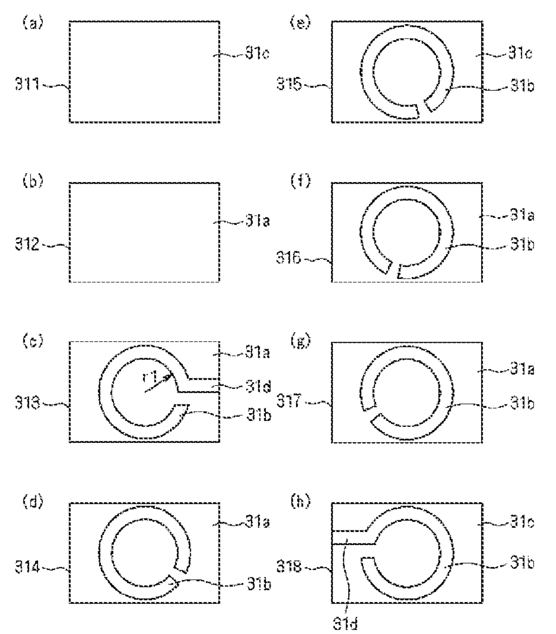
24
21
22
23
23a
23b
23c

【図３】



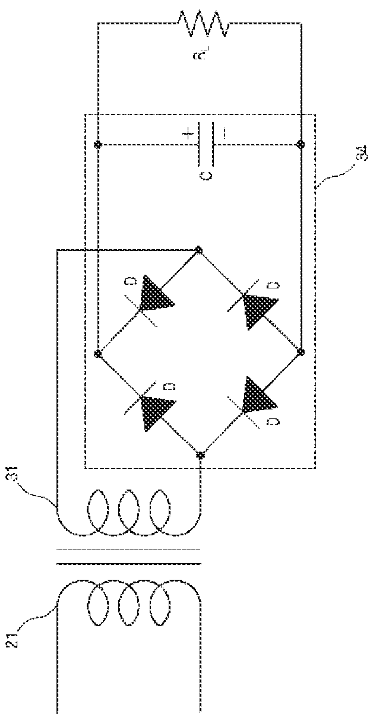
31c
31a
31c
31a
31c
320
31
31b
31b
320
311
312
313
314
315
316
317
318

【図４】



(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
311
312
313
314
315
316
317
318
31a
31b
31c
31d
r1

【図５】



PATENT ABSTRACTS OF JAPAN

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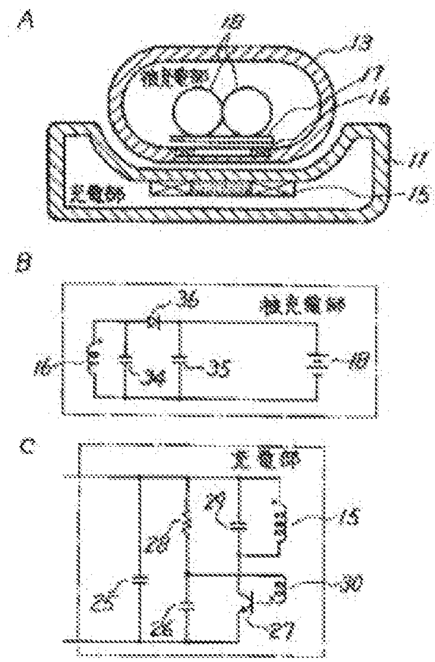
(71)Applicant : TDK CORP
(72)Inventor : TAKAHASHI MINORU
URANO TAKASHI

(54) NON-CONTACT TYPE CHARGER

(57)Abstract:
PURPOSE: To rapidly charge a secondary battery by improving the power transmission efficiency from a charging part to a part to be charged in a non-contact type charger.
CONSTITUTION: In a non-contact type charger where a charging part and a part to be charged are separated, the charging part is provided with an oscillation circuit including a parallel resonance circuit consisting of a transmission side coil 15 and a capacitor 29 for resonance, the part to be charged is provided a reception side coil 16 for inducing voltage while it is electromagnetically connected to the transmission side coil 15 of an oscillation circuit on charging and a secondary battery 18 which is charged by a voltage which is induced at the reception side coil 16, a capacitor 34 for resonance is connected in parallel with the reception side coil 16 at the part to be charged and a parallel resonance circuit is provided. Also, in the part to be charged, an electromagnetic shielding plate 17 for shielding electromagnetic field generated at the charging part is laid out between the reception side coil 16 and the secondary battery 18 for constituting the parallel resonance circuit.



[Claim(s)]

[Claim 1]A coil for separating and constituting a live part and a live part, equipping the aforementioned live part with an oscillating circuit containing a parallel resonant circuit of a coil and a capacitor, carrying out inductive coupling to a coil of the aforementioned oscillating circuit at the aforementioned live part at the time of charge, and inducing voltage.

A rechargeable battery which can be charged with voltage induced in this coil.

In a noncontact battery charger provided with the above,

A noncontact battery charger having connected a capacitor to a coil of the aforementioned live part, and parallel, and constituting a parallel resonant circuit.

[Claim 2]The noncontact battery charger according to claim 1 having arranged an electromagnetic shield for shielding electromagnetic field generated in a live part in the aforementioned live part between a coil and a rechargeable battery which constitute a parallel resonant circuit.

[Detailed Description of the Invention]

[0001]

[Industrial Application]The present invention relates to the noncontact battery charger used for various kinds of electrical machinery and apparatus which use the rechargeable battery which can be charged as a power supply, such as an electric shaver (electric razor machine), a cordless telephone, an electric toothbrush, and a laptop PC, or an electronic device.

[0002]Especially the present invention relates to the noncontact battery charger which enabled it to charge the live part which has a rechargeable battery by non-contact to the live part which has an oscillating circuit for charge.

[0003]

[Description of the Prior Art]Fig.8 is an explanatory view of a conventional example. A stand and 2 among Fig.8 a power plug and 3 the handle of a toothbrush, and 4 for one A power cord, As for a diode and T_r, in a rechargeable battery, L_1, an L_2primary coil, an L_3secondary coil, D_1, and D_2, a transistor, C_1, C_2, and C_3 show resistance 5, as for a capacitor and R_1.

[0004]Conventionally, it had the live part and the live part and the equipment shown in Fig.8 was known as equipment which performs noncontact type charge, for example (refer to JP,S60-8636,U). This equipment is an example of an electric toothbrush, the stand 1 has a live part, and a live part is on the handle 3 of a toothbrush.

[0005]And a live part of the stand 1 is equipped with a high-frequency oscillator (self-oscillating circuit) which comprised primary side coil L_1 of a transformer, L_2, transistor T_r, resistance R_1, capacitor C_2, and C_3.

It is constituted so that electromagnetic field may be generated outside from the aforementioned high frequency oscillation circuit.

[0006]In order to carry out inductive coupling to primary side coil L_1 of the aforementioned live part, and L_2 and to make the live part of the handle 3 of a toothbrush induce voltage, secondary side coil L_3 of a transformer is provided, and diode D_2 for rectification, the rechargeable battery (nickel-Cd cell) 5, etc. are provided.

[0007]Although they use this electric toothbrush at the time of use of a toothbrush, people's having the handle 3 of a toothbrush and picking it out from the stand 1, when not using it, as shown in a figure, a toothbrush is stood to the stand 1 and it keeps it.

[0008]By this storage state, since primary coil L_1 of a live part, L_2, and secondary coil L_3 of a live part carry out inductive coupling, voltage induces to secondary coil L_3 of a live part. And the rechargeable battery 5 is charged via diode D_2 with this induced voltage.

[0009]

[Problem to be solved by the invention]The following problems occurred in the above conventional things. Primary coil L_1 and L_2 are stored by the live part of the stand 1, and secondary coil L_3 is stored by the live part of the handle 3 of a toothbrush. And the handle 3 of the toothbrush is constituted so that charge may be performed in the state where it was stored inside the tube of the stand 1.

[0010]In this case, the stand 1 and the handle 3 of a toothbrush are formed integrally with resin, and have watertight construction so that an internal circuit component may not be damp with water. For this reason, there are thickness of the resin part of the outside of the handle 3 of a toothbrush and thickness of the resin part which constitutes the housing of the stand 1, and the distance between the primary secondary coils becomes largely only that part.

[0011]Therefore, the degree of coupling between the primary secondary coils becomes small, and the charging current to the rechargeable battery for charge becomes extremely small. As a result, the boost charge of the rechargeable battery for charge cannot be carried out for a short time.

[0012]An object of the present invention is to make boost charge of a rechargeable battery possible by solving such conventional problem and improving the transfer-of-power efficiency from a live part to a live part in a noncontact battery charger.

[0013]

[Means for solving problem]Fig.1 is a principle explanatory view of the present invention. In order to attain the aforementioned purpose, separate, and the present invention constitutes a live part and a live part, and to the aforementioned live part, Have an oscillating circuit (high frequency oscillation circuit) containing the parallel resonant circuit which consists of the transmitting side coil 15 and the capacitor 29 for resonance, and to the aforementioned live part, In the noncontact battery charger provided with the rechargeable battery 18 which can be charged with the voltage induced to the receiving side coils 16 and these receiving side coils 16 for carrying out inductive coupling to the transmitting side coil 15 of the aforementioned oscillating circuit at the time of charge, and inducing voltage, The capacitor 34 for resonance was connected in parallel with the receiving side coils 16 of the aforementioned live part, and the parallel resonant circuit was constituted.

[0014]In the aforementioned live part, the electromagnetic shield 17 for shielding the electromagnetic field generated in the live part between the receiving side coils 16 and the rechargeable battery 18 which constitute a parallel resonant circuit has been arranged.

[0015]

[Function]The operation of the present invention based on the aforementioned composition is described based on Fig.1. When performing charge to the rechargeable battery 18, it is in the state which carried the live part on the live part, and carries out by switching on a power supply. In this charging state, since the transmitting side coil 15 and the receiving side coils 16 are arranged oppositely, these coils function as the coil of a transformer similarly. That is, in the transmitting side coil 15, the receiving side coils 16 function as a secondary coil of a transformer by the primary coil of a transformer.

[0016]If the oscillating circuit of a live part oscillates at the time of charge, the parallel resonant circuit which constitutes this oscillating circuit will be in the state where it resonated on predetermined frequency. At this time, the transmitting side coil 15 and the receiving side coils 16 carry out inductive coupling, the magnetic flux generated with the transmitting side coil 15 interlinks to the receiving side coils 16, and voltage induces to the receiving side coils 16.

[0017]With this induced voltage, the parallel resonant circuit of the live part which consists of the receiving side coils 16 and the capacitor 34 for resonance resonates, and the rechargeable battery 18 is charged with the output of this parallel resonant circuit. That is, at the time of charge, the parallel resonant circuit of a live part and the parallel resonant circuit of a live part resonate simultaneously, and the rechargeable battery 18 is charged.

[0018]As mentioned above, when the parallel resonant circuit in a live part resonates, even if charging current becomes largely, the terminal voltage of a rechargeable battery is maintainable to a big value. For this reason, the boost charge of a rechargeable battery becomes possible.

[0019]If the capacity value of the capacitor 34 for resonance becomes largely especially, the charging current to the rechargeable battery 18 and the terminal voltage of a rechargeable battery will become very largely, it will become possible to send a high current to the rechargeable battery 18 for a short time, and efficient boost charge can be performed.

[0020]

[Working example]Hereafter, the working example of the present invention is described based on Drawings. The working example described below is an example applied to the noncontact rechargeable electric shaver.

[0021]Fig.2 - Fig.7 are the figures showing the working example of the present invention, and ten among Fig.2 - Fig.7 A live part stand,11 a live part stand housing and 12 an electric shaver and 13 An electric shaver housing, The printed circuit board and 15 for 14 a transmitting side coil and 16 receiving side coils and 17 An electromagnetic shield, 18 a rechargeable battery and 19 a ferrite core and 20 An electric shaver placing part, A power plug and 23 for 22 a fuse and 24 a full wave rectifier circuit and 25 The capacitor for smooth, 26 the capacitor for an oscillation, and 27 the transistor for switching, and 28 A starting resistance, 29 the capacitor for resonance, and 30 the coil for a return, and 34 The capacitor for resonance, 35 the capacitor for smooth, and 36 the diode for rectification, and 37 A constant current element, 38 an ammeter and 39 a voltmeter, and 41 and 42 The transistor for switching, 43 -- a choke coil, and 44 and 45 -- a second transmitting side coil and 49 show first receiving side coils, 50 shows second receiving side coils, and, as for a first transmitting side coil and 47, a starting resistance and 46 show the choke coil for smooth 51.

[0022]**1: Description of a noncontact rechargeable electric shaver ... Fig.2 and Fig.3 reference Fig.2 are the description Fig.1 of a noncontact rechargeable electric shaver, A figure is a side view and B figure is a plan view.Fig.3 is the description Fig.2 of a noncontact rechargeable electric shaver, A figure is the direction cross sectional view of X-Y of Fig.2, and B figure is a partial enlarged drawing of A figure.

[0023]The noncontact rechargeable electric shaver of this example comprises the electric shaver 12 and the live part stand 10. And the live part is provided to the live part stand 10, and the live part is provided for the electric shaver 12.

[0024]The live part stand housing 11 is provided to the aforementioned live part stand 10, and the live part is provided in this live part stand housing 11. The electric shaver housing 13 is provided for the electric shaver 12, and the live part is provided in this electric shaver housing 13.

[0025]The electric shaver placing part 20 for carrying and putting the electric shaver 12 on some aforementioned live part stand housings 11 is provided. And by taking out and using the electric shaver 12 from the electric shaver placing part 20, and carrying the electric shaver 12 on the electric shaver placing part 20, when other when using the electric shaver 12, it is constituted so that it may charge by non-contact.

[0026]Although circuit components, such as a high frequency oscillation circuit for charge, are provided in the live part provided in the aforementioned live part stand housing 11, these circuit components are mounted on the printed circuit board 14. And the transmitting side coil 15 is mounted on the aforementioned printed circuit board 14 in the state where it wound around the ferrite core 19, among the aforementioned circuit components.

[0027]In this case, the transmitting side coils 15 wound around the ferrite core 19 are the electric shaver placing part 20 and a position which opposes, and are arranged in the position nearest to the above-mentioned electric shaver placing part 20.

[0028]Although the parallel resonant circuit of a coil and a capacitor is provided in the live part provided in the above-mentioned electric shaver housing 13, the receiving side coils 16 which constitute the parallel resonant circuit are provided inside the electric shaver housing 13. In the electric shaver housing 13, the electromagnetic shield 17, the rechargeable battery 18, etc. are provided.

[0029]In this case, it is in the state which put the electric shaver 12 on the electric shaver placing part 20, the receiving side coils 16 are arranged so that it may become a position nearest to the electric shaver placing part 20, and it positions and they are arranged so that it may oppose with the transmitting side coil 15.

[0030]It is in the state which put the electric shaver 12 on the electric shaver placing part 20, and the rechargeable battery 18 is arranged in a position far from the electric shaver placing part 20, and the electromagnetic shield 17 is arranging between the receiving side coils 16 and the rechargeable battery 18, and it is performing electromagnetic shielding from the transmitting side coil 15.

[0031]When the above-mentioned electromagnetic shield 17 cannot be found, the electromagnetic field generated with the transmitting side coil 15 attain even the rechargeable battery 18, and an eddy current flows into the metal body of the rechargeable battery 18. As a result, there is a possibility that a rechargeable battery may generate heat and a rechargeable battery may deteriorate. However, by providing the electromagnetic shield 17, the electromagnetic field generated with the transmitting side coil 15 can be shielded, and generation of heat of the aforementioned rechargeable battery 18 can be prevented.

[0032]As the aforementioned rechargeable battery, a nickel-cadmium battery, a nickel hydoride battery, a lithium ion battery, etc. are usable, for example. The electromagnetic shield 17 consists of complex ferrites (complex of a ferrite and resin), for example.

[0033]As shown in B figure of Fig.3, at the time of charge, the thickness of the live part stand housing 11 and the electric shaver housing 13, etc. exist between the receiving side coils 16 and the transmitting side coil 15. Therefore, gap length L_g exists between the receiving side coils 16 and the transmitting side coil 15.

[0034]**2: Description of the circuit configuration of a live part and a live part ... Fig.4 reference Fig.4 is an explanatory view of a charge circuit, A figure shows the circuit configuration figure of a live part, and B figure shows the circuit configuration figure of a live part.

[0035](1) : to the live part in the description aforementioned electric shaver 12 of the circuit configuration of a live part, the circuit of composition of having been shown in A figure of Fig.4 is provided. This circuit comprises the fuse 23, the full wave rectifier circuit 24, the capacitor 25 for smooth, the capacitor 26 for an oscillation, the transistor 27 for switching, the starting resistance 28, the capacitor 29 for resonance, and the transmitting side coil 15.

[0036]In the aforementioned circuit, the fuse 23, the full wave rectifier circuit 24, and a circuit which consists of the capacitor 25 for smooth are circuits which constitute a power supply section. It is a circuit which carries out full wave rectification of the exchange of commercial frequency input from the power plug 22, and makes a terminal of the capacitor 25 for smooth generate direct current voltage.

[0037]A circuit which consists of the capacitor 26 for an oscillation, the capacitor 29 for resonance, the starting resistance 28, the transistor 27 for switching, and the transmitting side coil 15 constitutes a collector alignment type self-oscillating circuit.

The aforementioned transmitting side coil 15 and the capacitor 29 for resonance constitute a parallel resonant circuit.

In this case, the aforementioned oscillating circuit is constituted so that it may oscillate with the resonance frequency of the aforementioned parallel resonant circuit.

[0038]The aforementioned transmitting side coil 15 and the coil 30 for a return are coils wound around the ferrite core (refer to Fig.3), respectively. In this case, at the time of charge, the transmitting side coil 15 functions as a primary coil of a transformer, and the coil 30 for a return functions as a coil for a return of a transformer.

[0039](2) : to the live part provided in the electric shaver housing 13 of the description electric shaver 12 of the circuit configuration of a live part, the circuit of composition of having been shown in B figure of Fig.4 is provided.

[0040]This circuit comprises the receiving side coils 16, the capacitor 34 for resonance, the capacitor 35 for smooth, the diode 36 for rectification, and the constant current element 37.

It is constituted so that the rechargeable battery 18 may be charged in these circuits.

[0041]In the aforementioned circuit, multiple connection of the capacitor 34 for resonance is carried out to the receiving side coils 16, and the parallel resonant circuit consists of these. In this case, at the time of charge, the receiving side coils 16 are constituted so that inductive coupling may be carried out to the transmitting side coil 15 of a live part. Therefore, at the time of charge, voltage induces to the receiving side coils 16, and it is constituted so that the aforementioned parallel resonant circuit may resonate with this induced voltage.

[0042]**3: The charging operation of the of operation description aforementioned live part of a charge circuit and a live part is as follows.

(1) When performing charge to the outline rechargeable battery of :operation, as shown in Fig.2 and Fig.3, where the electric shaver 12 is carried on the electric shaver placing part 20 of the live part stand 10, carry out by switching on a power supply.

[0043]In this charging state, since the transmitting side coil 15 and the receiving side coils 16 are arranged oppositely, these coils function as the primary coil of a transformer, and a secondary coil similarly. That is, in the transmitting side coil 15, the receiving side coils 16 function as a secondary coil of a transformer with the primary coil of a transformer.

[0044]Therefore, an oscillation of the oscillating circuit of a live part will resonate the parallel resonant circuit which constitutes this oscillating circuit on predetermined frequency. At this time, the transmitting side coil 15 and the receiving side coils 16 carry out inductive coupling, the magnetic flux generated with the transmitting side coil 15 interlinks to the receiving side coils 16, and voltage induces to the receiving side coils 16.

[0045]With this induced voltage, the parallel resonant circuit of a live part resonates and the rechargeable battery 18 is charged with the output of this parallel resonant circuit. That is, at the time of charge, the parallel resonant circuit of a live part and the parallel resonant circuit of a live part resonate simultaneously, and a rechargeable battery is charged. Hereafter, operation of each part is described.

[0046](2) : when the volts alternating current of commercial frequency (50/60H_Z) is applied to the power plug 22, make the terminal of the capacitor 25 for smooth generate the direct current voltage which carried out smooth in the description live part of a live part of operation, when the full wave rectifier circuit 24 performs full wave rectification and the capacitor 25 for smooth smooths.

[0047]And in the collector alignment type self-oscillating circuit which consists of the capacitor 26 for an oscillation, the capacitor 29 for resonance, the starting resistance 28, the transistor 27 for switching, and the transmitting side coil 15, the aforementioned direct current voltage performs oscillation operation as follows.

[0048]First, if current flows into the base of the transistor 27 for switching through the starting resistance 28 and the coil 30 for a return, the collector current of the transistor 27 for switching will flow, and current will flow also into the transmitting side coil 15. And this current increases gradually.

[0049]For this reason, since current flows through the base of the capacitor 26 for an oscillation, the coil 30 for a return, and the transistor 27 for switching with the voltage which voltage generated in the coil 30 for a return, and was generated in this coil 30 for a return, The current of the collector of the transistor 27 for switching tends to increase further (increase in the current by positive feedback).

[0050]Then, if the voltage of the coil 30 for a return is reversed, the transistor 27 for switching will be come by off. If time passes and the voltage of the coil 30 for a return is reversed, current will flow into the transistor 27 for switching again, and the same operation as the above will be carried out.

[0051]Thus, although the transistor 27 for switching repeats ON-and-OFF operation and is performed according to the polarity of the voltage of the coil 30 for a return, the parallel resonant circuit which consists of the transmitting side coil 15 and the capacitor 29 for resonance is resonating on predetermined frequency in this case.

[0052]Therefore, when the transistor 27 for switching is set to ON and collector current increases, the collector current of the transistor 27 for switching turns into sinusoidal current decided by frequency of fixing by the aforementioned parallel resonant circuit. For this reason, the voltage generated in the coil 30 for a return also turns into sine voltage of the aforementioned frequency, and the collector voltage of the transistor 27 for switching also turns into sine voltage.

[0053]On the other hand, since the aforementioned parallel resonant circuit is the resonance state when the transistor 27 for switching is OFF, the collector voltage of the transistor 27 for switching turns into continuous sine voltage.

[0054]It resonates on the frequency decided by a parallel resonant circuit as mentioned above with the inductance value of the transmitting side coil 15, and the capacity value of the capacitor 29 for resonance. And in an oscillating circuit, it oscillates with the resonance frequency of the aforementioned parallel resonant circuit.

[0055](3) : in the live part-ed [of operation description] of a live part, operate as follows at the time of charge, and charge to a rechargeable battery. While the oscillating circuit of the aforementioned live part is oscillating, the transmitting side coil 15 and the receiving side coils 16 serve as relation between a primary transformer coil and a secondary coil, and inductive coupling is carried out mutually. For this reason, voltage induces to the receiving side coils 16, and current flows.

[0056]Since the receiving side coils 16 and the capacitor 34 for resonance constitute the parallel resonant circuit at this time, it resonates on the predetermined frequency decided by the receiving side coils 16 and the capacitor 34 for resonance.

[0057]If this parallel resonant circuit will be in the resonance state, sine voltage will occur in this parallel resonant circuit. Current flows into the capacitor 35 for smooth via the diode 36 for rectification with this voltage, and the direct current voltage smoothed for the terminal of this capacitor 35 for smooth occurs.

[0058]With the direct current voltage generated for the terminal of this capacitor 35 for smooth, charging current flows into the rechargeable battery 18 via the constant current element 37, and the rechargeable battery 18 is charged.

**4: Description of the example of survey in a noncontact battery charger ... Drawing 5 and Fig.6 reference Fig.5 are the explanatory views of a measuring circuit, and Fig.6 is an example of data measuring.In order to check the effect of the charging characteristic by the live part and live part of the aforementioned working example, the charging characteristic was measured by the measuring circuit shown in Fig.5, and the data measuring shown in Fig.6 was obtained.

[0059](1) : description of a measuring circuit and a measuring method ... When measuring the characteristic of the Fig.5 reference aforementioned live part and a live part, the power supply was switched on and measured, where [which was shown in Fig.5] it carried out measuring circuit use and the electric shaver 12 is carried on the electric shaver placing part 20 of the live part stand 10 (refer to Fig.2 and Fig.3).

[0060]Although the circuit of the live part described in the aforementioned working example and a live part was used for the aforementioned measuring circuit, it removed the constant current element 37 provided to the live part in this case, and as shown in Fig.5, it connected the ammeter 38 and the voltmeter 39.

[0061]And voltage which measured the current measured with the aforementioned ammeter 38 with I_0 (mA) and a voltmeter was made into V_0(V). In this case, aforementioned current I_0 is charging current of the rechargeable battery 18, and aforementioned voltage V_0 is the terminal voltage of a rechargeable battery.

[0062]The inductance value of C_P and the transmitting side coil 15 for the capacity value of the capacitor 29 for resonance L_P, Gap length of the transmitting side [inductance value / of the receiving side coils 16 / capacity value / of L_S and the capacitor 34 for resonance / resonance frequency / of the parallel resonant circuit of C_S and a live part] coil 15 at the time of f_1 and charge and the receiving side coils 16 was made into L_g (refer to Fig.3).

[0063]And constants at the time of measurement were C_P=2200pF, L_P=4.6mH, and L_S=16microhenry, and measured frequency f_1 was f_1=1/root2piC_PL_P=250KH_Z.

[0064]As for the thickness of 38 mm and the transmitting side coil 15, gap length L_g of the transmitting side coil 15 and the receiving side coils 16 was [diameter of 6.0 mm and the transmitting side coil 15 / the thickness of 26 mm and the receiving side coils 16 of the diameter of 3.9 mm and the receiving side coils 16] 1.6 mm.

[0065]Performing the aforementioned parameter input and changing capacity value C_S as a parameter, charging current I_0 was measured with the ammeter 38, and terminal voltage V_0 of the rechargeable battery 18 was measured with the voltmeter 39. When parallel resonant circuit resonance frequency of a live part is made into f_2, it becomes f_2=1/rootpiL_SC_S.

[0066](2) : oscillate the description at the time of measurement, and the oscillating circuit of the description live part of the example of data measuring by resonance frequency f_1=1/root2piC_PL_P determined with the inductance value of the transmitting side coil 15, and the capacity value of the capacitor 29 for resonance. In the working example, the constant was selected as mentioned above and measured resonance frequency f_1 was f_1=250KH_Z as mentioned above.

[0067]In this case, the alternating current of frequency f_1 flows into the transmitting side coil 15, and magnetic flux occurs perpendicularly from a ferrite core. This magnetic flux is interlinked with the receiving side coils 16 which constitute the parallel resonant circuit of a live part, and induces voltage to these receiving side coils 16. With this induced voltage, the parallel resonant circuit which consists of the receiving side coils 16 and the capacitor 34 for resonance resonates. Resonance frequency f_2 at this time changes with capacity value C_S, and is decided by f_2=1/rootpiL_SC_S.

[0068]And the terminal of the capacitor 35 for smooth is made to generate direct current voltage on the voltage generated by the resonance operation of the parallel resonant circuit of the aforementioned live part, and the rechargeable battery 18 is charged with this direct current voltage. At this time, the data shown in Fig.6 was obtained by measuring charging current I_0 at the time of charge with the ammeter 38, and measuring terminal voltage V_0 of a rechargeable battery with the voltmeter 39.

[0069]It measured in this measurement, changing capacity value C_S of the capacitor 34 for resonance with C_S=0 (micro F) ->0.22 (micro F) ->0.33 (micro F) ->0.43 (micro F) ->0.53 (micro F) ->0.63 (micro F).

[0070]As for the data measuring shown in Fig.6, charging current I_0 (mA) and a vertical axis are shown for the horizontal axis as terminal voltage V_0(V) of a rechargeable battery. C_S=0 (micro F) of 34 capacitor for resonance corresponds, when there is nothing, and it is in the same state as the thing of a conventional example.

[0071]As capacity value C_S is increased with C_S=0 (micro F) ->0.22 (micro F) ->0.33 (micro F) ->0.43 (micro F) ->0.53 (micro F) ->0.63 (micro F) according to the data of Fig.6, Both charging current I_0 and terminal voltage V_0 of a rechargeable battery increase, and it becomes a good charging characteristic.

[0072]Especially when changing capacity value C_S with 0.53(micro F)->0.63 (micro F), even if charging current I_0 increases, terminal voltage V_0 of a rechargeable battery is in a sufficient high state, and is suitable for high-speed charge.

[0073]That is, in capacity value C_S=0.63 (micro F), charging current I_0 and terminal voltage V_0 of a rechargeable battery are the maximums, and parallel resonant circuit output power $Q=V_0xI_0$ (W) became the maximum.

[0074]Conditions used as $f_1=f_2$ are f_1=1/root2piC_PL_P=f_2=1/rootpiL_SC_S.

It is set to C_S=0.634 (micro F) as a result of calculation.

In the aforementioned measurement, capacity value C_S is [charging current I_0 and terminal voltage V_0 of a rechargeable battery] the maximums in 0.63 [somewhat smaller than the value of above C_S=0.634 (micro F)] (micro F), and parallel resonant circuit output power $Q=V_0xI_0$ (W) became the maximum. In C_S>=0 and 634 (micro F), it became $f_1>=f_2$ and it became impossible oscillating the live part side.

[0075]This is timing later than the time of one cycle which the transistor 27 for switching has switched when continuing self-oscillation in a live part by the positive feedback in the transmitting side coil 15 and the coil 30 for a return, Since the current which flows into the parallel resonant circuit by the side of a live part is reversed, it is because it becomes impossible to maintain the oscillation by the side of a live part.

[0076]As mentioned above, as a result of measurement, by C_S=0, the terminal voltage of a rechargeable battery is deteriorated extremely and it is not suitable for the boost charge of the rechargeable battery. However, if the value of C_S becomes largely and increases to C_S=0.53(micro F)->0.63 (micro F), charging current I_0 and terminal voltage V_0 of a rechargeable battery will become very largely, it will become possible to send a high current to the rechargeable battery 18 for a short time, and boost charge will become possible.

[0077]**5: Description of the example of a deformation circuit of a live part and a live part ... The drawing 7 reference Fig.7 is a figure showing the example of a deformation circuit of a live part and a live part, A figure is a circuit configuration figure of a live part, and B figure is a circuit configuration figure of a live part. Even if the circuit of the aforementioned live part and a live part deforms like Fig.7, it is feasible. Hereafter, it describes about this example of a deformation circuit.

[0078](1) : -- **** of a live part -- this example of a circuit is an example using the oscillating circuit of the push pull type [oscillating circuit / of a live part]. Since it constituted from a live part so that it might switch with the two transistors 41 and 42 for switching, the transmitting side coil also consists of two coils which consists of the first transmitting side coil 46 and the second transmitting side coil 47. The starting resistance also consists of the two starting resistances 44 and 45.

[0079]In this case, the first transmitting side coil 46, the second transmitting side coil 47, and the capacitor 29 for resonance constitute the parallel resonant circuit. The choke coil 43 is for carrying out a constant current operation of the current which flows into a circuit. The outside of the aforementioned composition is the same as the thing of the aforementioned working example.

[0080](2) : in the description of a live part, and the live part, two receiving side coils which consists of the first receiving side coils 49 and the second receiving side coils 50 are used in accordance with the circuit of a live part. In this case, the first receiving side coils 49, the second receiving side coils 50, and the capacitor 34 for resonance constitute the parallel resonant circuit. The choke coil 51 is for smooth. The outside of the aforementioned composition is the same as the thing of the aforementioned working example.

[0081](Other working examples) Although described about the working example above, even if it performs the present invention as follows, it is feasible.

(1) : the oscillating circuit of a live part is applicable not only to the circuit of the aforementioned working example but other same oscillating circuits.

[0082](2) : the noncontact battery charger provided with the live part and the live part is usable to various kinds of apparatus, such as not only an electric shaver but a cellular-phone machine, cordless telephone, etc.

[0083]

[Effect of the Invention]As described above, according to the present invention, there are the following effects.

(1) : perform charge to a rechargeable battery by providing the parallel resonant circuit of a coil and a capacitor to a live part, and providing the parallel resonant circuit which consists of a coil and a capacitor also to a live part, and resonating simultaneously the parallel resonant circuit of a live part, and the parallel resonant circuit of a live part at the time of charge.

[0084]For this reason, the transfer-of-power efficiency from a live part to a live part can be improved, and the boost charge of a rechargeable battery becomes possible.

(2) : even if the charging current to a rechargeable battery increases by selecting the capacity

value of the capacitor for resonance which constitutes the parallel resonant circuit of a live part especially, it is able to make it not to make the terminal voltage of a rechargeable battery be deteriorated.

[0085]Therefore, selection of the capacity value of the aforementioned capacitor can perform high-speed charge always doubled with the characteristic of the rechargeable battery.

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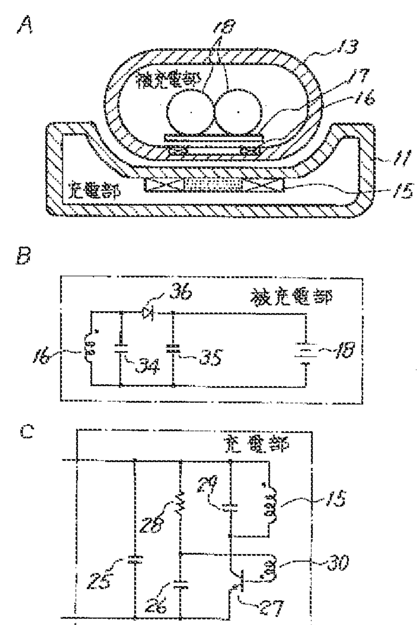
(71)出願人　000003067
ティーディーケイ株式会社
東京都中央区日本橋１丁目13番１号
(72)発明者　高橋　実
東京都中央区日本橋一丁目13番１号　ティーディーケイ株式会社内
(72)発明者　浦野　高志
東京都中央区日本橋一丁目13番１号　ティーディーケイ株式会社内
(74)代理人　弁理士　今村　辰夫　（外２名）

(54)【発明の名称】　非接触型充電器

(57)【要約】
【目的】　本発明は非接触型充電器に関し、非接触型充電器において、充電部から被充電部への電力伝送効率を向上させることにより、２次電池の急速充電を可能にすることを目的とする。
【構成】　充電部と被充電部とを分離して構成し、充電部には送信側コイル１５と共振用コンデンサ２９からなる並列共振回路を含む発振回路を備え、被充電部には充電時に発振回路の送信側コイル１５と電磁結合して電圧を誘起させるための受信側コイル１６と、該受信側コイル１６に誘起した電圧により充電可能な２次電池１８を備えた非接触型充電器において、被充電部の受信側コイル１６と並列に共振用コンデンサ３４を接続して並列共振回路を構成した。また、被充電部において、並列共振回路を構成する受信側コイル１６と２次電池１８との間に充電部で発生した電磁界の遮蔽を行うための電磁遮蔽板１７を配置した。

本発明の原理説明図



【特許請求の範囲】
【請求項１】　充電部と被充電部とを分離して構成し、前記充電部には、コイルとコンデンサの並列共振回路を含む発振回路を備え、
前記被充電部には、充電時に前記発振回路のコイルと電磁結合して電圧を誘起させるためのコイルと、該コイルに誘起した電圧により充電可能な２次電池を備えた非接触型充電器において、
前記被充電部のコイルと並列にコンデンサを接続して並列共振回路を構成したことを特徴とする非接触型充電器。
【請求項２】　前記被充電部において、
並列共振回路を構成するコイルと２次電池との間に、充電部で発生した電磁界の遮蔽を行うための電磁遮蔽板を配置したことを特徴とする請求項１記載の非接触型充電器。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、電動シェーバー（電動ひげそり器）、コードレス電話機、電動歯ブラシ、ラップトップ型パソコンなど、充電可能な２次電池を電源として使用する各種の電気機器、或いは電子機器等に利用される非接触型充電器に関する。
【０００２】特に本発明は、２次電池を有する被充電部を、充電用の発振回路を有する充電部に対して非接触で充電できるようにした非接触型充電器に関する。
【０００３】
【従来の技術】図８は従来例の説明図である。図８中、１はスタンド、２は電源プラグ、３は歯ブラシの柄、４は電源コード、５は２次電池、L_1 、L_2 は１次コイル、L_3は２次コイル、D_1 、D_2 はダイオード、T_r はトランジスタ、C_1 、C_2 、C_3 はコンデンサ、R_1 は抵抗を示す。
【０００４】従来、充電部と被充電部を備え、非接触式充電を行う装置として、例えば、図８に示した装置が知られていた（実開昭６０－８６３６号公報参照）。この装置は電動歯ブラシの例であり、スタンド１に充電部があり、歯ブラシの柄３に被充電部がある。
【０００５】そして、スタンド１の充電部には、トランスの１次側コイルL_1 、L_2 、トランジスタT_r 、抵抗R_1 、コンデンサC_2 、C_3 で構成された高周波発振器（自励発振回路）を備えており、前記高周波発振回路から外部に電磁界を発生するように構成されている。
【０００６】また、歯ブラシの柄３の被充電部には、前記充電部の１次側コイルL_1 、L_2と電磁結合して電圧を誘起させるために、トランスの２次側コイルL_3 を設けると共に、整流用のダイオードD_2 、２次電池（Ｎｉ－Ｃｄ電池）５等が設けてある。
【０００７】この電動歯ブラシは、歯ブラシの使用時には、人が歯ブラシの柄３を持ってスタンド１から取り出して使用するが、使用しない時は、図のように歯ブラシをスタンド１に立てて保管する。
【０００８】この保管状態で、充電部の１次コイルL_1 、L_2 と、被充電部の２次コイルL_3 が電磁結合するので、被充電部の２次コイルL_3 には電圧が誘起する。そして、この誘起した電圧によりダイオードD_2 を介して２次電池５が充電される。
【０００９】
【発明が解決しようとする課題】前記のような従来のものにおいては、次のような課題があった。１次コイルL_1 、L_2 がスタンド１の充電部に収納され、２次コイルL_3 が、歯ブラシの柄３の被充電部に収納されている。そして、歯ブラシの柄３は、スタンド１の筒内部に収納された状態で充電が行われるように構成されている。
【００１０】この場合、スタンド１や、歯ブラシの柄３は内部の回路部品が水で濡れることがないように、例えば樹脂により一体成形され、水密構造となっている。このため、歯ブラシの柄３の外側の樹脂部分の厚みと、スタンド１のハウジングを構成する樹脂部分の厚みがあり、その分だけ、１次、及び２次コイル間の距離が大きくなる。
【００１１】従って、１次、２次コイル間の結合度が小さくなり、充電用２次電池への充電電流が極端に小さくなる。その結果、充電用２次電池を短時間で急速充電できない。
【００１２】本発明は、このような従来の課題を解決し、非接触型充電器において、充電部から被充電部への電力伝送効率を向上させることにより、２次電池の急速充電を可能にすることを目的とする。
【００１３】
【課題を解決するための手段】図１は本発明の原理説明図である。本発明は前記の目的を達成するため、充電部と被充電部とを分離して構成し、前記充電部には、送信側コイル１５と共振用コンデンサ２９からなる並列共振回路を含む発振回路（高周波発振回路）を備え、前記被充電部には、充電時に前記発振回路の送信側コイル１５と電磁結合して電圧を誘起させるための受信側コイル１６と、該受信側コイル１６に誘起した電圧により充電可能な２次電池１８を備えた非接触型充電器において、前記被充電部の受信側コイル１６と並列に共振用コンデンサ３４を接続して並列共振回路を構成した。
【００１４】また、前記被充電部において、並列共振回路を構成する受信側コイル１６と２次電池１８との間に、充電部で発生した電磁界の遮蔽を行うための電磁遮蔽板１７を配置した。
【００１５】
【作用】前記構成に基づく本発明の作用を、図１に基づいて説明する。２次電池１８への充電を行う場合は、被充電部を充電部の上に載せた状態で、電源を投入して行う。この充電状態では、送信側コイル１５と受信側コイ

ル１６が対向配置されるので、これらのコイルが、トランスのコイルと同様に機能する。すなわち、送信側コイル１５がトランスの１次捲線で、受信側コイル１６がトランスの２次コイルとして機能する。

【００１６】充電時に充電部の発振回路が発振すると、該発振回路を構成する並列共振回路が所定の周波数で共振した状態となる。この時、送信側コイル１５と受信側コイル１６が電磁結合し、送信側コイル１５で発生した磁束が受信側コイル１６に鎖交し、受信側コイル１６に電圧が誘起する。

【００１７】この誘起した電圧により、受信側コイル１６と共振用コンデンサ３４からなる被充電部の並列共振回路が共振し、この並列共振回路の出力で２次電池１８を充電する。すなわち、充電時には、充電部の並列共振回路と、被充電部の並列共振回路が同時に共振し２次電池１８の充電を行う。

【００１８】前記のように、被充電部での並列共振回路が共振することにより、充電電流が大きくなっても、２次電池の端子電圧は大きな値に維持できる。このため、２次電池の急速充電が可能になる。

【００１９】特に、共振用コンデンサ３４の容量値が大きくなると、２次電池１８への充電電流、及び２次電池の端子電圧が極めて大きくなり、２次電池１８へ短時間に大電流を流すことが可能となって、効率の良い急速充電ができる。

【００２０】

【実施例】以下、本発明の実施例を図面に基づいて説明する。なお、以下に説明する実施例は、非接触型充電式電動シェーバーに適用した例である。

【００２１】図２～図７は本発明の実施例を示した図であり、図２～図７中、１０は充電部スタンド、１１は充電部スタンドハウジング、１２は電動シェーバー、１３は電動シェーバーハウジング、１４はプリント板、１５は送信側コイル、１６は受信側コイル、１７は電磁遮蔽板、１８は２次電池、１９はフェライトコア、２０は電動シェーバー載置部、２２は電源プラグ、２３はヒューズ、２４は全波整流回路、２５は平滑用コンデンサ、２６は発振用コンデンサ、２７はスイッチング用トランジスタ、２８は起動抵抗、２９は共振用コンデンサ、３０は帰還用コイル、３４は共振用コンデンサ、３５は平滑用コンデンサ、３６は整流用ダイオード、３７は定電流素子、３８は電流計、３９は電圧計、４１、４２はスイッチング用トランジスタ、４３はチョークコイル、４４、４５は起動抵抗、４６は第１の送信側コイル、４７は第２の送信側コイル、４９は第１の受信側コイル、５０は第２の受信側コイル、５１は平滑用チョークコイルを示す。

【００２２】§１：非接触型充電式電動シェーバーの説明・・・図２、図３参照

図２は非接触型充電式電動シェーバーの説明図１であり、Ａ図は側面図、Ｂ図は平面図である。また、図３は非接触型充電式電動シェーバーの説明図２であり、Ａ図は図２のＸ－Ｙ方向断面図、Ｂ図はＡ図の一部拡大図である。

【００２３】本実施例の非接触型充電式電動シェーバーは、電動シェーバー１２と、充電部スタンド１０で構成されている。そして、充電部スタンド１０には充電部が設けてあり、電動シェーバー１２には被充電部が設けてある。

【００２４】前記充電部スタンド１０には充電部スタンドハウジング１１が設けてあり、この充電部スタンドハウジング１１内に充電部が設けてある。電動シェーバー１２には電動シェーバーハウジング１３が設けてあり、この電動シェーバーハウジング１３内に被充電部が設けてある。

【００２５】また、前記充電部スタンドハウジング１１の一部に、電動シェーバー１２を載せて置くための電動シェーバー載置部２０が設けてある。そして、電動シェーバー１２を使用する時は、電動シェーバー載置部２０から電動シェーバー１２を取り出して使用し、それ以外の時は、電動シェーバー１２を電動シェーバー載置部２０上に載せておくことにより、非接触で充電を行うように構成されている。

【００２６】前記充電部スタンドハウジング１１内に設けた充電部には、充電用の高周波発振回路等の回路部品が設けてあるが、これらの回路部品は、プリント板１４上に搭載されている。そして、前記回路部品の内、送信側コイル１５は、フェライトコア１９に巻いた状態で前記プリント板１４上に搭載する。

【００２７】この場合、フェライトコア１９に巻いた送信側コイル１５は、電動シェーバー載置部２０と対向する位置で、かつ前記電動シェーバー載置部２０に最も近い位置に配置する。

【００２８】前記電動シェーバーハウジング１３内に設けた被充電部には、コイルとコンデンサの並列共振回路が設けてあるが、その並列共振回路を構成する受信側コイル１６が電動シェーバーハウジング１３の内部に設けてある。また、電動シェーバーハウジング１３内には、電磁遮蔽板１７、２次電池１８等が設けてある。

【００２９】この場合、受信側コイル１６は、電動シェーバー１２を電動シェーバー載置部２０に載せた状態で、電動シェーバー載置部２０に最も近い位置となるように配置し、かつ、送信側コイル１５と対向するように位置決めして配置する。

【００３０】また、２次電池１８は、電動シェーバー１２を電動シェーバー載置部２０に載せた状態で、電動シェーバー載置部２０から遠い位置に配置し、電磁遮蔽板１７は、受信側コイル１６と２次電池１８の間に配置することで、送信側コイル１５からの電磁遮蔽を行っている。

【0031】前記電磁遮蔽板17が無い場合は、送信側コイル15で発生した電磁界が2次電池18まで達し、2次電池18の金属体に渦電流が流れる。その結果、2次電池が発熱し2次電池が劣化する恐れがある。しかし、電磁遮蔽板17を設けることにより、送信側コイル15で発生した電磁界を遮蔽し、前記2次電池18の発熱を防止することができる。

【0032】前記2次電池としては、例えば、ニッケル・カドミウム電池、ニッケル・水素電池、リチウム・イオン電池等が使用可能である。また、電磁遮蔽板17は、例えば、複合フェライト（フェライトと樹脂の複合体）で構成する。

【0033】更に、図3のB図に示したように、充電時には、受信側コイル16と送信側コイル15の間には、充電部スタンドハウジング11と電動シェーバーハウジング13の厚み等が存在する。従って、受信側コイル16と送信側コイル15の間には、ギャップ長L_gが存在する。

【0034】§2：充電部、及び被充電部の回路構成の説明・・・図4参照

図4は充電回路の説明図であり、A図は充電部の回路構成図、B図は被充電部の回路構成図を示す。

【0035】(1)：充電部の回路構成の説明

前記電動シェーバー12内の充電部には、図4のA図に示した構成の回路が設けてある。この回路は、ヒューズ23、全波整流回路24、平滑用コンデンサ25、発振用コンデンサ26、スイッチング用トランジスタ27、起動抵抗28、共振用コンデンサ29、送信側コイル15で構成されている。

【0036】前記回路において、ヒューズ23、全波整流回路24、平滑用コンデンサ25からなる回路は、電源部を構成する回路であり、電源プラグ22から入力した商用周波数の交流を全波整流して、平滑用コンデンサ25の端子に直流電圧を発生させる回路である。

【0037】また、発振用コンデンサ26、共振用コンデンサ29、起動抵抗28、スイッチング用トランジスタ27、送信側コイル15からなる回路は、コレクタ同調型自励発振回路を構成しており、前記送信側コイル15と共振用コンデンサ29は並列共振回路を構成している。この場合、前記発振回路は、前記並列共振回路の共振周波数で発振するように構成されている。

【0038】前記送信側コイル15と帰還用コイル30は、それぞれフェライトコア（図3参照）に巻いたコイルである。この場合、充電時には送信側コイル15はトランスの1次捲線として機能し、帰還用コイル30はトランスの帰還用捲線として機能するものである。

【0039】(2)：被充電部の回路構成の説明

電動シェーバー12の電動シェーバーハウジング13内に設けた被充電部には、図4のB図に示した構成の回路が設けてある。

【0040】この回路は、受信側コイル16と、共振用コンデンサ34と、平滑用コンデンサ35と、整流用ダイオード36と、定電流素子37で構成されており、これらの回路で2次電池18を充電するように構成されている。

【0041】前記回路において、受信側コイル16には共振用コンデンサ34が並列接続されていて、これらで並列共振回路を構成している。この場合、受信側コイル16は、充電時に、充電部の送信側コイル15と電磁結合するように構成されている。従って、充電時には、受信側コイル16に電圧が誘起し、この誘起した電圧により前記並列共振回路が共振するように構成されている。

【0042】§3：充電回路の動作説明

前記充電部、及び被充電部の充電動作は次の通りである。

(1)：動作の概要

2次電池への充電を行う場合は、図2、図3に示したように、電動シェーバー12を充電部スタンド10の電動シェーバー載置部20上に載せた状態で電源を投入して行う。

【0043】この充電状態では、送信側コイル15と受信側コイル16が対向配置されるので、これらのコイルが、トランスの1次コイル、2次コイルと同様に機能する。すなわち、送信側コイル15がトランスの1次コイルで、受信側コイル16がトランスの2次コイルとして機能する。

【0044】従って、充電部の発振回路が発振すると、該発振回路を構成する並列共振回路が所定の周波数で共振する。この時、送信側コイル15と受信側コイル16が電磁結合し、送信側コイル15で発生した磁束が受信側コイル16に鎖交し、受信側コイル16に電圧が誘起する。

【0045】この誘起した電圧により、被充電部の並列共振回路が共振し、この並列共振回路の出力で2次電池18を充電する。すなわち、充電時には、充電部の並列共振回路と、被充電部の並列共振回路が同時に共振し、2次電池の充電を行う。以下、各部の動作を説明する。

【0046】(2)：充電部の動作説明

充電部では、電源プラグ22に商用周波数（50／60H_z）の交流電圧を印加すると、全波整流回路24が全波整流を行い、平滑用コンデンサ25が平滑化を行うことにより、平滑用コンデンサ25の端子に平滑した直流電圧を発生させる。

【0047】そして、発振用コンデンサ26、共振用コンデンサ29、起動抵抗28、スイッチング用トランジスタ27、送信側コイル15からなるコレクタ同調型自励発振回路では、前記直流電圧により次のように発振動作を行う。

【0048】先ず、起動抵抗28、帰還用コイル30を通じてスイッチング用トランジスタ27のベースに電流

が流れると、スイッチング用トランジスタ２７のコレクタ電流が流れ、送信側コイル１５にも電流が流れる。そして、この電流は徐々に増加する。

【００４９】このため、帰還用コイル３０に電圧が発生し、該帰還用コイル３０に発生した電圧により、発振用コンデンサ２６、帰還用コイル３０、スイッチング用トランジスタ２７のベースを通じて電流が流れるため、スイッチング用トランジスタ２７のコレクタの電流は更に増加しようとする（正帰還による電流の増加）。

【００５０】その後、帰還用コイル３０の電圧が逆転すると、スイッチング用トランジスタ２７がオフになる。更に時間が経過して帰還用コイル３０の電圧が逆転すると、再びスイッチング用トランジスタ２７に電流が流れ、前記と同様な動作をする。

【００５１】このように、帰還用コイル３０の電圧の極性に応じて、スイッチング用トランジスタ２７はオン／オフ動作を繰り返して行うが、この場合、送信側コイル１５と共振用コンデンサ２９からなる並列共振回路は、所定の周波数で共振している。

【００５２】従って、スイッチング用トランジスタ２７がオンになり、コレクタ電流が増加した時、スイッチング用トランジスタ２７のコレクタ電流は、前記並列共振回路による固定の周波数で決まる正弦波電流となる。このため、帰還用コイル３０に発生する電圧も、前記周波数の正弦波電圧となり、スイッチング用トランジスタ２７のコレクタ電圧も正弦波電圧となる。

【００５３】一方、スイッチング用トランジスタ２７がオフの場合、前記並列共振回路は、共振状態なので、スイッチング用トランジスタ２７のコレクタ電圧は連続した正弦波電圧となる。

【００５４】前記のようにして、並列共振回路では、送信側コイル１５のインダクタンス値と共振用コンデンサ２９の容量値で決まる周波数で共振する。そして、発振回路では、前記並列共振回路の共振周波数で発振する。

【００５５】(3)　：被充電部の動作説明

被充電部では、充電時に次のように動作して、２次電池に対し充電を行う。前記充電部の発振回路が発振している時、送信側コイル１５と受信側コイル１６はトランス１次コイルと２次コイルの関係となり、互いに電磁結合する。このため、受信側コイル１６には電圧が誘起し、電流が流れる。

【００５６】この時、受信側コイル１６と共振用コンデンサ３４は並列共振回路を構成しているので、受信側コイル１６と共振用コンデンサ３４で決まる所定の周波数で共振する。

【００５７】この並列共振回路が共振状態になると、該並列共振回路には正弦波電圧が発生する。この電圧により整流用ダイオード３６を介して平滑用コンデンサ３５に電流が流れ、該平滑用コンデンサ３５の端子に平滑化した直流電圧が発生する。

【００５８】この平滑用コンデンサ３５の端子に発生した直流電圧により、定電流素子３７を介して２次電池１８に充電電流が流れ、２次電池１８を充電する。

§４：非接触型充電器における実測例の説明・・・図５、図６参照

図5は測定回路の説明図、図6は実測データ例である。前記実施例の充電部、及び被充電部による充電特性の効果を確認するため、図5に示した測定回路により充電特性を測定し、図6に示した実測データを得た。

【００５９】(1)　：測定回路と測定方法の説明・・・図５参照

前記充電部、及び被充電部の特性を測定する際、図5に示した測定回路使用し、電動シェーバー１２を充電部スタンド１０の電動シェーバー載置部２０上に載せた状態（図２、図３参照）で、電源を投入して測定した。

【００６０】前記測定回路は、前記実施例で説明した充電部と被充電部の回路を使用したが、この場合、被充電部に設けた定電流素子３７を取り去り、図5に示したように、電流計３８と電圧計３９を接続した。

【００６１】そして、前記電流計３８で測定した電流をI_0（mA）、電圧計で測定した電圧をV_0（V）とした。この場合、前記電流I_0は2次電池１８の充電電流であり、前記電圧V_0は2次電池の端子電圧である。

【００６２】また、共振用コンデンサ２９の容量値をC_P、送信側コイル１５のインダクタンス値をL_P、受信側コイル１６のインダクタンス値をL_S、共振用コンデンサ３４の容量値をC_S、充電部の並列共振回路の共振周波数をf_1、充電時における送信側コイル１５と受信側コイル１６のギャップ長をL_g（図3参照）とした。

【００６３】そして、測定時における定数等は、C_P＝２２００ｐＦ、L_P＝４．６ｍＨ、L_S＝１６μＨであり、測定した周波数f_1は、$f_1 = 1/\sqrt{2\pi C_P L_P}$＝２５０ＫＨ$_Z$であった。

【００６４】また、送信側コイル１５と受信側コイル１６のギャップ長L_gは６．０ｍｍ、送信側コイル１５の直径は３８ｍｍ、送信側コイル１５の厚みは３．９ｍｍ、受信側コイル１６の直径は２６ｍｍ、受信側コイル１６の厚みは１．６ｍｍであった。

【００６５】前記の定数設定を行い、容量値C_Sをパラメータとして変化させながら、電流計３８で充電電流I_0を測定し、電圧計３９で２次電池１８の端子電圧V_0を測定した。なお、被充電部の並列共振回路共振周波数をf_2とした場合、$f_2 = 1/\sqrt{\pi L_S C_S}$となる。

【００６６】(2)　：測定時の説明と、実測データ例の説明

充電部の発振回路は、送信側コイル１５のインダクタンス値と、共振用コンデンサ２９の容量値で決定される共振周波数$f_1 = 1/\sqrt{2\pi C_P L_P}$で発振する。実施例では、前記のように定数を選定し、測定した共振周波数f_1は、前記のようにf_1＝２５０ＫＨ$_Z$であった。

【0067】この場合、送信側コイル15に周波数f_1の交流電流が流れ、フェライトコアより垂直方向に磁束が発生する。この磁束は被充電部の並列共振回路を構成する受信側コイル16と鎖交し、該受信側コイル16に電圧を誘起する。この誘起電圧により、受信側コイル16と共振用コンデンサ34からなる並列共振回路が共振する。この時の共振周波数f_2は、容量値C_Sにより変化し、$f_2 = 1/\sqrt{\pi} L_S C_S$で決まる。

【0068】そして、前記被充電部の並列共振回路の共振動作により発生した電圧で、平滑用コンデンサ35の端子に直流電圧を発生させ、この直流電圧で2次電池18を充電する。この時、電流計38で充電時の充電電流I_0を測定し、電圧計39で2次電池の端子電圧V_0を測定することにより、図6に示したデータを得た。

【0069】この測定では、共振用コンデンサ34の容量値C_Sを$C_S = 0$（μF）→0．22（μF）→0．33（μF）→0．43（μF）→0．53（μF）→0．63（μF）と変化させながら測定した。

【0070】図6に示した実測データは、横軸が充電電流I_0（mA）、縦軸が2次電池の端子電圧V_0（V）として示してある。なお、$C_S = 0$（μF）は、共振用コンデンサ34が無い場合に相当し、従来例のものと同じ状態である。

【0071】図6のデータによれば、容量値C_Sを$C_S = 0$（μF）→0．22（μF）→0．33（μF）→0．43（μF）→0．53（μF）→0．63（μF）と増加するに従って、充電電流I_0、及び2次電池の端子電圧V_0が共に増加し、良好な充電特性となる。

【0072】特に、容量値C_Sを0．53（μF）→0．63（μF）と変化させた時は充電電流I_0が増加しても、2次電池の端子電圧V_0は十分に高い状態であり、高速充電に適している。

【0073】すなわち、容量値$C_S = 0.63$（μF）では、充電電流I_0、及び2次電池の端子電圧V_0が最大値であり、並列共振回路出力電力$Q = V_0 \times I_0$（W）が最大となった。

【0074】なお、$f_1 = f_2$となる条件は、$f_1 = 1/\sqrt{2\pi} C_P L_P = f_2 = 1/\sqrt{\pi} L_S C_S$であり、計算の結果、$C_S = 0.634$（$\mu$F）となる。前記測定では、容量値$C_S$が、前記の$C_S = 0.634$（$\mu$F）の値より少し小さい0．63（$\mu$F）で充電電流$I_0$、及び2次電池の端子電圧$V_0$が最大値であり、並列共振回路出力電力$Q = V_0 \times I_0$（W）が最大となった。また、$C_S \geqq 0$、634（$\mu$F）の範囲では、$f_1 \geqq f_2$となり、充電部側が発振不能となった。

【0075】これは、充電部において、送信側コイル15と帰還用コイル30での正帰還により自励発振を継続する時、スイッチング用トランジスタ27のスイッチングしている1周期の時間よりも遅いタイミングで、被充電部側の並列共振回路に流れる電流が逆転するために、充電部側の発振が維持できなくなるためである。

【0076】以上のように、測定の結果、$C_S = 0$では2次電池の端子電圧が極端に低下し、2次電池の急速充電には適していない。しかし、C_Sの値が大きくなり、$C_S = 0.53$（μF）→0．63（μF）まで増加すると、充電電流I_0、及び2次電池の端子電圧V_0が極めて大きくなり、2次電池18へ短時間に大電流を流すことが可能となり、急速充電が可能になる。

【0077】§5：充電部、及び被充電部の変形回路例の説明・・・図7参照

図7は充電部、及び被充電部の変形回路例を示した図であり、A図は充電部の回路構成図、B図は被充電部の回路構成図である。前記充電部、及び被充電部の回路は、図7のように変形しても実施可能である。以下、この変形回路例について説明する。

【0078】(1)：充電部の説明

この回路例は充電部の発振回路にプッシュプル型の発振回路を用いた例である。充電部では、2個のスイッチング用トランジスタ41、42によりスイッチングを行うように構成したため、送信側コイルも、第1の送信側コイル46と第2の送信側コイル47からなる2個のコイルで構成している。また、起動抵抗も2個の起動抵抗44、45で構成している。

【0079】この場合、第1の送信側コイル46、第2の送信側コイル47、及び共振用コンデンサ29により並列共振回路を構成している。また、チョークコイル43は、回路に流れる電流の定電流作用をさせるためのものである。なお、前記構成の外は、前記実施例のものと同じである。

【0080】(2)：被充電部の説明

また、被充電部では、充電部の回路に合わせて、第1の受信側コイル49と第2の受信側コイル50からなる2個の受信側コイルを使用している。この場合、第1の受信側コイル49、第2の受信側コイル50、及び共振用コンデンサ34により並列共振回路を構成している。また、チョークコイル51は平滑用のものである。なお、前記構成の外は、前記実施例のものと同じである。

【0081】（他の実施例）以上実施例について説明したが、本発明は次のようにしても実施可能である。

(1)：充電部の発振回路は、前記実施例の回路に限らず、他の同様な発振回路にも適用可能である。

【0082】(2)：充電部と被充電部を備えた非接触型充電器は、電動シェーバーに限らず、携帯電話器、コードレス電話器など各種の機器に使用可能である。

【0083】

【発明の効果】以上説明したように、本発明によれば次のような効果がある。

(1)：充電部にコイルとコンデンサの並列共振回路を設け、かつ被充電部にもコイルとコンデンサからなる並列共振回路を設け、充電時には、充電部の並列共振回路と

被充電部の並列共振回路とを同時に共振させることにより、２次電池への充電を行う。

【００８４】このため、充電部から被充電部への電力伝送効率を向上させることができ、２次電池の急速充電が可能になる。

(2) ：特に、被充電部の並列共振回路を構成する共振用コンデンサの容量値を選定することにより、２次電池への充電電流が増加しても、２次電池の端子電圧を低下させないようにすることが可能である。

【００８５】従って、前記コンデンサの容量値の選択により、常に２次電池の特性に合わせた高速充電を行うことができる。

【図面の簡単な説明】

【図１】本発明の原理説明図である。

【図２】実施例における非接触型充電式電動シェーバーの説明図１である。

【図３】実施例における非接触型充電式電動シェーバーの説明図２である。

【図４】実施例における充電回路の説明図である。

【図５】実施例における測定回路の説明図である。

【図６】実施例における実測データ例である。

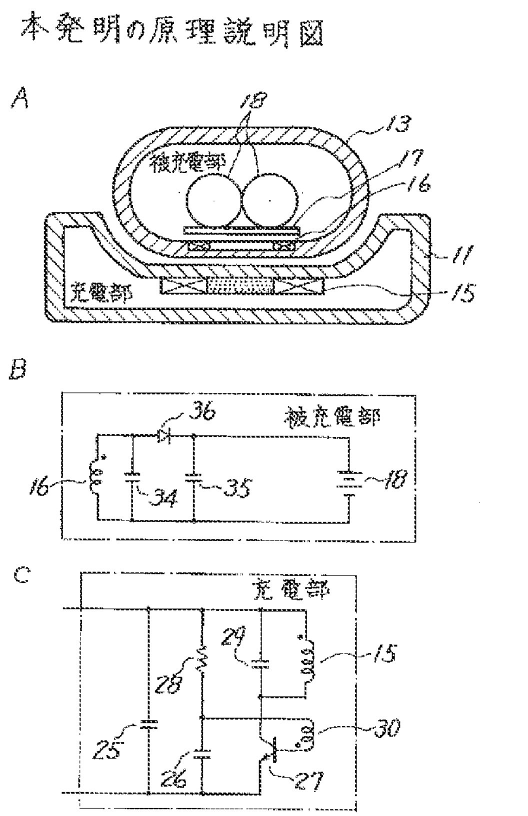
【図７】実施例における充電部、被充電部の変形回路例を示した図である。

【図８】従来例の説明図である。

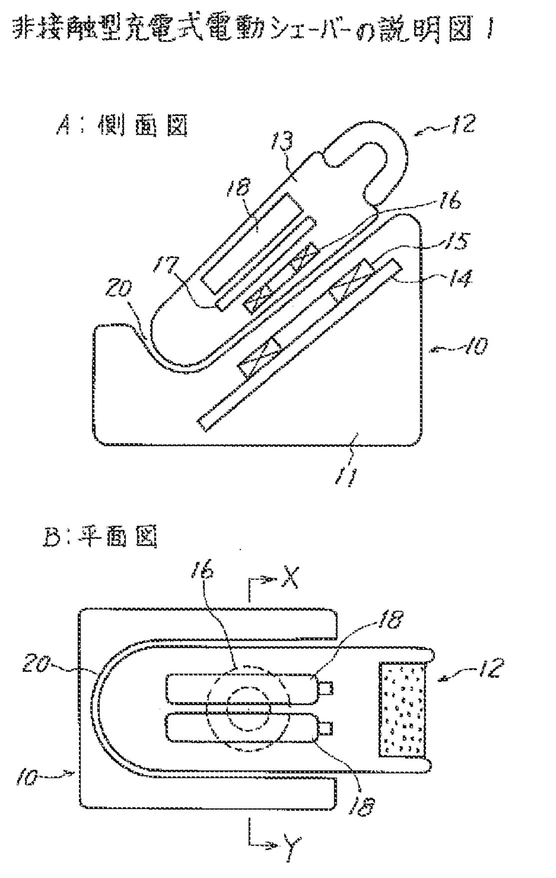
【符号の説明】

１１　充電部スタンドハウジング
１３　電動シェーバーハウジング
１５　送信側コイル
１６　受信側コイル
１７　電磁遮蔽板
１８　２次電池
２５　平滑用コンデンサ
２６　発振用コンデンサ
２７　スイッチング用トランジスタ
２８　起動抵抗
２９　共振用コンデンサ
３０　帰還用コイル
３４　共振用コンデンサ
３５　平滑用コンデンサ
３６　整流用ダイオード

【図１】



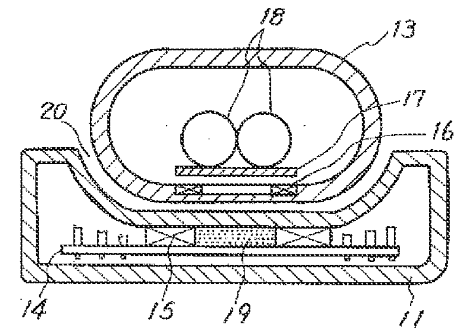
【図２】



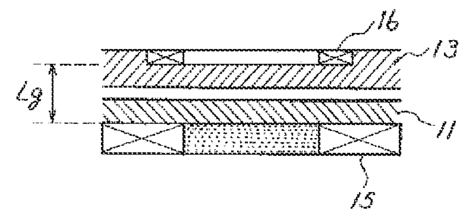
【図3】

非接触型充電式電動シェーバーの説明図２

A：図２のX−Y方向断面図



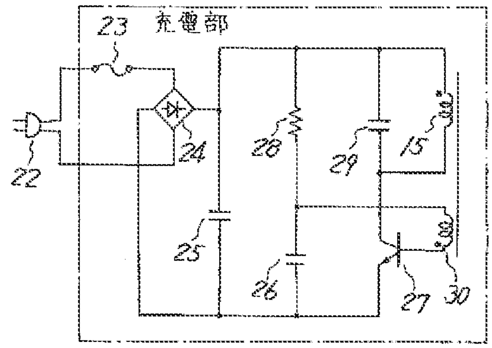
B：A図の一部拡大図



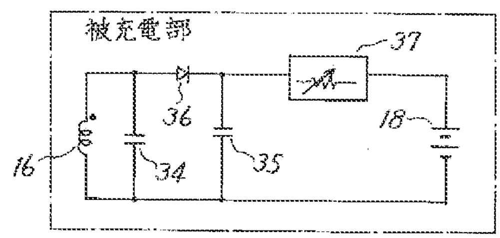
【図4】

充電回路の説明図

A：充電部の回路構成図

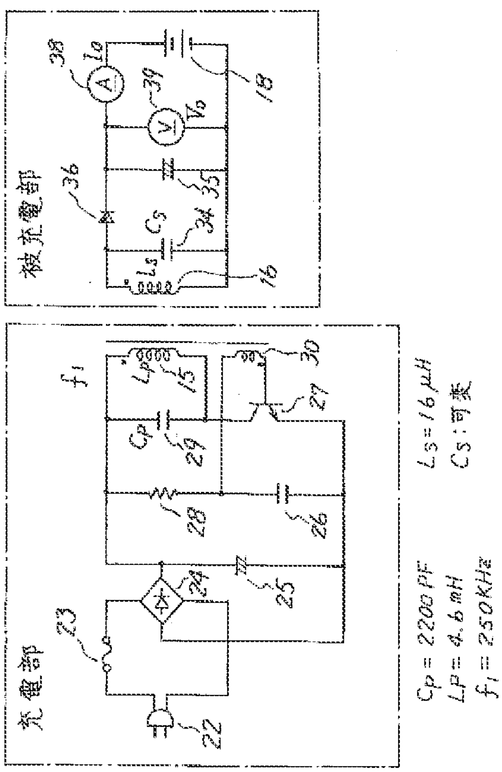


B：被充電部の回路構成図



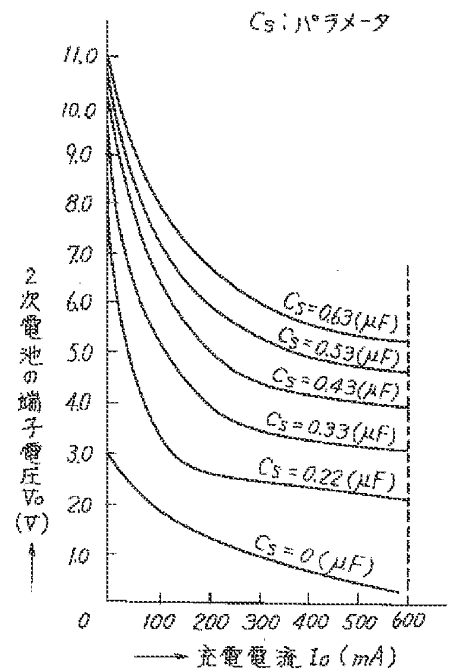
【図5】

測定回路の説明図

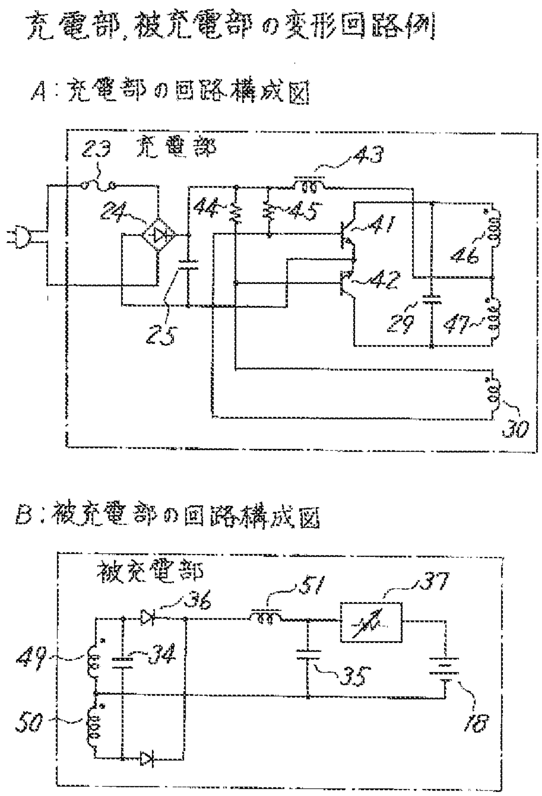


【図6】

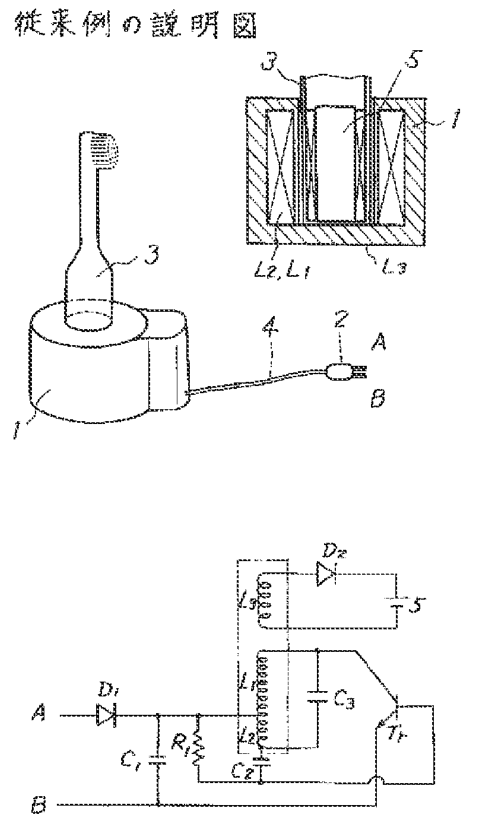
実測データ例



【図7】



【図8】



【手続補正書】
【提出日】平成７年５月３０日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】　充電部と被充電部とを分離して構成し、前記充電部には、コイルとコンデンサの並列回路を含む発振回路を備え、
前記被充電部には、充電時に前記発振回路のコイルと電磁結合して電圧を誘起させるためのコイルと、該コイルに誘起した電圧により充電可能な２次電池を備えた非接触型充電器において、
前記被充電部のコイルと並列にコンデンサを接続して並列共振回路を構成すると共に、
前記被充電部の並列共振回路を構成するコイルと２次電池との間に、充電部で発生した電磁界の遮蔽を行うための電磁遮蔽板を配置したことを特徴とする非接触型充電器。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００８５
【補正方法】変更
【補正内容】
【００８５】従って、前記コンデンサの容量値の選択により、常に２次電池の特性に合わせた高速充電を行うことができる。
（３）：電磁遮蔽板が無い場合は、送信側コイルで発生した電磁界が２次電池まで達し、２次電池の金属体に渦電流が流れる。その結果、２次電池が発熱し２次電池が劣化する恐れがある。しかし、本発明では、被充電部の並列共振回路を構成するコイルと２次電池との間に、前記充電部で発生した電磁界の遮蔽を行うための電磁遮蔽板を配置したので、送信側コイルで発生した電磁界を遮蔽し、２次電池の発熱を防止することができる。

フロントページの続き

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Ｈ０２Ｊ　17/00	B			
Ｈ０５Ｋ　9/00	F			
// Ａ４６Ｂ　17/00		7361－3K		

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First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/SARAH M ALLEN
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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.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on July 15, 2014.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2681
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	2681
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

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

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached. However, Applicants have not submitted copies of the U.S. Patent and published U.S. Patent Applications cited on attached Form PTO/SB/08 pursuant to 37 CFR 1.98(a)(2)(ii).

Applicants note that Japanese Publication Nos. 2006-042519, 2012-010533, and H08-79976, cited as F1 through F3, respectively, on the attached form PTO/SB/08, were written in a foreign language; however, English language Abstracts and full English translations are provided herewith. Applicants respectfully request that the references be made of record and considered in the examination of the subject application.

J:\SUN\LGI\420\IDS-Refs\7-15-14\SIDS.doc/sma

Applicants also note that the references cited on the attached form PTO/SB/08 were cited in a European Search Report from a counterpart foreign application. Applicants are attaching a copy of the European Search Report.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/sma

Attachments: Form PTO/SB/08; copies of references cited.

대 한 민 국 특 허 청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

출 원 번 호 : Application Number	10-2012-0079004
출 원 년 월 일 : Filing Date	2012년 07월 19일 JUL. 19, 2012
출 원 인 : Applicant(s)	엘지이노텍 주식회사 LG INNOTEK CO., LTD.

2014년 06월 19일

특 허 청
COMMISSIONER

제출 일자 : 2012-07-19

【서지사항】

【서류명】 특허출원서

【참조번호】 P2012Z0928KR

【출원구분】 특허출원

【출원인】

【명칭】 엘지이노텍 주식회사

【출원인코드】 1-1998-000285-5

【대리인】

【성명】 서교준

【대리인코드】 9-2004-000236-3

【포괄위임등록번호】 2009-020964-8

【발명의 국문명칭】 무선전력 수신장치 및 그의 제조 방법

【발명의 영문명칭】 APPARATUS FOR RECEIVING WIRELESS POWER AND METHOD FOR MANUFACTURING THEREOF

【발명자】

【성명】 김양현

【성명의 영문표기】 KIM, YANG HYUN

【주민등록번호】 820901-1XXXXXX

【우편번호】 100-095

【주소】 서울특별시 중구 남대문로5가 541번지 서울스퀘어

【국적】 KR

【발명자】

【성명】 안정욱

【성명의 영문표기】 AN, JEONG WOOK

【주민등록번호】 740501-1XXXXXX

【우편번호】 100-095

【주소】	서울특별시 중구 남대문로5가 541번지 서울스퀘어
【국적】	KR
【심사청구】	청구

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 서교준 (서명 또는 인)

【수수료】

【출원료】	0	면	38,000	원
【가산출원료】	50	면	0	원
【우선권주장료】	0	건	0	원
【심사청구료】	16	항	770,000	원
【합계】	808,000 원			

【명세서】

【발명의 명칭】

무선전력 수신장치 및 그의 제조 방법{APPARATUS FOR RECEIVING WIRELESS POWER AND METHOD FOR MANUFACTURING THEREOF}

【기술분야】

<1> 본 발명은 무선전력 수신장치 및 그의 제조 방법에 관한 것이다. 보다 상세하게는, 무선전력 전송 또는 안테나에 적용되어 전체 두께를 감소시키고, 제조 공정을 단순화 시킨 무선전력 수신장치 및 그의 제조 방법에 관한 것이다.

【배경기술】

<2> 무선으로 전기 에너지를 원하는 기기로 전달하는 무선전력전송 기술(wireless power transmission 또는 wireless energy transfer)은 이미 1800년대에 전자기유도 원리를 이용한 전기 모터나 변압기가 사용되기 시작했고, 그 후로는 라디오파나 레이저와 같은 전자파를 방사해서 전기에너지를 전송하는 방법도 시도 되었다. 우리가 흔히 사용하는 전동칫솔이나 일부 무선면도기도 실상은 전자기유도 원리로 충전된다. 전자기 유도는 도체의 주변에서 자기장을 변화시켰을 때 전압이 유도되어 전류가 흐르는 현상을 말한다. 전자기 유도 방식은 소형 기기를 중심으로 상용화가 빠르게 진행되고 있으나, 전력의 전송 거리가 짧은 문제가 있다.

<3> 현재까지 무선 방식에 의한 에너지 전달 방식은 전자기 유도 이외에 공진 및 단파장 무선 주파수를 이용한 원거리 송신 기술 등이 있다.

<4> 그러나, 일반적으로 단말기에 내장된 무선전력 수신장치는 두께가 두껍고, 제조 공정이 복잡한 문제가 있다.

【발명의 내용】

【해결하려는 과제】

<5> 본 발명은 자성 기판의 내부에 코일부를 배치시켜 무선전력 수신장치의 두께를 크게 감소시킬 수 있는 방법의 제공을 목적으로 한다.

<6> 본 발명은 자성 기판의 내부에 코일부를 배치시키고, 근거리 통신 안테나를 자성 기판에 배치시켜 높은 전력전송 효율을 유지시키며 외부 장치와 통신도 가능케 하는 방법의 제공을 목적으로 한다.

<7> 본 발명은 자성 기판 내부에 코일부를 배치시켜 무선전력 수신장치의 제조 공정을 단순화 시킨 방법의 제공을 목적으로 한다.

【과제의 해결 수단】

<8> 본 발명의 일 실시 예에 따른 무선전력 수신장치는 자성 기판 및 상기 자성 기판의 내부에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 한다.

<9> 상기 자성 기판은 상기 코일부를 수용하는 패턴 홈을 포함하고,

<10> 상기 코일부는 상기 패턴 홈에 배치되어 도전 패턴 또는 도전층으로 형성된 것을 특징으로 한다.

<11> 상기 코일부의 두께는 상기 자성 기판의 두께보다 더 작고, 상기 코일부 상

측이 상기 자성 기판 외부로 노출된 것을 특징으로 한다.

<12> 상기 무선전력 수신장치는 상기 코일부의 상 측에 배치되어, 상기 코일부의 양단에 접속된 연결부를 더 포함하는 것을 특징으로 한다.

<13> 상기 코일부와 및 상기 연결부는 솔더에 의해 접속되는 것을 특징으로 한다.

<14> 상기 무선전력 수신장치는 상기 자성 기판 상면에 직접 상기 코일부를 감싸는 형태로 배치된 근거리 통신 안테나를 더 포함하는 것을 특징으로 한다.

<15> 상기 무선전력 수신장치는 상기 코일부 및 상기 근거리 통신 안테나의 상 측에 배치되어, 상기 코일부의 양단 및 상기 근거리 통신 안테나의 양단에 접속된 연결부를 더 포함한다.

<16> 상기 근거리 통신 안테나는 NFC(NEAR FIELD COMMUNICATION) 안테나인 것을 특징으로 한다.

<17> 상기 자성 기판은 센더스트 타입의 자성체를 포함하는 것을 특징으로 한다.

<18> 상기 코일부는 상기 송신 측으로부터 전자기 유도을 이용해 전력을 수신하는 것을 특징으로 한다.

<19> 상기 코일부는 상기 송신 측으로부터 공진을 이용해 전력을 수신하는 것을 특징으로 한다.

<20> 본 발명의 일 실시 예에 따른 무선전력 수신장치의 제조 방법은 무선으로 전력을 수신하기 위한 코일이 배치될 위치에 돌출부가 형성된 금형을 이용하여 자성 기판에 열과 압력을 동시에 가하는 단계와 상기 금형을 상기 자성기판으로부터 분

리시켜 상기 자성 기판에 상기 코일을 배치하기 위한패턴 홈을 형성하는 단계 및 상기 형성된 패턴 홈에 도전 패턴을 형성하는 단계를 포함하는 것을 특징으로 한다.

<21> 상기 코일을 형성하는 단계는 상기 패턴 홈에 금속을 충진하여 상기 도전 패턴을 형성하는 것을 특징으로 한다.

<22> 상기 도전 패턴을 형성하는 단계는 상기 패턴 홈에 상기 도전 패턴을 갖도록 에칭을 거친 금속을 삽입하여, 상기 도전 패턴을 형성하는 것을 특징으로 한다.

<23> 상기 무선전력 수신장치의 제조 방법은 상기 형성된 도전 패턴을 무선전력 수신장치의 연결부와 솔더링을 통해 연결하는 단계를 더 포함하는 것을 특징으로 한다.

<24> 본 발명의 일 실시 예에 따른 단말기는 자성 기판 및 상기 자성 기판의 내부에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 무선전력 수신장치가 내장된 것을 특징으로 한다.

【발명의 효과】

<25> 본 발명의 실시 예에 따르면, 다음과 같은 효과가 있다.

<26> 첫째, 본 발명은 자성 기판의 내부에 도전 패턴을 형성하여 무선전력 수신장치의 두께를 크게 감소시킬 수 있다.

<27> 둘째, 자성 기판의 내부에 도전 패턴을 형성하여 높은 전력전송 효율을 갖을

수 있으며, 동시에 근거리 통신 안테나를 이용하여 외부 장치와 통신도 가능케 한다.

<28> 셋째, 자성 기판의 내부에 형성된 도전 패턴으로 인해, 외부로 향하는 자기장의 방향을 코일부 측으로 변경시켜, 전력 전송 효율을 높일 수 있고, 동시에 외부로 누출되는 자기장의 양을 감소시켜, 인체 유해성을 갖는 자기장의 영향을 최소화할 수 있다.

<29> 넷째, 패턴 홈을 형성하는 과정 및 코일부를 삽입하는 과정 만을 통해 무선전력 수신장치를 제조할 수 있어, 제조 공정이 단순화되는 효과가 있다.

<30> 한편 그 외의 다양한 효과는 후술될 본 발명의 실시 예에 따른 상세한 설명에서 직접적 또는 암시적으로 개시될 것이다.

【도면의 간단한 설명】

<31> 도 1은 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

도 2는 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 3은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

도 4 내지 도 8는 본 발명의 일 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법에 설명하기 위한 도면이다.

도 9는 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'로 자른 경우, 본 발명의 제2 실시 예에 따른 무선전력 송신장치(1000)의 단면도이다.

도 10은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 11은 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

도 12는 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 13은 도 12의 연결부(300)에 도시된 점을 따라 B에서 B'으로 자른 경우, 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 단면도이다.

도 14는 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

도 15는 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 16은 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)를 C에서 C'으로 자른 단면도이다.

도 17 내지 도 21은 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법을 설명하기 위한 도면이다.

도 22는 본 발명의 제1 실시 예에 따라 자성 기판 상면에 코일부를 배치한

경우, 사용 주파수에 따른 코일부(200)의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

도 23은 본 발명의 제5 실시 예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 사용 주파수에 따른 코일부(200)의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

도 24는 본 발명의 제1 실시 예에 따라 자성 기판 상면에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

도 25은 본 발명의 제5 실시 예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

【발명을 실시하기 위한 구체적인 내용】

<32> 이하에서는, 첨부된 도면을 참조하여 본 발명의 바람직한 실시예에 대하여 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있도록 상세히 설명한다.

<33> 도 1은 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 사시도이고, 도 2는 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 평면도이고, 도 3은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

<34> 도 1 내지 도 3을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300)를 포함할 수 있다.

<35> 무선전력 수신장치(1000)는 송신 측으로부터 무선으로 전력을 수신할 수 있다. 일 실시 예에서 무선전력 수신장치(1000)는 전자기 유도를 이용해 무선으로 전력을 수신 할 수 있다. 일 실시 예에서 무선전력 수신장치(1000)는 공진을 이용해 무선으로 전력을 수신할 수 있다.

<36> 전자기 유도 및 공진 모두 자기장을 이용하여 전력을 전송하는 방식이다.

<37> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시킬 수 있다.

<38> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과를 가질 수 있다.

<39> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 측방으로 변경시켜 코일부(200)에 자기장이 더 집중적으로 전달될 수 있도록 한다.

<40> 자성 기판(100)은 송신 측으로부터 전달받는 자기장 중 외부로 누출되는 자기장을 흡수하여 열로 방출시킬 수도 있다. 외부에 누출되는 자기장의 양이 감소되면, 인체에 유해한 영향을 미칠 수 있는 상황이 방지될 수 있다.

<41> 도 3을 참고하면, 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다.

<42> 자성체(110)는 입자 또는 세라믹의 형태를 포함할 수 있다.

<43> 지지체(120)는 열경화성 수지 또는 열가소성 수지를 포함할 수 있다.

<44> 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

<45> 다시 도 1을 설명하면, 코일부(200)는 제1 연결단자(210), 제2 연결단자(220), 코일(230)을 포함할 수 있다. 코일(230)은 도전층 또는 도전 패턴을 형성할 수 있다.

<46> 제1 연결단자(210)는 코일(230)의 일단에 제2 연결단자(220)는 코일(230)의 타단에 위치한다.

<47> 제1 연결단자(210) 및 제2 연결단자(220)는 연결부(300)와의 접속을 위해 필요한 단자이다.

<48> 코일(230)은 하나의 도선이 복수 번 권선된 코일 패턴을 형성할 수 있다. 일 실시 예에서 코일 패턴은 평면 나선 구조일 수 있으나, 이에 한정될 필요는 없고, 다양한 패턴을 형성할 수 있다.

<49> 코일부(200)는 자성 기판(100)의 상면에 직접 배치될 수 있다. 일 실시 예에서 코일부(200)와 자성 기판(100) 사이에는 접착층(미도시)이 더 배치될 수 있다.

<50> 코일부(200)는 도전체를 포함할 수 있다. 도전체는 금속 또는 합금이 이용될 수 있다. 일 실시 예에서 금속은 은 또는 구리가 사용될 수 있으나, 이에 한정될 필요는 없다.

<51> 코일부(200)는 송신 측으로부터 무선으로 수신한 전력을 연결부(300)에 전달할 수 있다. 코일부(200)는 송신 측으로부터 전자기 유도 또는 공진을 이용하여 전

력을 수신할 수 있다.

<52> 연결부(300)는 제3 연결단자(310), 제4 연결단자(320), 인쇄회로기판(330)을 포함할 수 있다.

<53> 제3 연결단자(310)는 제1 연결단자(210)와 접속될 수 있고, 제4 연결단자(320)는 제2 연결단자(220)와 접속될 수 있다.

<54> 인쇄회로기판(330)은 배선층을 포함할 수 있고, 배선층은 후출할 수신회로 등이 배치될 수 있다.

<55> 연결부(300)는 수신회로(미도시)와 코일부(200) 사이를 연결하여 코일부(200)로부터 전달받은 전력을 수신회로(미도시)를 통해 부하(미도시)로 전달할 수 있다. 수신회로는 교류전력을 직류전력으로 변환하는 정류회로 및 변환된 직류전력에서 리플 성분을 제거하여 부하에 전달하는 평활회로를 포함할 수 있다.

<56> 도 2 내지 도 3은 코일부(200)와 연결부(300)가 연결된 상태인 경우, 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 상세한 구성을 설명하기 위한 도면이다.

<57> 도 2는 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

<58> 도 2는 코일부(200)와 연결부(300)가 서로 접속되어 있는 상태를 보여준다.

<59> 일 실시 예에서 코일부(200)와 연결부(300) 간의 접속은 솔더에 의해 이루어질 수 있다. 구체적으로 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연

결단자(310)는 제1 솔더(10)에 의해 연결될 수 있고, 코일부(200)의 제2 연결단자(220)와 연결부(300)의 제4 연결단자(320)는 제2 솔더(20)에 의해 연결될 수 있다. 구체적으로, 제1 연결단자(210)는 제1 솔더(10)의 비아홀을 통해 제3 연결단자(310)와 연결될 수 있고, 제2 연결단자(220)는 제2 솔더(20)의 비아홀을 통해 제4 연결단자(320)와 연결될 수 있다.

<60> 도 2에 도시된 무선전력 수신장치(1000)는 단말기 등과 같은 전자기기에 내장될 수 있다.

<61> 단말기는 셀룰러 폰, PCS(Personal Communication Servie) 폰, GSM 폰, CDMA-2000 폰, WCDMA 폰과 같은 통상적인 이동 전화기, PMP(Portable Multimedia Player), PDA(Personal Digital Assistants), 스마트폰, MBS(Mobile Broadcast System) 폰 일 수 있으나, 이에 한정될 필요는 없고, 무선으로 전력을 수신할 수 있는 어떠한 장치든 상관없다.

<62> 도 2에서 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 단면에 대한 설명은 도 3에서 한다.

<63> 도 3은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

<64> 도 3을 참고하면, 자성 기판(100) 상면에는 코일부(200)의 구성요소인 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 배치되어 있다.

<65> 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100)의

상면에 코일부(200)가 직접 배치되어 있어, 기존의 FPCB 상에 코일 패턴을 형성한 경우와 달리 전체적인 두께를 크게 감소시킬 수 있다.

<66> 바람직하게 자성 기판(100)의 두께는 0.43㎜이고, 코일부(200)의 두께는 0.1㎜이고, 이를 합한 두께는 0.53㎜일 수 있다. 그러나, 이 수치는 예시에 불과하다.

<67> 즉, 코일부(200)를 도전체, 도전 패턴, 박막과 같은 형태로 구성함으로써 무선전력 수신장치(1000)의 두께를 감소시킬 수 있다. 이는, 요즘 휴대용 단말기와 같이 슬림화를 요구하고 있는 전자기기에 적용한다면 휴대용 단말기의 전제 두께를 감소시키면서 송신 측으로부터 전력을 수신하는데 유용한 효과를 가져올 수 있다.

<68> 코일부(200)의 상 측에는 연결부(300)가 직접 배치되어 있다. 코일부(200)의 상 측에 연결부(300)가 직접 배치됨에 따라 코일부(200)와 연결부(300)가 쉽게 접속될 수 있다.

<69> 코일부(200)의 제1 연결단자(210)는 솔더(10)에 의해 연결부(300)의 제3 연결단자(310)와 접속된다.

<70> 코일부(200)의 제2 연결단자(220)는 솔더(20)에 의해 연결부(300)의 제4 연결단자(320)와 접속된다.

<71> 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 코일(230)과 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

<72> 도 4 내지 도 8는 본 발명의 일 실시 예에 따른 무선전력 수신장치(1000)의

제조 방법에 설명하기 위한 도면이다.

<73> 무선전력 수신장치(1000)의 구성은 도 1 내지 도 3에서 설명한 것과 본질적으로 결합될 수 있다.

<74> 먼저, 도 4를 참고하면, 자성 기판(100)이 형성된다.

<75> 다음으로 도 5를 참고하면, 자성 기판(100)의 상면에 직접 도전체(201)를 적층된다. 일 실시 예에서는 자성 기판(100)의 상면에 접착층이 적층된 후, 도전체(201)가 적층될 수도 있다.

<76> 일 실시 예에서 자성 기판(100)의 상면에 도전체(201)를 적층시키는 방법은 도전체(201)를 소정의 온도에서 가열하고, 그 후, 소정의 압력을 가하는 라미네이팅(laminating) 공정이 사용될 수 있다. 라미네이팅(laminating) 공정이란, 열과 압력을 이용하여 서로 다른 종류의 금속박, 종이 등을 접착시키는 공정을 의미한다.

<77> 다음으로 도 6을 참고하면, 도전체(201)의 상 면에 마스크(500)가 적층된다. 마스크(500)는 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 형성되어 있는 위치의 상 면에만 적층될 수 있다.

<78> 다음으로, 도 7을 참고하면, 도 6의 상태에서 에칭액에 담구면 마스크(500)가 위치하지 않은 홈 부분이 식각된다. 그러면, 도전체(201)는 일정한 도전 패턴을 형성하게 된다.

<79> 그 후, 마스크(500)를 제거하면, 무선전력 수신장치(1000)의 코일부(200)가

형성된다.

<80> 다음으로 도 8을 참고하면, 코일부(200)와 연결부(300)가 접속되도록 솔더링 작업을 거친다.

<81> 즉, 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연결단자(310)를 솔더(10)에 의해 접속시키고, 코일부(200)의 제2 연결단자(200)와 연결부(300)의 제4 연결단자(320)를 솔더(20)에 의해 접속시킨다.

<82> 상기와 같이 자성 기판(100) 상 면에 직접 코일부(200)를 배치시킴으로써, 무선전력 수신장치(1000)의 전체 두께를 크게 감소시킬 수 있고, 라미네이팅과 에칭 과정만을 통해 무선전력 수신장치(1000)를 제조할 수 있어 공정이 단순화되는 효과가 있다.

<83> 도 9는 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 본 발명의 제2 실시 예에 따른 무선전력 송신장치(1000)의 단면도이다.

<84> 도 9를 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300), 접착층(700)을 포함할 수 있다.

<85> 자성 기판(100), 코일부(200), 연결부(300)는 도 1에서 설명한 것과 같다.

<86> 접착층(700)은 자성 기판(100)과 코일부(200) 사이에 배치되어 자성 기판(100)과 코일부(200)를 접착시킨다.

<87> 도 10은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

<88> 도 10을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300), 근거리 통신 안테나(600)를 포함할 수 있다.

<89> 자성 기판(100), 코일부(200), 연결부(300)에 대한 설명은 도 1 내지 도 3에서 설명한 것과 같다.

<90> 근거리 통신 안테나(600)는 제5 연결단자(610), 제6 연결단자(620), 외곽 코일(630)을 포함한다.

<91> 제5 연결단자(610) 및 제6 연결단자(620)는 연결부(300)에 접속된다.

<92> 근거리 통신 안테나(600)는 근거리 무선통신이 가능한 리더기와 통신을 수행할 수 있다. 근거리 통신 안테나(600)는 상기 리더기와 정보를 송수신하는 안테나의 역할을 수행한다.

<93> 일 실시 예에서 근거리 통신 안테나(600)는 코일부(200)의 외곽에 배치될 수 있다. 일 실시 예에서 코일부(200)가 자성 기판(100)의 중앙에 배치된 경우, 근거리 통신 안테나(600)는 코일부(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 근거리 통신 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

<94> 근거리 통신 안테나(600)는 코일부(200)처럼 도전 패턴, 도전층을 형성할 수 있다.

<95> 근거리 통신 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다. NFC(Near

Field Communication)는 13.56MHz의 대역을 가지며, 가까운 거리의 무선통신을 하기 위한 기술이다.

<96> 근거리 통신 안테나(600)는 자성 기판(100)의 상면에 직접 배치될 수 있다.

<97> 근거리 통신 안테나(600)가 자성 기판(100)에 배치되는 방법은 상기 도 4에서 설명한 제조 방법과 동일할 수 있다.

<98> 다음으로 도 11 내지 도 13에서 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 상세한 구성을 설명한다.

<99> 도 11은 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

<100> 도 11을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300)를 포함한다.

<101> 코일부(200), 연결부(300)에 대한 설명은 도 1에서 설명한 것과 같다. 다만, 자성 기판(100)의 경우, 일부 구조가 다르므로 이를 중심으로 설명한다.

<102> 도 11을 참고하면, 자성 기판(100)은 연결부(300)의 구조와 동일한 구조를 갖는 수용영역을 형성하고 있다. 즉, 도 1의 경우, 자성 기판(100) 상면에 코일부(200)가 배치되고, 코일부(200) 위에 연결부(300)가 연결되는 구조이나, 도 10의 경우, 자성 기판(100) 자체에 연결부(300)의 구조와 동일한 구조에 해당하는 부분만큼 수용영역이 형성되어, 코일부(200)의 하측에 연결부(300)가 배치될 수 있다.

<103> 도 12는 본 발명의 제4 실시 예에 따른 무선전력 수신장치(1000)의 평면도이

다.

<104> 도 12는 코일부(200)와 연결부(300)가 서로 접속되어 있는 상태를 보여준다.

<105> 연결부(300)의 두께는 자성 기판(100)의 두께와 같거나 작을 수 있다.

<106> 연결부(300)는 자성 기판(100)의 수용영역(130)에 배치될 수 있다.

<107> 연결부(300)의 두께가 자성 기판(100)의 두께와 같거나 작다면, 도 3의 실시예와 달리, 연결부(300)의 두께만큼 무선전력 수신장치(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

<108> 도 13은 도 12의 연결부(300)에 도시된 점을 따라 B에서 B'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

<109> 연결부(300)의 두께는 자성 기판(100)의 두께보다 작은 경우를 가정하여 설명한다.

<110> 도 13을 참고하면, 연결부(300) 상면에는 코일부(200)의 구성요소인 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 배치되어 있다.

<111> 코일부(200)의 하 측에는 연결부(300)가 배치되어 있다.

<112> 코일부(200)의 제1 연결단자(210)는 솔더(10)에 의해 연결부(300)의 제3 연결단자(310)와 접속된다.

<113> 코일부(200)의 제2 연결단자(220)는 솔더(20)에 의해 연결부(300)의 제4 연결단자(320)와 접속된다.

<114> 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 코일(230)과 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

<115> 도 13을 참고하면, 연결부(300)의 두께가 자성 기판(100)의 두께보다 작으므로, 도 3의 실시 예와 달리, 연결부(300)의 두께만큼 무선전력 수신장치(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 도 10에서 도시한 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

<116> 다음으로, 도 14 내지 도 20에서 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)에 대해 상세히 설명한다.

<117> 도 14는 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 사시도이고, 도 15는 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 평면도이고, 도 16은 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)를 C에서 C'으로 자른 단면도이고, 도 17 내지 도 21은 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법을 설명하기 위한 도면이다.

<118> 먼저, 도 14를 참조하면, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300)를 포함할 수 있다.

<119> 일 실시 예에서 무선전력 수신장치(1000)는 연결부(300)를 포함하지 않을 수 있다.

<120> 일 실시 예에서 무선전력 수신장치(1000)는 송신 측으로부터 전자기 유도에

의해 전력을 수신할 수 있다. 이 경우, 코일부(200)의 코일(210)은 송신 측의 코일과 전자기 유도에 의해 무선으로 전력을 수신할 수 있다.

<121> 일 실시 예에서 무선전력 수신장치(1000)는 송신 측으로부터 공진에 의해 전력을 수신할 수 있다. 이 경우, 코일부(200)의 코일(210)은 송신 측의 송신 공진 코일과 공진 주파수에서 동작하여 전력을 수신하는 수신 공진 코일 및 수신 공진 코일과 커플링되어 전달받은 전력을 수신회로로 전달하는 수신 유도 코일을 포함할 수 있다.

<122> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시킬 수 있다.

<123> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과를 가질 수 있다.

<124> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 측방으로 변경시켜 코일부(200)에 자기장이 더 집중적으로 전달될 수 있도록 한다.

<125> 자성 기판(100)은 송신 측으로부터 전달받는 자기장 중 외부로 누출되는 자기장을 흡수하여 열로 방출시킬 수도 있다. 외부에 누출되는 자기장의 양이 감소되면, 인체에 유해한 영향을 미칠 수 있는 상황이 방지될 수 있다.

<126> 도 14를 참고하면, 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다.

<127> 자성체(110)는 입자 또는 세라믹의 형태를 포함할 수 있다. 일 실시 예에서 자성체(110)는 스피넬 타입, 헥사 타입, 센다스트 타입, 퍼멀로이 타입의 자성체 중 어느 하나일 수 있다.

<128> 지지체(120)는 열경화성 수지 또는 열가소성 수지를 포함할 수 있으며, 자성 기판(100)을 지지하는 역할을 수행한다.

<129> 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

<130> 다시 도 14를 설명하면, 코일부(200)는 제1 연결단자(210), 제2 연결단자(220), 코일(230)을 포함할 수 있다. 코일(230)은 도전층 또는 도전 패턴을 형성할 수 있다.

<131> 코일부(200)는 자성 기판(100)의 내부에 배치될 수 있다. 구체적으로, 코일부(200)는 자성 기판(100)의 내부에 함몰되어 배치될 수 있다. 더 구체적으로, 자성 기판(100)은 패턴 홈을 포함할 수 있고, 상기 패턴 홈에는 상기 코일부(200)가 배치될 수 있다. 상기 패턴 홈은 상기 코일부(200)가 형성하는 도전 패턴 또는 도전층의 형태와 동일한 형태를 가질 수 있다.

<132> 코일부(200)의 두께는 자성 기판(100)의 두께보다 더 작고, 코일부(200)의 상 측은 자성 기판(100)의 외부로 노출될 수 있다.

<133> 자성 기판(100)에 코일부(200) 및 연결부(300)가 배치되어 무선전력 수신장치(1000)가 제조되는 공정은 도 17 내지 도 21에서 후술한다.

<134> 제1 연결단자(210)는 코일(230)의 일단에 제2 연결단자(220)는 코일(230)의 타단에 위치한다.

<135> 제1 연결단자(210) 및 제2 연결단자(220)는 연결부(300)와의 접속을 위해 필요한 단자이다.

<136> 코일(230)은 하나의 도선이 복수 번 권선된 패턴을 형성할 수 있다. 일 실시예에서 패턴은 평면 나선 구조일 수 있으나, 이에 한정될 필요는 없고, 다양한 패턴을 형성할 수 있다.

<137> 코일부(200)는 송신 측으로부터 무선으로 수신한 전력을 연결부(300)에 전달할 수 있다. 코일부(200)는 송신 측으로부터 전자기 유도 또는 공진을 이용하여 수신한 전력을 연결부(300)에 전달할 수 있다.

<138> 연결부(300)는 제3 연결단자(310), 제4 연결단자(320), 인쇄회로기판(330)을 포함할 수 있다.

<139> 제3 연결단자(310)는 제1 연결단자(210)와 접속될 수 있고, 제4 연결단자(320)는 제2 연결단자(220)와 접속될 수 있다.

<140> 인쇄회로기판(330)은 배선층을 포함할 수 있고, 배선층은 후출할 수신회로 등을 포함할 수 있다.

<141> 연결부(300)는 수신회로(미도시)와 코일부(200) 사이를 연결하여 코일부(200)로부터 전달받은 전력을 수신회로를 통해 부하(미도시)로 전달할 수 있다. 수신회로는 교류전력을 직류전력으로 변환하는 정류회로(미도시) 및 변환된 직류전력

에서 리플 성분을 제거하여 부하에 전달하는 평활회로(미도시)를 포함할 수 있다.

<142> 도 15 내지 도 16은 코일부(200)와 연결부(300)가 연결된 상태인 경우, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 상세한 구성을 설명하기 위한 도면이다.

<143> 도 15는 코일부(200)와 연결부(300)가 서로 접속되어 있는 상태를 보여준다.

<144> 코일부(200)와 연결부(300) 간의 접속은 솔더에 의해 이루어질 수 있다.

<145> 도 16을 참조하면, 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연결단자(310)는 제1 솔더(10)에 의해 연결될 수 있고, 코일부(200)의 제2 연결단자(220)와 연결부(300)의 제4 연결단자(320)는 제2 솔더(20)에 의해 연결될 수 있다. 구체적으로, 제1 연결단자(210)는 제1 솔더(10)의 비아홀을 통해 제3 연결단자(310)와 연결될 수 있고, 제2 연결단자(220)는 제2 솔더(20)의 비아홀을 통해 제4 연결단자(320)와 연결될 수 있다.

<146> 일 실시 예에서 상기 비아홀은 레이져를 이용하여 형성될 수 있다. 이 때, 레이져는 UV 레이져, CO2 레이져 등이 이용될 수 있다.

<147> 도 16을 참조하면, 자성 기판(100) 및 코일부(200)가 연결부(300)와 접속되어 있는 무선전력 수신장치(1000)의 단면도가 도시되어 있다.

<148> 즉, 자성 기판(100)의 패턴 홈(140)에는 코일부(200)의 구성요소인 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 도시되어 있고, 자성 기판(100) 및 코일부(200)가 연결부(300)와 접속되어 있는 상태가 도시되어 있다.

<149> 코일(230)의 폭(W)과 두께(T), 자성 기판(100)의 두께(T1)은 소정의 값을 갖도록 설계될 수 있다. 일 실시 예에서 코일(230)의 두께는 0.1㎜, 자성 기판(100)의 두께는 0.43㎜일 수 있으나, 이는 예시에 불과하다. 일 실시 예에서 코일(230)의 두께(T)는 자성 기판(100)의 두께(T1)보다 작을 수 있다.

<150> 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100)의 패턴 홈(140)에 코일부(200)가 직접 배치되어 있어, 코일부(200)의 두께만큼 무선전력 수신장치(1000)가 장착된 전자기기의 전체 두께가 감소될 수 있다. 본 발명의 제5 실시 예를 휴대용 단말기와 같은 무선전력 수신장치(1000)를 장착하고 있는 전자기기에 적용한다면, 슬림화가 요구되고 있는 휴대용 단말기의 전체 두께를 감소시키는 효과를 얻을 수 있다.

<151> 또한, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100)의 패턴 홈(140)에 코일부(200)가 배치되어 있어, 기존의 FPCB 상에 코일 패턴을 형성한 경우와 달리, 무선전력 수신장치(1000)가 장착된 전자기기의 전체 사이즈가 감소될 수 있다.

<152> 도 17 내지 도 21은 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법을 설명하기 위한 도면이다.

<153> 이하에서는 도 14 내지 도 16의 내용과 결부시켜, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법을 설명한다.

<154> 먼저, 도 17을 참조하면, 자성 기판(100)이 배치된다. 일 실시 예에서 자성

기판(100)은 폴리에틸렌계 고무 위에 센더스트(sendust) 합금계(Al, Fe, SiO2) 금속 분말을 도포하고, 표면에 산화 피막을 형성하여 제조될 수 있다.

<155> 다음으로, 도 18을 참조하면, 자성 기판(100)에 코일부(200)를 수용할 수 있는 패턴 홈을 형성하기 위해 금형(1)을 이용하여, 열과 압력을 동시에 가한다. 금형(1)은 코일부(200)의 형상과 같도록 제작될 수 있다. 일 실시 예에서 금형(1)의 재료로는 알루미늄 합금, 구리합금, 주철 등이 사용될 수 있다.

<156> 금형(1)에는 무선으로 전력을 수신하기 위한 코일부(200)가 배치될 위치에 대응한 돌출부가 형성될 수 있다.

<157> 금형(1)을 이용하여, 열을 가할 시, 자성 기판(100)의 구성요소인 센더스트 합금계 금속 분말의 특성을 고려하여 특정 온도를 갖는 열을 가한다. 일 실시 예에서 자성 기판(100)이 상기 폴리에틸렌계 고무 위에 센더스트(sendust) 합금계 금속 분말을 도포하여 제조된 경우, 금형(1)을 이용하여 열과 압력을 가할 시, 100도 이상 180도 이하의 온도에서 고압으로 압력을 가한 후, 100도 이하의 온도로 냉각시킨 다음, 자성 기판(100)으로부터 금형(1)을 분리한다. 금형(1)을 이용하여, 자성 기판(100)에 압력을 가한 후, 금형(1)을 바로 분리하게 되면, 패턴 홈(140)에 남아 있는 열로 인해, 원하고자 하는 패턴 홈(140)이 형성되지 않을 수 있기 때문에, 100도 이하로 냉각 시킨 후, 자성 기판(100)으로부터 금형(1)을 분리시킬 필요가 있다.

<158> 만약, 자성 기판(100)으로 센더스트 합금계 금속 분말을 사용하는 경우, 분말의 배열, 밀도 등에 따라 가하는 온도와 압력이 달라질 수 있다. 즉, 분말의 배

열이 균일하지 못한 경우에는 더 높은 온도와 압력을 가해야 하며, 분말의 배열이 균일한 경우에는 분말의 배열이 균일하지 못한 경우에 비해 더 낮은 온도 및 압력을 가해도 된다. 또한, 분말의 밀도가 낮은 경우에는 높은 경우에 비해 더 낮은 온도 및 압력을 가해도 된다. 또한, 분말의 성분 즉, 분말을 구성하는 합금에 따라 가해지는 온도 및 압력이 달라질 수도 있다.

<159> 이와 같이, 분말의 배열, 밀도, 성분에 따라 가해지는 온도는 5도 내지 100도 정도 차이가 날 수 있다.

<160> 일 실시 예에서 금형(1)을 이용하여, 열과 압력을 가하는 대신, 자성 기판(100)에 코일부(200)를 수용할 수 있는 패턴 홈을 형성하기 위해 레이져를 조사할 수 있다. 패턴 홈은 자외선 영역의 파장을 갖는 레이져 빔을 발사하는 엑시머 레이져(excimer laser)를 사용하여 형성될 수 있다. 상기 엑시머 레이져는 KrF 엑시머 레이져(크립톤 불소, 중심파장 248nm) 또는 ArF 엑시머 레이져(아르곤 불소, 중심파장 193nm) 등이 사용될 수 있다.

<161> 다음으로, 도 19를 참조하면, 도 19는 금형(1)을 자성 기판(100)으로부터 분리 시 패턴 홈(140)이 형성된 자성 기판(100)의 상태를 보여준다.

<162> 다음으로, 도 20을 참조하면, 도 19의 상태에서 자성 기판(100)에 형성된 패턴 홈(140)에 코일부(200)를 삽입한다. 코일부(200)가 삽입되면, 자성 기판(100)의 패턴 홈(140)는 일정한 도전 패턴이 형성된다.

<163> 일 실시 예에서 자성 기판(100)의 패턴 홈(140)에 코일부(200)가 삽입되는

과정은 도금 또는 코일부(200)가 형성하는 도전 패턴을 갖도록 에칭과정을 거친 금속을 삽입하는 방법이 사용될 수 있다.

<164> 구체적으로, 도금은 패턴 홈(140)을 금속 물질로 충진하는 공정을 통해 코일부(200)가 형성될 수 있다. 이때, 상기 금속 물질은 Cu, Ag, Sn, Au, Ni 및 Pd 중 선택되는 어느 하나의 물질일 수 있으며, 상기 금속 물질 충진은 무전해 도금, 전해 도금, 스크린 인쇄(Screen Printing), 스퍼터링(Sputtering), 증발법(Ecaporation), 잉크젯팅 및 디스펜싱 중 어느 하나 또는 이들의 조합된 방식을 이용할 수 있다.

<165> 다음으로, 도 21을 참조하면, 코일부(200)와 연결부(300)가 접속되도록 솔더링 작업을 거친다.

<166> 즉, 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연결단자(310)를 솔더(10)에 의해 접속시키고, 코일부(200)의 제2 연결단자(200)와 연결부(300)의 제4 연결단자(320)를 솔더(20)에 의해 접속시킨다.

<167> 이와 같이, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법은 자성 기판(100)에 패턴 홈을 형성하고, 형성된 패턴 홈에 코일부(200)를 배치시킴으로써, 무선전력 수신장치(1000)의 전체 두께를 감소시킬 수 있고, 패턴 홈을 형성하는 과정 및 코일부를 삽입하는 과정 만을 통해 무선전력 수신장치(1000)를 제조할 수 있어, 제조 공정이 단순화되는 효과가 있다.

<168> 도 22는 본 발명의 제1 실시 예에 따라 자성 기판 상면에 코일부를 배치한

경우, 사용 주파수에 따른 코일부(200)의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이고, 도 23은 본 발명의 제5 실시 예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 사용 주파수에 따른 코일부(200)의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

<169> 코일부(200)의 인덕턴스, 저항 및 Q 값의 관계식은 다음의 [수학식 1]을 통해 표현될 수 있다.

<170> [수학식 1]

<171> Q=w*L/R

<172> [수학식 1]에서 w는 전력 전송 시 사용되는 주파수이고, L은 코일부(200)의 인덕턴스, R은 코일부(200)의 저항을 나타낸다.

<173> [수학식 1]에서 확인할 수 있듯이, 코일부(200)의 인덕턴스는 그 값이 증가할수록 Q값이 높아진다. Q값이 증가하면, 전력 전송 효율이 좋아질 수 있다. 코일부(200)의 저항은 코일부(200) 자체에서 발생하는 전력 손실량을 수치화한 것이며, 그 값이 작을수록 Q 값이 증가한다.

<174> 도 22 및 도 23을 참조하면, 사용 주파수가 150kHz 일때를 비교하면, 본 발명의 제1 실시 예에 따라 자성 기판(100) 상면에 코일부(200)를 배치한 경우에 비해, 도 23은 본 발명의 제5 실시 예에 따라 자성 기판(100) 내부의 패턴 홈(140)에 코일부(200)를 배치한 경우, 코일부(200)의 인덕턴스는 약 9986.92um에서 약 10339.34um로 352.42um만큼 증가하였고, 코일부(200)의 저항은 약 0.910옴에서 약

0.853옴으로 0.057옴만큼 감소한 것을 확인할 수 있다. 결국, 인덕턴스의 증가 및 저항의 감소양 만큼 Q값이 증가한다.

<175> 따라서, 본 발명의 제5 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100) 내부의 패턴 홈에 코일부(200)를 배치하여, Q값을 높일 수 있다.

<176> 도 24는 본 발명의 제1 실시 예에 따라 자성 기판 상면에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이고, 도 25은 본 발명의 제5 실시 예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

<177> 도 24 및 도 25를 참조하면, 자성 기판(100) 내부의 패턴 홈에 코일부(200)를 배치한 경우가 자성 기판(100) 상면에 코일부를 배치한 경우에 비해, 코일부(200)의 외측에서 자기장이 더 많이 방사됨을 확인할 수 있다. 이는, 자성 기판(100) 내부에 코일부(200)가 함몰된 구조에 의해 외부로 향하는 자기장의 방향을 코일부(200)의 측방으로 변경시키기 때문이다.

<178> 또한, 자성 기판(100) 내부의 패턴 홈에 코일부(200)를 배치한 경우가 자성 기판(100) 상면에 코일부(200)를 배치한 경우에 비해, 코일부(200)의 내측에서 자기장이 더 많이 방사됨을 확인할 수 있다. 이 또한, 자성 기판(100) 내부에 코일부(200)가 함몰된 구조에 의해 외부로 향하는 자기장의 방향을 코일부(200)의 측방으로 변경시키기 때문이다.

<179> 도 24 및 도 25를 참조하면, 무선전력 수신장치(1000)는 근거리 통신 안테나

(600)를 더 포함할 수 있다.

<180> 근거리 통신 안테나(600)는 근거리 무선통신이 가능한 리더기와 통신을 수행할 수 있다. 근거리 통신 안테나(600)는 상기 리더기와 정보를 송수신하는 안테나의 역할을 수행한다.

<181> 일 실시 예에서 근거리 통신 안테나(600)는 코일부(200)의 외곽에 배치될 수 있다. 일 실시 예에서 코일부(200)가 자성 기판(100)의 중앙에 배치된 경우, 근거리 통신 안테나(600)는 코일부(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 근거리 통신 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

<182> 근거리 통신 안테나(600)는 코일부(200)처럼 도전 패턴, 도전층을 형성할 수 있다.

<183> 근거리 통신 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다.

<184> 또한, 이상에서는 본 발명의 바람직한 실시 예에 대하여 도시하고 설명하였지만, 본 발명은 상술한 특정의 실시 예에 한정되지 아니하며, 청구범위에서 청구하는 본 발명의 요지를 벗어남이 없이 당해 발명이 속하는 기술분야에서 통상의 지식을 가진 자에 의해 다양한 변형 실시가 가능한 것은 물론이고, 이러한 변형 실시들은 본 발명의 기술적 사상이나 전망으로부터 개별적으로 이해 되어서는 안될 것

이다.

【부호의 설명】

<185> 10: 제1 솔더

20: 제2 솔더

100: 자성 기판

110: 자성체

120: 지지체

130: 수용영역

140: 패턴 홈

200: 코일부

201: 도전체

210: 제1 연결단자

220: 제2 연결단자

230: 코일

300: 연결부

310: 제3 연결단자

320: 제4 연결단자

330: 인쇄회로기판

500: 마스크

600: 근거리 통신 안테나

700: 접착층

【특허청구범위】

【청구항 1】

자성 기판; 및

상기 자성 기판의 내부에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 무선전력 수신장치.

【청구항 2】

제1항에 있어서,

상기 자성 기판은 상기 코일부를 수용하는 패턴 홈을 포함하고,

상기 코일부는 상기 패턴 홈에 배치되어 도전 패턴 또는 도전층으로 형성된 것을 특징으로 하는 무선전력 수신장치.

【청구항 3】

제1항에 있어서,

상기 코일부의 두께는 상기 자성 기판의 두께보다 더 작고, 상기 코일부 상측이 상기 자성 기판 외부로 노출된 것을 특징으로 하는 무선전력 수신장치.

【청구항 4】

제1항에 있어서,

상기 코일부의 상 측에 배치되어 상기 코일부의 양단에 접속된 연결부를 더 포함하는 무선전력 수신장치.

【청구항 5】

제4항에 있어서,

상기 코일부와 및 상기 연결부는 솔더에 의해 접속되는 것을 특징으로 하는 무선전력 수신장치.

【청구항 6】

제1항에 있어서,

상기 자성 기판 상면에 직접 상기 코일부를 감싸는 형태로 배치된 근거리 통신 안테나를 더 포함하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 7】

제6항에 있어서,

상기 코일부 및 상기 근거리 통신 안테나의 상 측에 배치되어, 상기 코일부의 양단 및 상기 근거리 통신 안테나의 양단에 접속된 연결부를 더 포함하는 무선전력 수신장치.

【청구항 8】

제6항에 있어서,

상기 근거리 통신 안테나는

NFC(NEAR FIELD COMMUNICATION) 안테나인 것을 특징으로 하는 무선전력 수신장치.

【청구항 9】

제1항에 있어서,

상기 자성 기판은 센더스트 타입의 자성체를 포함하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 10】

제1항에 있어서,

상기 코일부는 상기 송신 측으로부터 전자기 유도을 이용해 전력을 수신하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 11】

제1항에 있어서,

상기 코일부는 상기 송신 측으로부터 공진을 이용해 전력을 수신하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 12】

무선으로 전력을 수신하기 위한 코일이 배치될 위치에 돌출부가 형성된 금형을 이용하여 자성 기판에 열과 압력을 동시에 가하는 단계;

상기 금형을 상기 자성기판으로부터 분리시켜 상기 자성 기판에 상기 코일을 배치하기 위한 패턴 홈을 형성하는 단계; 및

상기 형성된 패턴 홈에 도전 패턴을 형성하여 상기 코일을 형성하는 단계를 포함하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 13】

제12항에 있어서,

상기 코일을 형성하는 단계는,

상기 패턴 홈에 금속을 충진하여 상기 도전 패턴을 형성하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 14】

제12항에 있어서,

상기 도전 패턴을 형성하는 단계는,

상기 패턴 홈에 상기 도전 패턴을 갖도록 에칭을 거친 금속을 삽입하여, 상기 도전 패턴을 형성하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 15】

제12에 있어서,

상기 형성된 도전 패턴을 무선전력 수신장치의 연결부와 솔더링을 통해 연결하는 단계를 더 포함하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 16】

상기 제1항의 무선전력 수신장치가 내장된 단말기.

제출 일자 : 2012-07-19

【요약서】

【요약】

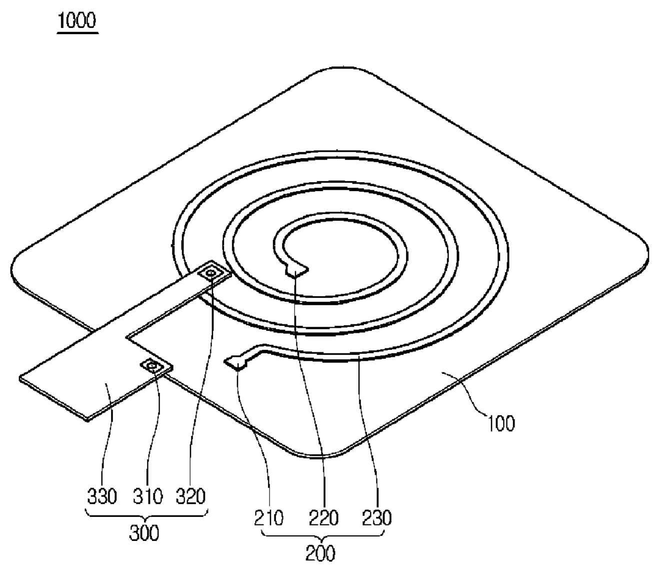
본 발명의 일 실시 예에 따른 무선전력 수신장치는 자성 기판 및 상기 자성 기판의 내부에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 한다.

【대표도】

도 16

【도면】

【도 1】



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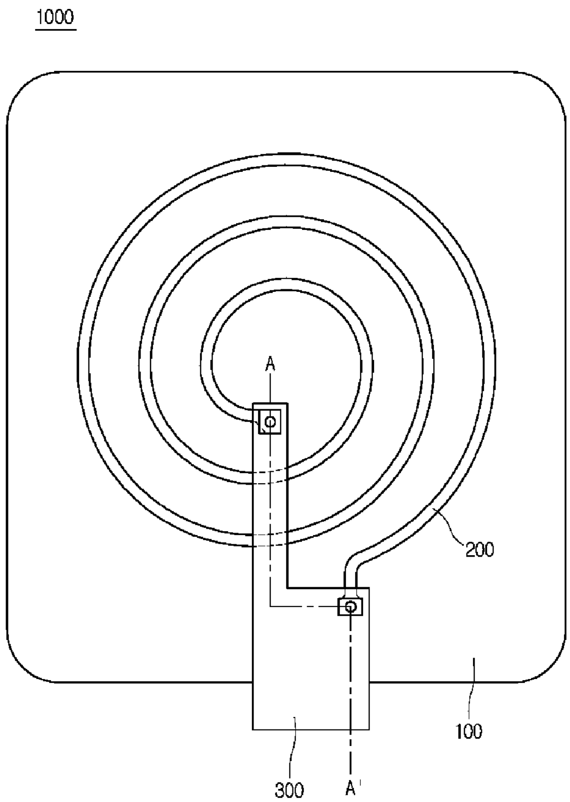

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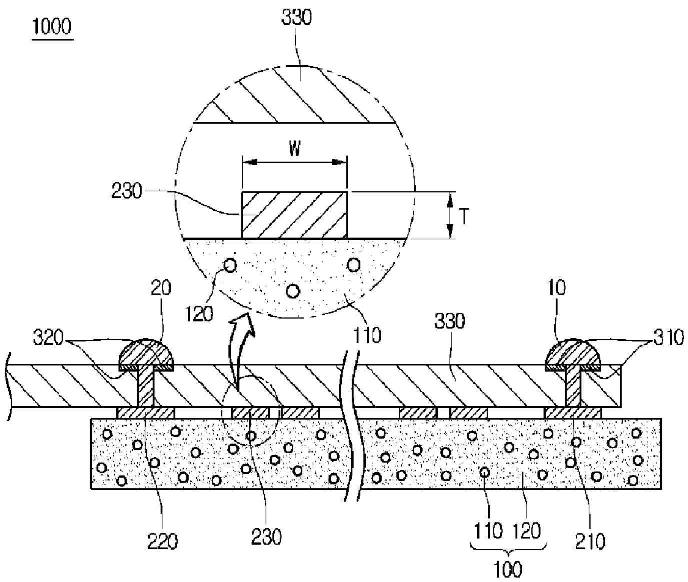
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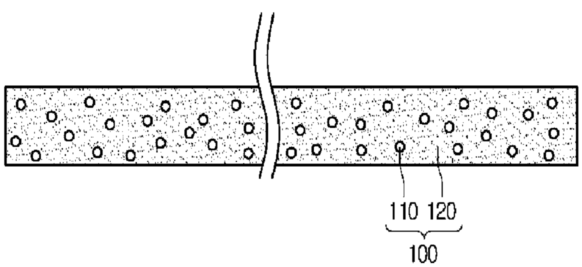
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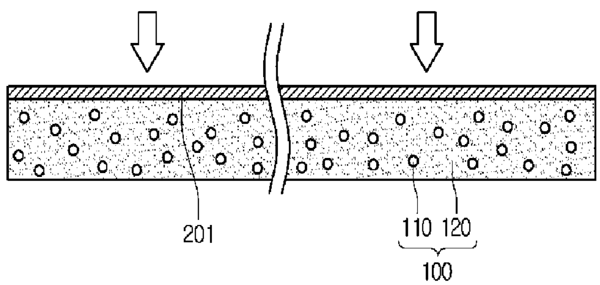

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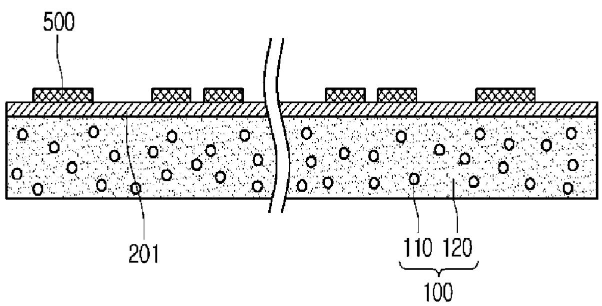

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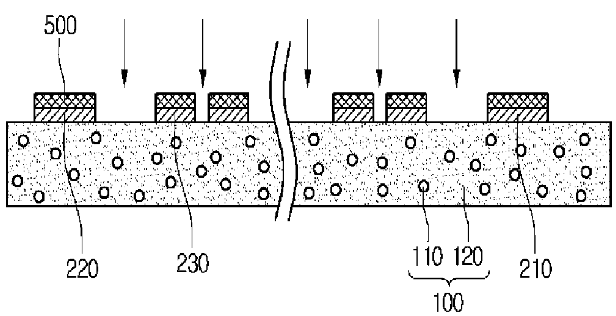

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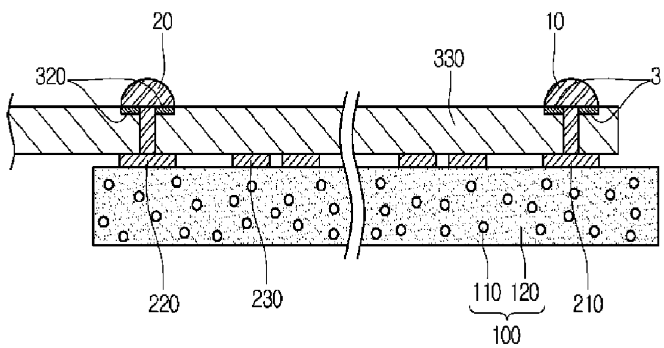
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【도 9】

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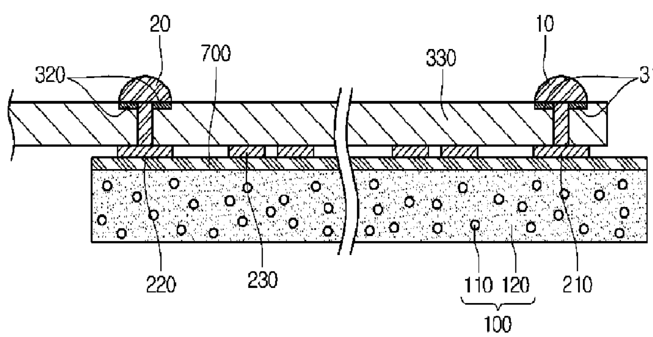
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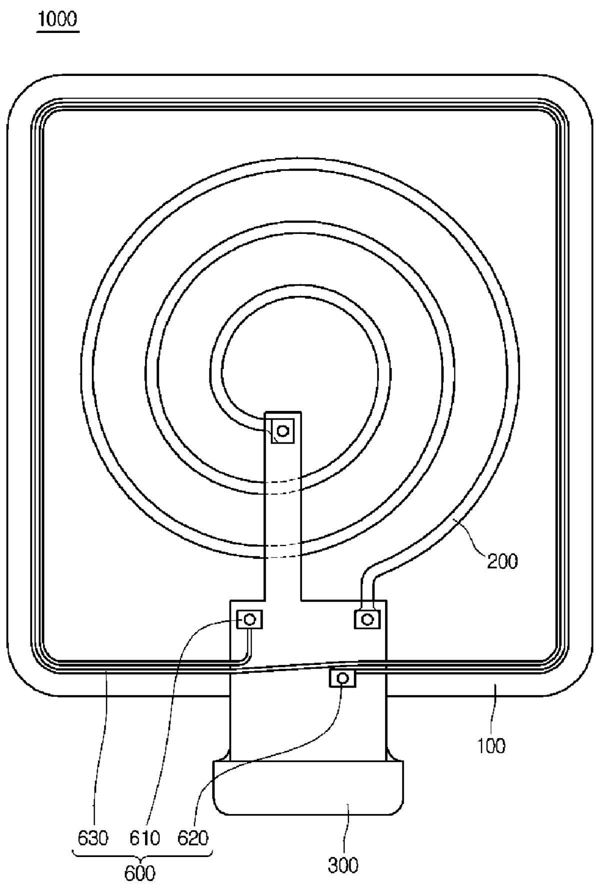

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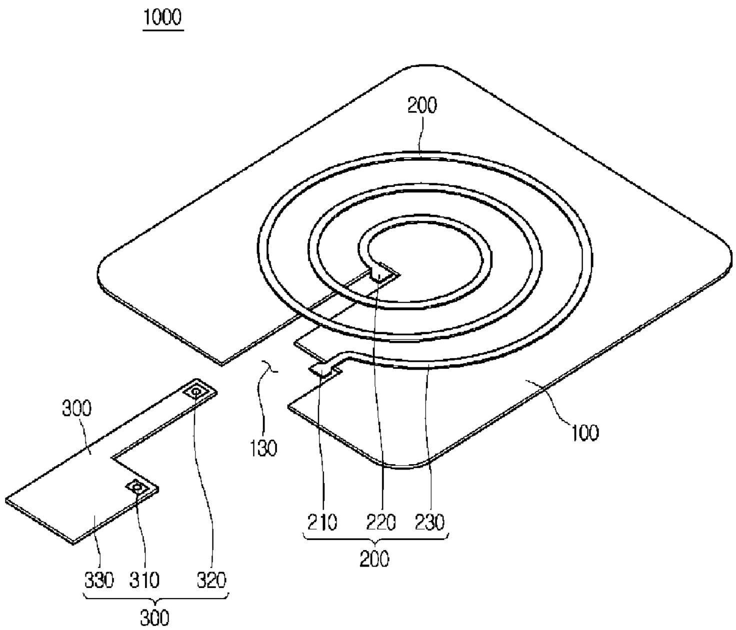

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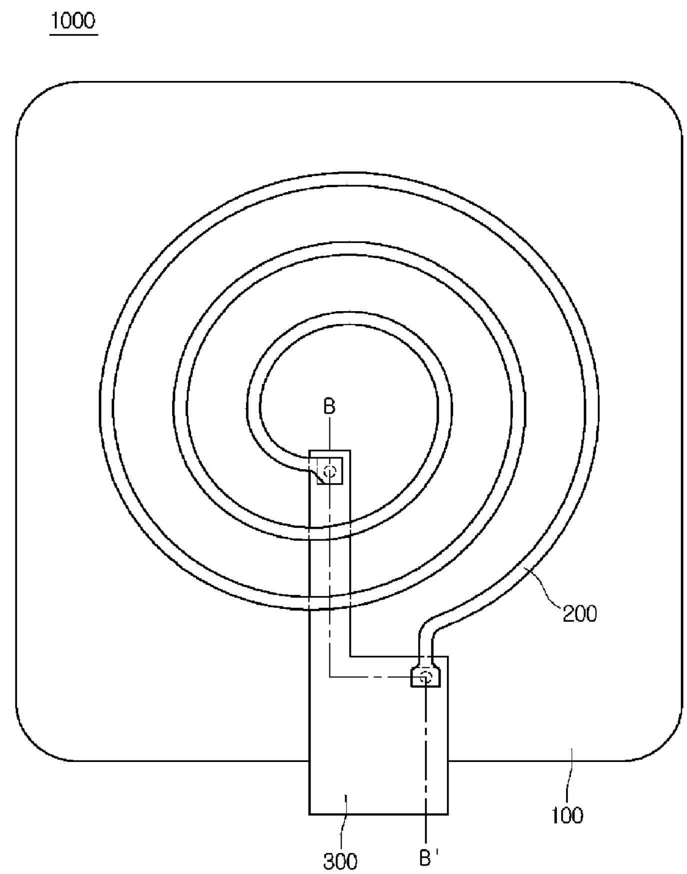
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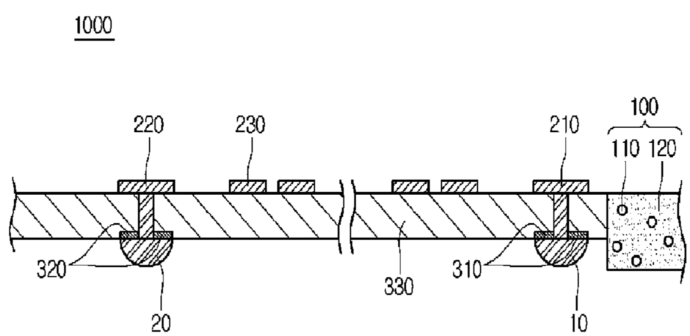
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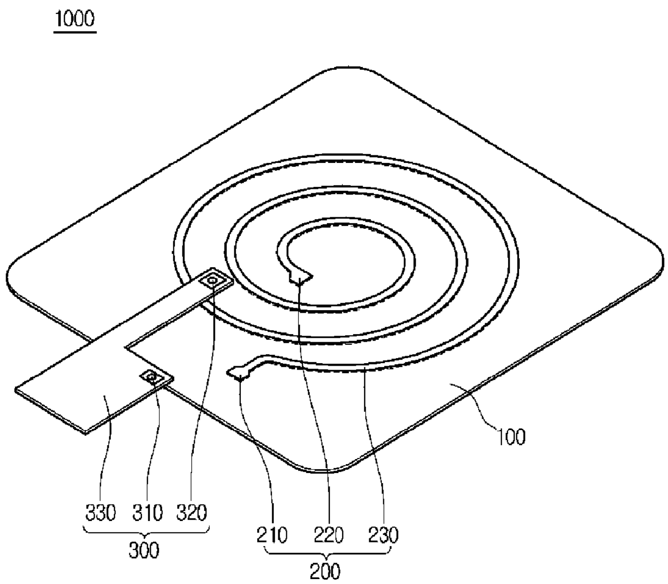

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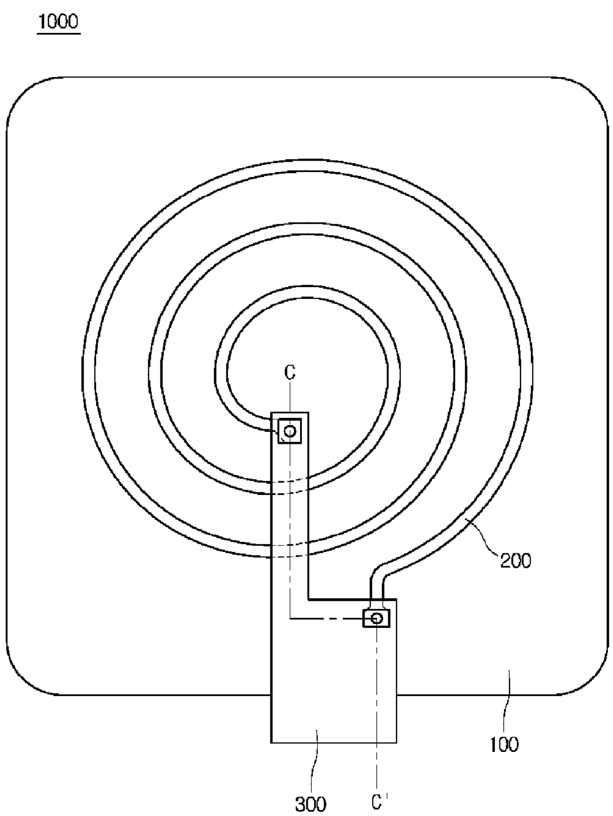
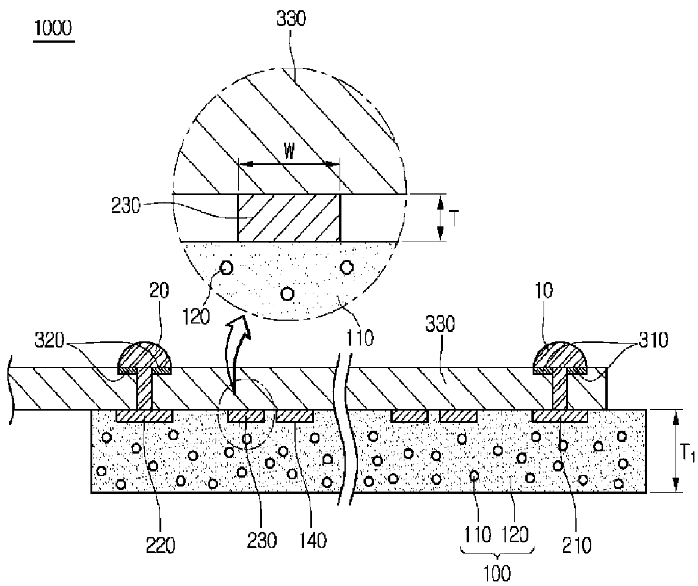


【도 16】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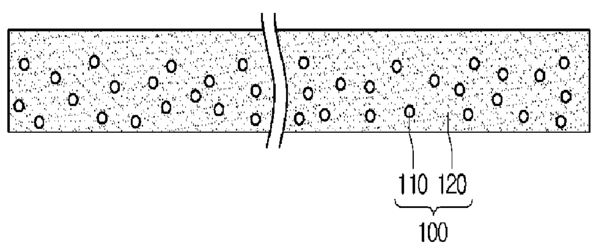
【도 17】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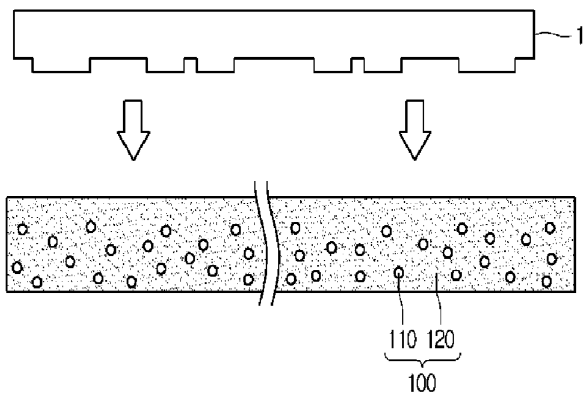
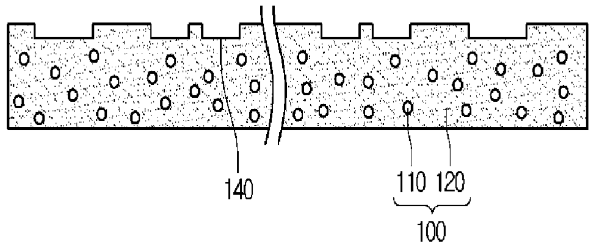
【도 18】



【도 19】



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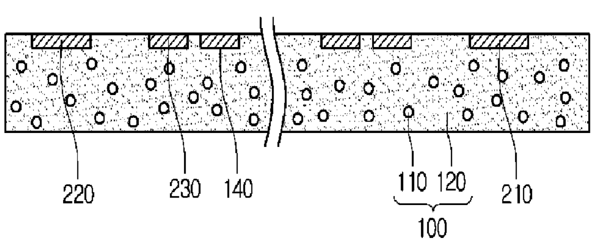

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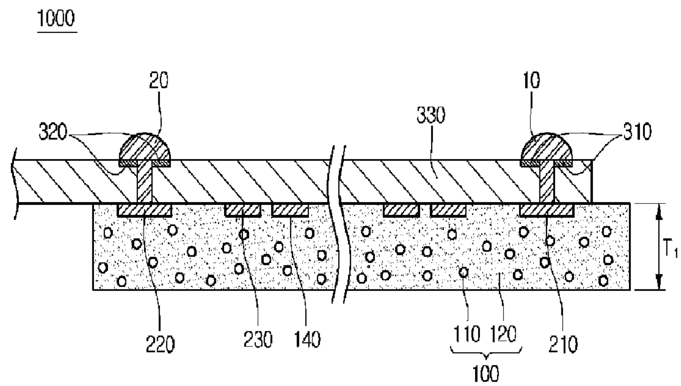


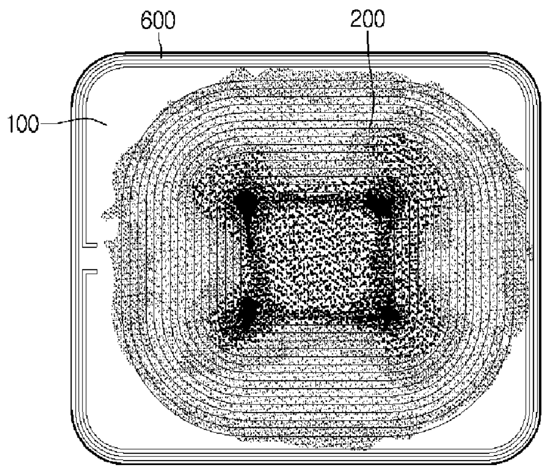
【도 22】

Freq[kHz]	Inductance Setup1 : Sweep	Resistance Setup1 : Sweep	Q Setup1 : Sweep
130.000000	10023.448082	0.809633	10.012480
131.000000	10021.543951	0.814464	10.028048
132.000000	10019.649417	0.819320	10.043115
133.000000	10017.764376	0.824199	10.057691
134.000000	10015.888496	0.829101	10.071784
135.000000	10014.021426	0.834027	10.085405
136.000000	10012.163025	0.838976	10.098561
137.000000	10010.312867	0.843948	10.111262
138.000000	10008.470902	0.848942	10.123517
139.000000	10006.636764	0.853960	10.135333
140.000000	10004.810399	0.859000	10.146721
141.000000	10002.991358	0.864062	10.157687
142.000000	10001.179585	0.869147	10.168241
143.000000	9999.374809	0.874254	10.178391
144.000000	9997.577015	0.879383	10.188142
145.000000	9995.785687	0.884534	10.197506
146.000000	9994.000944	0.889706	10.206488
147.000000	9992.222542	0.894900	10.215097
148.000000	9990.450319	0.900116	10.223339
149.000000	9988.684063	0.905352	10.231223
150.000000	9986.923648	0.910610	10.238756
151.000000	9985.169040	0.915889	10.245944
152.000000	9983.419964	0.921189	10.252794
153.000000	9981.676290	0.926509	10.259313
154.000000	9979.937950	0.931850	10.265510
155.000000	9978.204783	0.937212	10.271388
156.000000	9976.476722	0.942594	10.276956
157.000000	9974.753596	0.947996	10.282220
158.000000	9973.035485	0.953418	10.287185
159.000000	9971.321833	0.958860	10.291859
160.000000	9969.613051	0.964321	10.296247

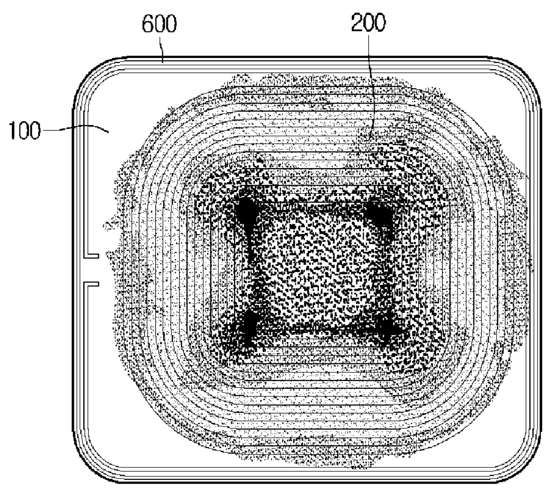
【도 23】

Freq[kHz]	Inductance Setup1 : Sweep	Resistance Setup1 : Sweep	Q Setup1 : Sweep
130.000000	10375.469101	0.760491	11.053420
131.000000	10373.611592	0.764922	11.072242
132.000000	10371.760893	0.769376	11.090493
133.000000	10369.916781	0.773853	11.108182
134.000000	10368.078898	0.778351	11.125322
135.000000	10366.247102	0.782872	11.141920
136.000000	10364.421100	0.787415	11.157989
137.000000	10362.600644	0.791979	11.173537
138.000000	10360.785303	0.796565	11.188574
139.000000	10358.975165	0.801173	11.203109
140.000000	10357.169752	0.805802	11.217153
141.000000	10355.369156	0.810452	11.230713
142.000000	10353.572957	0.815124	11.243801
143.000000	10351.780892	0.819816	11.256422
144.000000	10349.993078	0.824529	11.268591
145.000000	10348.209063	0.829263	11.280309
146.000000	10346.428853	0.834018	11.291589
147.000000	10344.652133	0.838792	11.302441
148.000000	10342.878918	0.843587	11.312871
149.000000	10341.108850	0.848402	11.322886
150.000000	10339.342085	0.853237	11.332499
151.000000	10337.578231	0.858092	11.341712
152.000000	10335.817245	0.862967	11.350536
153.000000	10334.058946	0.867867	11.358980
154.000000	10332.303299	0.872774	11.367050
155.000000	10330.550019	0.877706	11.374754
156.000000	10328.799305	0.882658	11.382099
157.000000	10327.050748	0.887629	11.389091
158.000000	10325.304351	0.892618	11.395741
159.000000	10323.560143	0.897626	11.402053
160.000000	10321.817935	0.902653	11.408035

【도 24】



【도 25】



I hereby certify that this correspondence is being electronically transmitted via EFS to the United States Patent and Trademark Office on April 29, 2014.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

PRELIMINARY AMENDMENT
Examining Group 2681
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	2681
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Confirm. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

PRELIMINARY AMENDMENT

Sir:

Please amend the subject application as follows:

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In the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A wireless power receiver comprising:

a ~~magnetic~~ substrate having a receiving space of a predetermined shaped formed therein for a connecting unit configured to connect to a wireless power receiving circuit; ~~and~~

a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive ~~layer~~ pattern on or within the ~~magnetic~~ substrate, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil, and

wherein the connecting unit is disposed in the receiving space and connected to the first and second terminals.

2. (Canceled)

3. (Currently Amended) The wireless power receiver of claim 1, wherein the ~~magnetic substratehas a~~shape of the receiving space ~~of a predetermined shape formed therein corresponding~~corresponds to a shape of ~~a~~the connecting unit ~~connected to a wireless power receiving circuit~~.

4-5. (Canceled)

6. (Currently Amended) The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the ~~magnetic substrate to surround~~substrate and surrounding the coil.

7. (Currently Amended) The wireless power receiver of claim 6, wherein the short-range communication antenna ~~comprises a near field communication (NFC) antenna~~has a rectangular configuration formed by winding one conductive line several times.

8. (Canceled)

9. (Currently Amended) The wireless power receiver of ~~claim 8~~claim 6, ~~further comprising~~ wherein the connecting unit ~~disposed in the receiving space and~~is connected to ~~the coil and a near field~~the short-range communication signal ~~process unit~~antenna.

10. (Canceled)

11. (Currently Amended) The wireless power receiver of ~~claim 10~~claim 1, wherein the conductive ~~coil~~pattern is ~~formed as~~ a conductive layer~~pattern at the magnetic substrate~~.

12. (Currently Amended) The wireless power receiver of ~~claim 10~~claim 1, wherein the ~~magnetic~~ substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

13. (Currently Amended) The wireless power receiver of ~~claim 10~~claim 12, wherein the coil has a thickness smaller than a thickness of the ~~magnetic~~ substrate and wherein an upper portion of the coil is exposed out of the ~~magnetic~~ substrate.

14-18. (Canceled)

19. (Currently Amended) A wireless portable terminal, ~~equipped therein with a~~comprising the wireless power receiver of claim 1.

20. (Canceled)

21. (New) The wireless power receiver of claim 1, wherein the substrate comprises magnetic material.

22. (New) The wireless power receiver of claim 1, further comprising a wireless power receiving circuit connected to the connecting unit.

23. (New) The wireless power receiver of claim 1, wherein the coil unit is disposed on a top surface of the substrate and the connecting unit.

24. (New) The wireless power receiver of claim 8, wherein the coil unit is disposed at an inner portion of the substrate, and wherein the short-range communication antenna is arranged at an outer peripheral portion of the substrate.

25. (New) The wireless power receiver of claim 1, wherein the substrate is flexible.

26. (New) The wireless power receiver of claim 6, wherein the short-range communication antenna is arranged at an outer peripheral portion of the coil.

27. (New) A wireless portable terminal, comprising the wireless power receiver of claim 3.

28. (New) The wireless portable terminal of claim 19, which is a smartphone.

29. (New) The wireless portable terminal of claim 27, which is a smartphone.

Remarks

Claims 1-20 are pending in the subject application and currently before the Examiner. By this Preliminary Amendment, Claims 1, 3, 6, 7, 9, 11-13, and 19 are amended; claims 2, 4-5, 8, 10, 14-18, and 20 are canceled; claims 21-29 are added. No new matter is introduced by these amendments. Upon entry of these amendments, claims 1, 3, 6, 7, 9, 11-13, 19, and 21-29 will be before the Examiner. Entry and consideration of the amendments presented herein is respectfully requested.

The Commissioner is hereby authorized to charge any fees which may be required to Deposit Account No. 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: P.O. Box 142950
Gainesville, FL 32614-2950

JL/sma/lcf

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Electronic Acknowledgement Receipt

EFS ID:	18895802
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/GEORGIA KOSMAKOS
Filer Authorized By:	Jeff Lloyd
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Prelim-Amend.pdf	188742 247ba4ce79d9697a047c41c8551719425de46d9e	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	5
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/663,012	Filing Date 10/29/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	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	04/29/2014	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	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
/CHERYL CLARK/

PTO/SB/08A

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/663,012
(use as many sheets as necessary)				Filing Date	October 29, 2012
				First Named Inventor	Jeong Wook An
				Art Unit	2836
				Examiner Name	Rexford N. Barnie
Sheet	1	of	1	Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	US-2008/0164840	07-10-2008	Kato *et al.*	ALL
	U2	US-2012/0044114	02-23-2012	Eom *et al.*	ALL
	U3	US-			
	U4	US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP 2002-299138	10-11-2002	Kawasaki Steel Corp.	ALL	
	F2	JP 2008-172872	07-24-2008	Sony Ericsson Mobile Comm. JP	ALL	
	F3	JP 2008-205215	09-04-2008	Seiko Epson Corp.	ALL	
	F4	JP 2008-210861	09-11-2008	Yonezawa Densen KK	ALL	
	F5	JP 2008-27015	02-07-2008	Dainippon Printing Co. Ltd.	ALL	
	F6	JP 61-69811	05-13-1986	Fuji Denki Kagaku Kabushiki Kaisha	ALL	
	F7	JP 6-267746	09-22-1994	Murata Mfg. Co. Ltd.	ALL	
	F8	KR 10-2008-0074640	08-13-2008	Anyquitous Co. Ltd.	ALL	
	F9	KR 10-2012-0016778	02-27-2012	Samsung Elec. Co. Ltd.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated November 11, 2013 in Korean Application No. 10-2012-0123375.	
	R2	Office Action dated November 12, 2013 in Japanese Application No. 2012-238616.	
	R3		
	R4		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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Espacenet

Bibliographic data: JP2008172872 (A) — 2008-07-24

CONTACTLESS POWER TRANSMISSION COIL, PORTABLE TERMINAL AND TERMINAL CHARGER

No documents available for this priority number.

Inventor(s): KATO HIROSHI; SUZUKI KUNIHARU; SUZUKI KATSUYA; YAMAZAK MANABU; KONDO YOICHIRO; ONISHI KOTA; YODA KENTARO; JIN KANKI; KAMIJO TAKAHIRO; SOGABE HARUHIKO ± (KATO HIROSHI, ; SUZUKI KUNIHARU, ; SUZUKI KATSUYA, ; YAMAZAKI MANABU, ; KONDO YOICHIRO, ; ONISHI KOTA, ; YODA KENTARO, JIN KANKI, ; KAMIJO TAKAHIRO, ; SOGABE HARUHIKO)

Applicant(s): SONY ERICSSON MOBILE COMM JP; SEIKO EPSON CORP ± (SONY ERICSSON MOBILECOMMUNICATIONS JAPAN INC, ; SEIKC EPSON CORP)

Classification:
- **international:** ***H01M10/46; H02J17/00; H02J7/00; H02M3/155; H05K1/16***
- **cooperative:** **H01F27/2804; H01F38/14;** H01F2027/2819; H01F27/2828; H01F27/365; H02J7/025

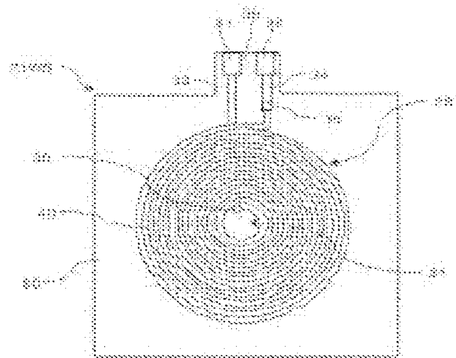
Application number: JP20070001634 20070109

Priority number(s): JP20070001634 20070109

Also published as: JP4947637 (B2) US2008164840 (A1) EP2348517 (A1) EP2081199 (A1) CN101304184 (A) CN101304184 (B) less

Abstract of JP2008172872 (A)

PROBLEM TO BE SOLVED: To further reduce the thickness of a portable terminal and a terminal charger by reducing the thickness of a contactless power transmission coil. SOLUTION: A planar coil is formed by spirally winding an electric wire 40 made of a single wire or stranded wire. A flexible printed board 30 has a first and second external connection terminal portions 31, 32; a first coil contact point portion 36 connected to the end of an electric wire of an inner circumferential portion 37 of the planar coil; a second coil contact point portion 35 connected to the end of an electric wire of an inner circumferential portion 38 of the planar coil; a first internal conductor pattern 33 for connecting the first coil connection point portion 36 to the first external connection terminal portion 31; and a second internal conductor pattern 34 for connecting the second coil connection point portion 35 to the second external connection terminal portion 32. One of the planar portions of the planar coil is bonded on the surface of the flexible printed board 30.



(19)日本国特許庁(JP)　(12)**公開特許公報(A)**　(11)特許出願公開番号
特開2008-172872
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(51)Int.Cl.			F I			テーマコード（参考）
H02J	***7/00***	***(2006.01)***	H02J	7/00	301D	4E351
H02J	***17/00***	***(2006.01)***	H02J	17/00	B	5G003
H01M	***10/46***	***(2006.01)***	H01M	10/46		5H030
H02M	***3/155***	***(2006.01)***	H02M	3/155	Y	5H730
H05K	***1/16***	***(2006.01)***	H05K	1/16	B	

審査請求 未請求　請求項の数 9　OL　（全 19 頁）

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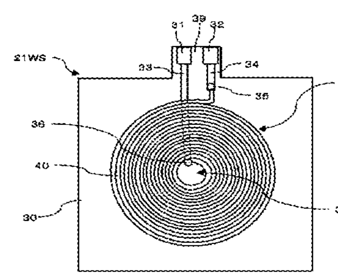
(71)出願人 501431073
ソニー・エリクソン・モバイルコミュニケーションズ株式会社
東京都港区港南１丁目８番１５号
(71)出願人 000002369
セイコーエプソン株式会社
東京都新宿区西新宿２丁目４番１号
(74)代理人 100101384
弁理士　的場　成夫
(74)代理人 100117514
弁理士　佐々木　敦朗
(72)発明者 加藤　博
東京都港区港南１丁目８番１５号　ソニー・エリクソン・モバイルコミュニケーションズ株式会社内

最終頁に続く

(54)【発明の名称】無接点電力伝送コイル、携帯端末及び端末充電装置



[0001]　本発明は、例えば携帯電話端末などの小型且つ薄型の携帯端末に内蔵された二次電池の充電を行う際に、電磁誘導を利用して非接触による電力伝送を行うための無接点電力伝送コイルと、その無接点電力伝送コイルを内蔵した携帯端末及び端末充電装置に関する。

[0002]　従来より、例えば携帯端末に内蔵された二次電池を充電するための充電用電力を、無接点電力伝送コイルによる電磁誘導を利用して伝送するようなシステムが知られている。

[0003]　また、特開２００６－４２５１９号の公開特許公報（特許文献１）には、例えば携帯電話端末のように薄型化が要求される携帯端末に搭載される無接点電力伝送コイルとして、表面に絶縁層が設けられた単線又は撚り線からな

る電線を略々同一平面内に渦巻き状（スパイラル状）に巻回した平面コイルを用いることが開示されている。さらに、この公報には、送電側の平面コイルと受電側の平面コイルを対向させて配置した時に、それら両コイルの対向面の反対側の面に、両コイルから発生する磁界による不要輻射を抑えるための磁性シートを、当該反対側の面全体を覆うようにそれぞれ設けることが開示されている。

[0004] 【特許文献１】 特開２００６－４２５１９号公報（図２及び図３）

[0005] 図２７及び図２８には、従来の渦巻き状の平面コイルを備えた無接点電力伝送コイル２００の概略的な構造を示す。

[0006] 図２７に示すように、渦巻き状平面コイルは、単線や撚り線からなる電線２０１を同一平面内に渦巻き状に巻回したものとなされており、当該平面コイルの外周側２０３の電線端部（例えば巻き終わり側の電線端部）２０５がそのまま外部へ引き出され、一方、内周側２０２の電線端部（例えば巻き始め側の電線端部）２０４が上記渦巻き状に巻回された電線部の上（若しくは下）を通って外周側に引き出されている。そして、当該無接点電力伝送コイル２００は、図２８に示すように、上記平面コイルの一方の平面部側に接着シート２１１等により磁性シート２１０が貼り付けられ、他方の平面部側が必要に応じて接着シート２１１等により端末筐体２１３の内壁面等に貼り付けられる。なお、図示は省略しているが、磁性シート２１０の外側には、アルミニウム等からなる金属シートも貼り付けられる。

[0007] ところで、最近は携帯電話端末等をこれまで以上に薄型化することが望まれており、そのため、当該端末の筐体内に配設される各種電子部品そのものの厚みを薄くすることのみならず、上述した渦巻き状平面コイルからなる無接点電力伝送コイルについても、その厚みをさらに薄くすることが要求されている。

[0008] しかしながら、上述の図２７及び図２８に示したような従来の渦巻き状平面コイルを携帯電話端末等に搭載した場合、平面コイルの内周側２０２の電線端部２０４が上記渦巻き状に巻回された電線部の上（若しくは下）を通って外周側に引き出されているため、或る程度の太さがある電線が重なることになり、その電線重なり部分によって当該平面コイルの最大厚みが非常に大きくなってしまい、携帯電話端末の更なる薄型化に対する障害となっている。

[0009] 本発明は、このような実情に鑑みて提案されたものであり、更なる薄型化が可能な渦巻き状平面コイルからなる無接点電力伝送コイルと、その無接点電力伝送コイルを内蔵した携帯端末及び端末充電装置を提供することを目的とする。

[0010] 本発明の無接点電力伝送コイル、本発明の携帯端末、及び、本発明の端末充電装置は、単線又は撚り線からなる線状導体を略々同一平面内に渦巻き状に巻回して形成された平面コイルと、第一，第二の外部接続端子部と、渦巻き状の線状導体の内周側端部に接続される第一の接点部と、渦巻き状の線状導体の外周側端部に接続される第二の接点部と、第一の接点部と第一の外部接続端子部とを接続する第一の導体パターンと、第二の接点部と第二の外部接続端子部とを接続する第二の導体パターンとが形成されたプリント基板とを有し、平面コイルの一方の平面部がプリント基板の表面上に取り付けられていることにより、上述した課題を解決する。

[0011] すなわち本発明によれば、平面コイルは、単線又は撚り線からなる線状導体を略々同一平面内に渦巻き状に巻回して形成されており、その平面コイルの内周側端部と外部接続端子との間の接続を、プリント基板の導体パターンにより行っているため、平面コイルの線状導体を内周側から外周側へ引き出す場合のように、線状導体が重なってしまうことがない。

[0012] 本発明によれば、単線又は撚り線からなる線状導体の重なりを無くすことができるため、無接点電力伝送コイルの更なる薄型化が可能となる。したがって、その無接点電力伝送コイルを搭載することで、携帯端末や端末充電装置の薄型化が可能となる。

[0013] 以下、図面を参照しながら、本発明の一実施形態について説明する。

[0014] なお、本実施形態では、本発明の渦巻き状平面コイルを有する無接点電力伝送コイルが搭載された携帯端末の一例として携帯電話端末を挙げ、また、本発明の端末充電装置の一例として、上記携帯電話端末を少なくとも充電可能なクレードルを挙げているが、勿論、ここで説明する内容はあくまで一例であり、本発明はこの例に限定されないことは言うまでもない。

[0015] 〔クレードルと携帯電話端末の概略構成及び充電時の基本動作〕

図１には、本発明実施形態の携帯電話端末２とクレードル１の主要部の概略的な内部構造を示す。

[0016]　本実施形態の携帯電話端末２は、少なくとも、当該端末の動作電力を発生する二次電池からなるバッテリ２２と、上記バッテリ２２の充電を行う際の受電側の無接点電力伝送コイルとなる二次側伝送コイル２１と、上記二次側伝送コイル２１を通じて受電した電力を上記バッテリ２２へ供給して充電させるための充電制御回路を含む各種電子回路が実装された回路基板２３とを、当該端末筐体の内部に備えている。なお、本実施形態においては、一般的な携帯電話端末が備えているその他の構成要素の図示及び説明については省略している。

[0017]　上記バッテリ２２は着脱可能となされており、携帯電話端末２には当該バッテリ２２を着脱する際に開閉（若しくは着脱）されるバッテリ蓋２０が設けられている。

[0018]　上記二次側伝送コイル２１は、後述するように、導電性を有する線状導体が渦巻き状に形成された平面コイルとなされており、当該二次側伝送コイル２１の一方の平面部が、上記バッテリ蓋２０の内壁面、若しくは上記バッテリ２２のバッテリ蓋側の外表面上に貼り付けられている。本実施形態では、上記バッテリ蓋２０の内壁面に二次側伝送コイル２１が貼り付けられている場合を例に挙げて説明する。上記二次側伝送コイル２１の詳細な構成については後述する。

[0019]　一方、本実施形態のクレードル１は、少なくとも、携帯電話端末２のバッテリ２２の充電を行う際の送電側の無接点電力伝送コイルとなる一次側伝送コイル１０と、上記一次側伝送コイル１０への電力供給とその制御を行う制御基板部１１と、例えば家庭用電源に接続される電源コード１２とを、当該クレードル筐体の内部に備えている。なお、本実施形態において、一般的なクレードルが備えているその他の構成要素の図示及び説明については省略する。

[0020]　このクレードル１の一次側伝送コイル１０は、携帯電話端末２の二次側伝送コイル２１と略々同様に、導電性を有する線状導体が渦巻き状に形成された平面コイルとなされており、当該一次側伝送コイル１０の一方の平面部が、当該クレードル１に設けられている端末載置台の筐体内壁面側に貼り付けられている。

[0021]　制御基板部１１は、当該クレードル１の端末載置台に上記携帯電話端末２が置かれ、その携帯電話端末２の二次側伝送コイル２１と当該クレードル１の一次側伝送コイル１０とが近接配置することにより、一次側伝送コイル１０内の磁界の状態が変化する。そして、制御基板部１１は、上記二次側伝送コイル２１が近接配置された時の一次側伝送コイル１０における磁界の状態変化を間欠駆動等により監視する。

[0022]　本実施形態の携帯電話端末２の充電制御回路は、クレードル１の端末載置台に自端末が置かれて、二次側伝送コイル２１とクレードル１の一次側伝送コイル１０とが近接配置することで、二次側伝送コイル２１内の磁界の状態に変化が生じた時、その磁界状態変化に応じた電圧変動を検知可能となされている。そして、携帯電話端末２の充電制御回路は、上記一次側伝送コイル１０が近接配置された時の二次側伝送コイル２１における磁界の状態変化に応じた電圧変動による電圧値が、予め定めた所定の電圧値になったことを検知した時に、自端末がクレードル１の端末載置台に置かれたと判断する。

[0023]　また、本実施形態において、クレードル１と携帯電話端末２は、上記一次側伝送コイル１０及び二次側伝送コイル２１を介した情報の伝達が可能となされている。例えば、上記携帯電話端末２がクレードル１の端末載置台に置かれ、上述のように磁界の状態変化に基づいて相互に一次側コイル１０と二次側コイル２１とが近接配置した時、それらクレードル１と携帯電話端末２は、上記一次側伝送コイル１０及び二次側伝送コイル２１を介した情報伝達により、互いに相手方を認証するための識別情報の交換を行う。

[0024]　そして、本実施形態において、上記一次側コイル１０と二次側コイル２１とが近接配置されたことをクレードル１及び携帯電話端末２が共に検知し、更に、クレードル１と携帯電話端末２とが互いに相手方を認証できた時に、クレードル１から電力伝送が行われ、その伝送された電力により携帯電話端末２のバッテリ２２の充電が行われることになる。

[0025]　このように携帯電話端末２のバッテリ２２への充電が開始される場合、上記クレードル１の制御基板部１１は、上記電源コード１２を通じて供給される家庭用交流電圧を所定の直流電圧に変換し、その直流電圧を用いて所定の周波数の交流電圧を生成して、当該生成した交流電圧を上記一次側伝送コイル１０へ供給する。一方、携帯電話端末２側では、上記クレードル１の一次側伝送コイル１０からの交流電圧により上記二次側伝送コイル２１に交流電圧が誘起されると、その誘起された交流電圧を整流して直流電圧に変換し、その直流電圧によりバッテリ２２の充電を行う。

[0026]　また、本実施形態において、クレードル１の制御基板部１１は、一次側伝送コイル１０の磁界の状態変化に基づく電圧値が予め定めた所定の電圧値にならなかった時、若しくは、一次側伝送コイル１０の磁界の状態変化に基づく電圧値が予め定めた所定の電圧値になった場合でも上記識別情報による相手方の認証が出来なかった時には、上記一次側伝送コイル１０の磁界の状態変化が例えばコイン等の金属物体やその他の導電性物体が端末載置台に載っ

ていることで発生したものであると判断し、上記一次側伝送コイル１０への電力供給を行わないように制御する。

[0027] また、本実施形態において、クレードル１からの電力伝送により携帯電話端末２のバッテリ２２の充電が行われている時、それらクレードル１と携帯電話端末２との間では、上記一次側伝送コイル１０及び二次側伝送コイル２１を介して充電情報の伝達が行われる。すなわち、携帯電話端末２の充電制御回路は、クレードル１からの電力伝送によりバッテリ２２の充電が行われている時、そのバッテリ２２の充電情報をクレードル１へ伝送する。クレードル１の制御基板部１１は、携帯電話端末２から伝達された充電情報により、その端末２のバッテリ２２の充電状況を監視しており、バッテリ２２の充電が完了していないことを当該充電情報により把握している場合には上記一次側伝送コイル１０を通じた電力伝送を続行し、一方、バッテリ２２の充電が完了したことを充電情報により把握した場合には電力伝送を停止するような制御を行う。その他にも、制御基板部１１は、例えば、携帯電話端末２から何らかの異常を示す情報が供給されたような場合にも電力伝送を停止する制御を行う。

[0028] 〔無接点電力伝送コイルの詳細〕

以下、本発明の実施形態にかかる無接点電力伝送コイルの詳細を説明する。なお、以下に説明する各実施形態では、主に携帯電話端末２に搭載される無接点電力伝送コイル（二次側伝送コイル２１）を例に挙げている。また、以下に示す各図は、各実施形態の無接点電力伝送コイルを概略的に示すものであり、コイルの巻線数や各部の縮尺，配置等については実際のものとは異なっており、本発明の説明を容易にするために必要に応じてデフォルメされて示されている。

[0029] 〔電線を渦巻き状に巻回した無接点電力伝送コイルの詳細〕

図２～図４には、電線４０を渦巻き状に巻回した平面コイルを有する無接点電力伝送コイル２１ＷＳの概略構成を示す。図２はフレキシブルプリント基板３０上に平面コイルが取り付けられた状態を正面から見た概略図を示しており、図３は平面コイルが取り付けられていない状態のフレキシブルプリント基板３０を正面から見た概略図を、図４は本実施形態の無接点電力伝送コイル２１ＷＳの概略断面図を示している。

[0030] 図２～図４において、本実施形態の無接点電力伝送コイル２１ＷＳは、表面に絶縁層が設けられた単線又は撚り線の電線４０を略々同一平面内に渦巻き状（スパイラル状）に巻回した平面コイルを有し、その平面コイルの一方の平面部側がフレキシブルプリント基板３０の表面上に接着シート４２にて貼り付けられており、また、平面コイルの他方の平面部側には、当該コイル及びクレードル１側の無接点電力伝送コイル１０の磁路を効率良く形成して鎖交磁束を多くすると共に、それら両コイルから発生する磁界による不要輻射を抑えるための磁性シート４３が当該他方の平面部の全体を覆うように接着シート４１を介して貼り付けられている。なお、フレキシブルプリント基板３０への平面コイルの取り付け、及び平面コイルへの磁性シート４３の取り付けは、図４に示した例のように、接着シート４１，４３による貼り付けの他に、平面コイル内、平面コイルとプリント基板３０との間、平面コイルと磁性シート４３との間に、例えば接着性を有する樹脂をインサートすることによる取り付けであっても良い。このように樹脂をインサートすることによる取り付けを行った場合、接着シートが不要となり、その分だけ無接点電力伝送コイルの厚みを薄くすることが可能となる。その他、図示は省略しているが、磁性シート４３の外側には必要に応じてアルミニウム等からなる金属シートも貼り付けられる。また、フレキシブルプリント基板３０の上記無接点電力伝送コイル２１ＷＳが貼り付けられた面の反対側の面は、図示しない接着シートにより、携帯電話端末２のバッテリ蓋２０の内壁面に貼り付けられることになる。

[0031] フレキシブルプリント基板３０は、例えばポリイミド樹脂などを基材とした非常に薄いシート状の基板であり、その表面には絶縁層が形成されている。但し、本実施形態のフレキシブルプリント基板３０は、図２及び図３に示すように、平面コイルが貼り付けられた時にその平面コイル内周部３７内に配置される第一のコイル接点部３６と、平面コイル外周部３８の外側近傍に配置される第二のコイル接点部３５と、第一の外部接続端子部３１及び第二の外部接続端子部３２とについては、表面絶縁層が形成されず、当該フレキシブルプリント基板の内部導体が外部へ露出するようになされている。また、第一のコイル接点部３６と第一の外部接続端子部３１は、表面絶縁層下に形成された第一の内部導体パターン３３を通じて電気的に接続されており、同様に、第二のコイル接点部３５と第二の外部接続端子部３２は、表面絶縁層下に形成された第二の内部導体パターン３４を通じて電気的に接続されている。そして、上記フレキシブルプリント基板３０に平面コイルが貼り付けられた時、上記第一のコイル接点部３６には当該平面コイルの内周部３７の巻き始め電線端部が電気的に接続され、上記第二のコイル接点部３５には当該平面コイルの外周部３８の巻き終わり電線端部が電気的に接続される。なお、実施形態の場合、図２及び図３に示すように、フレキシブルプリント基板３０は、突出部３９を有する略々四角形形状となされ、上記突出部３９に第一の外部接続端子部３１と第二の外部接続端子部３２が配されているが、本発明はこの基板形状に限定されるものではない。また、平面コイルが取り付けられる基板３０は、フレキシブルプリント基板の他に、薄型のソリッドタイプのプリント基板であっても良い。

[0032] 上述のように、図２～図４に示した実施形態の無接点電力伝送コイル２１ＷＳによれば、平面コイルの巻き始め

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電線端部がフレキシブルプリント基板３０の第一のコイル接点部３６に電気的に接続されると共に、平面コイルの巻き終わり電線端部がフレキシブルプリント基板３０の第二のコイル接点部３５に電気的に接続され、さらに、第一のコイル接点部３６と第一の外部接続端子部３１とが当該フレキシブルプリント基板３０の第一の内部導体パターン３３を通じて電気的に接続され、同様に、第二のコイル接点部３５と第二の外部接続端子部３２とが当該フレキシブルプリント基板３０の第二の内部導体パターン３４を通じて電気的に接続されており、前述の図２７及び図２８に示したように電線が重なってしまう部分が無く、したがって、当該無接点電力伝送コイル２１ＷＳの厚みを非常に薄くすることが可能になっている。

[0033] 〔フレキシブルプリント基板により形成された無接点電力伝送コイルの詳細〕

次に、図５～図８には、渦巻き状の導体パターンからなる平面コイルパターンが各々形成された複数のフレキシブルプリント基板を積層した多層構造の無接点電力伝送コイル２１ＰＳの概略構成を示す。なお、図５は多層構造のフレキシブルプリント基板からなる無接点電力伝送コイル２１ＰＳを正面から見た概略図を示しており、図６は多層構造のフレキシブルプリント基板の各層をそれぞれ分離した状態を示し、図７は多層構造のフレキシブルプリント基板からなる本実施形態の無接点電力伝送コイル２１ＰＳの概略断面図を、図８は図７中の楕円Ｅ１で囲った部分を拡大して示している。

[0034] 図５～図８において、本実施形態の無接点電力伝送コイル２１ＰＳは、例えば四層構造からなり、第一層目基板６４ａ，第二層目基板６４ｂ，第三層目基板６４ｃ，第四層目基板６４ｄは、それぞれ例えばポリイミド樹脂などを基材としたシート状の基板上に渦巻き状に巻回された線状の導体パターン６０が形成されている。最上層である第一層目基板６４ａの表面には表面絶縁層６２が形成されており、第一層目基板６４ａと第二層目基板６４ｂとの間には接着層及び層間絶縁層６３ａが形成されている。同様に、第二層目基板６４ｂと第三層目基板６４ｃとの間には接着層及び層間絶縁層６３ｂが、第三層目基板６４ｃと第四層目基板６４ｄとの間には接着層及び層間絶縁層６３ｃが形成されている。最下層の第四層目基板６４ｄの裏面側には接着層及び絶縁層６３ｄを介して磁性シート４３が貼り付けられている。

[0035] また、第一層目基板６４ａ～第四層目基板６４ｄの各導体パターン６０の内周部５７のパターン端部は第一のスルーホール５６により電気的に接続され、同様に、第一層目基板６４ａ～第四層目基板６４ｄの各導体パターン６０の外周部５８のパターン端部は第二のスルーホール５５により電気的に接続されている。さらに、各層の導体パターンの内周部５７側の第一のスルーホール５６は、各層の導体パターンの外周部５８側に設けられているスルーホール６１と電気的に接続されている。なお、図示は省略しているが、磁性シート４３の外側には必要に応じてアルミニウム等からなる金属シートも貼り付けられる。また、表面絶縁層６２の表面側は、図示しない接着シートにより携帯電話端末２のバッテリ蓋２０の内壁面に貼り付けられることになる。

[0036] また、本実施形態に無接点電力伝送コイル２１ＰＳにおいて、例えば第四層目基板６４ｄの第二のスルーホール５５は本発明にかかる第二のコイル接点部として、第二の内部導体パターン５４を通じて第二の外部接続端子部５２と電気的に接続されており、同様に、第四層目基板６４ｄの第一のスルーホール５６は本発明にかかる第一のコイル接点部として、上記スルーホール６１及び第一の内部導体パターン５３を通じて第一の外部接続端子部５１と電気的に接続されている。なお、この実施形態の場合、図５及び図７に示すように、多層構造のフレキシブルプリント基板は、突出部５９を有する略々四角形状となされ、上記突出部５９に第一の外部接続端子部５１と第二の外部接続端子部５２が配されているが、本発明はこの基板形状に限定されるものではない。

[0037] 上述のように、図５～図８に示した実施形態の無接点電力伝送コイル２１ＰＳによれば、平面コイルが電線に比べて非常に薄い多層フレキシブルプリント基板上の導体パターン６０により形成されていると共に、平面コイルの各導体パターン６０の内周部５７のパターン端部（巻き始めパターン端部）が接続された第一のスルーホール５６と第一の外部接続端子部５１とが、上記スルーホール６１と第一の内部導体パターン５３を通じて電気的に接続され、同様に、平面コイルの各導体パターン６０の外周部５８のパターン端部（巻き終わりパターン端部）が接続された第二のスルーホール５５と第二の外部接続端子部５２とが第二の内部導体パターン５４を通じて電気的に接続され、前述の図２７及び図２８に示したように電線が重なってしまう部分が無く、したがって当該無接点電力伝送コイル２１ＰＳの厚みを非常に薄くすることが可能になっている。特に、図５～図８に示した無接点電力伝送コイル２１ＰＳの場合は、平面コイルがフレキシブルプリント基板の導体パターン６０により形成されているため、前述のような電線による平面コイルを用いた無接点電力伝送コイルよりも更に厚みを薄くすることが可能となっている。

[0038] 〔平面コイルと磁性シートによる鎖交磁束の説明〕

次に、図９～図１４を参照しながら、磁性シートの貼り付け方によって変わる鎖交磁束について説明する。なお、以下の説明では、図２～図４に示した電線を渦巻き状に巻回した無接点電力伝送コイルを例に挙げているが、図５～図８に示した渦巻き状の導体パターンを多層フレキシブルプリント基板に形成した無接点電力伝送コイルに

ついても同様である。

[0039] 図９，図１１，図１３には、巻回された電線４０からなる平面コイルの平面部上に磁性シート４３，４４或いは磁性体層４５が形成された無接点電力伝送コイル２１をバッテリ蓋２０の壁２５に貼り付けた携帯電話端末２の当該コイル近傍部分と、同じく、巻回された電線８０からなる平面コイルの平面部上に磁性シート８３，８４或いは磁性体層８５が形成された無接点電力伝送コイル１０を筐体壁１３に貼り付けたクレードル１の当該コイル近傍（端末載置台近傍）部分の概略的な断面を示す。また図１０には図９中の楕円Ｅ２で囲った部分を拡大すると同時に携帯電話端末２とクレードル１の両平面コイルにより形成される磁束Mの流れを示し、同様に、図１２には図１０中の楕円Ｅ３で囲った部分を拡大すると同時に両平面コイルにより形成される磁束Mの流れを、図１４には図１３中の楕円Ｅ４で囲った部分を拡大すると同時に両平面コイルにより形成される磁束Mの流れを示している。なお、図１０，図１２，図１４の例では、図示を簡略化するための磁束Mの向きを一方向で描いているが、実際の電力伝送時には交流電圧が用いられるため磁束Mの向きは交互に反転することになる。また、図９～図１４では接着シートの図示を省略している。

[0040] 図９及び図１０の例は、携帯電話端末２側の無接点電力伝送コイル２１とクレードル１側の無接点電力伝送コイル１０の両者共に、平面コイルの平面部の全体を覆うように磁性シート４３，８３が貼り付けられている場合を表しており、図１１及び図１２の例は、無接点電力伝送コイル２１及び無接点電力伝送コイル１０の両者共に、平面コイルの平面部の形状に略々合わせた大きさの磁性シート４４，８４が貼り付けられている場合を、図１３及び図１４の例は、無接点電力伝送コイル２１及び無接点電力伝送コイル１０の両者共に、平面コイルの平面部の形状に合わせ且つ平面コイルの側面部にも略々密着するようになされた磁性体層４５，８５が設けられている場合を示している。

[0041] これら図９～図１４において、例えば図９及び図１０のように平面コイルの平面部の全体を覆うように磁性シート４３，８３を貼り付けた構成では、平面コイルの側面部で磁性シート４３，８３が平面コイルに密着せずに或る程度の隙間ができるため、磁路が遠くなって効率良く形成されず鎖交磁束は少なくなる。また、図１１及び図１２のように平面コイルの平面部の形状に略々合わせた大きさの磁性シート４４，８４を貼り付けた構成では、平面コイルの上面にしか磁性シートが存在しないため、磁路が効率良く形成されず鎖交磁束は少なくなる。一方、図１３及び図１４のように平面コイルの平面部の形状に略々合わせ且つ平面コイルの側面部にも略々密着するように磁性体層４５，８５が形成された構成では、平面コイルの上面だけでなく平面コイルの側面部にも磁性体層が存在するため、磁路が効率良く形成されて多くの鎖交磁束が形成されることになる。したがって、これらのことからわかるように、効率良く磁路を形成して多くの鎖交磁束を得るためには、図１３及び図１４に示したように、平面コイルの平面部だけでなく側面部にも略々密着するように磁性体層を形成することが望ましい。

[0042] 〔電線の平面コイル外周側面部にも磁性体層を形成した無接点電力伝送コイルの詳細〕

図１５～図１８には、電線４０を渦巻き状に巻回した平面コイルの平面部と側面部にも磁性体層１００を形成した場合の本実施形態の無接点電力伝送コイル２１WDの概略構成を示す。なお、図１５はフレキシブルプリント基板９０上に電線４０の平面コイルが貼り付けられた状態を正面から見た概略図を示しており、図１６はその平面コイルが貼り付けられていない状態のフレキシブルプリント基板９０を正面から見た概略図を、図１７はこの例の無接点電力伝送コイル２１WDの概略断面を、図１８は図１７中の楕円Ｅ５で囲った部分を拡大して示している。

[0043] 図１５～図１８において、本実施形態の無接点電力伝送コイル２１WDは、電線４０が巻回された平面コイルの一方の平面部側がフレキシブルプリント基板９０の表面上に例えば接着シート４２にて貼り付けられており、また、当該平面コイルの他方の平面部及び側面部には、磁性シートの貼り付け若しくはフェライト粉などを材料とする磁性体溶液を塗布することにより磁性体層１００が形成されている。なお、図示は省略しているが、磁性体層１００の外側には必要に応じてアルミニウム等からなる金属シートが貼り付けられる。また、フレキシブルプリント基板９０の上記無接点電力伝送コイル２１WDが貼り付けられた面の反対側の面は、図示しない接着シートにより、携帯電話端末２のバッテリ蓋２０の内壁面に貼り付けられることになる。

[0044] フレキシブルプリント基板９０は、ポリイミド樹脂などを基材とした非常に薄いシート状の基板であり、その表面には絶縁層が形成されていると共に、平面コイルの平面部に略々合致した形状を有している。また、この実施形態のフレキシブルプリント基板９０は、前述の図２及び図３の場合と同様に、平面コイルの内周部３７内に配置される第一のコイル接点部３６と、平面コイル外周部３８の外側近傍に配置される第二のコイル接点部３５と、第一の外部接続端子部３１及び第二の外部接続端子部３２とについては、表面絶縁層が形成されず、当該フレキシブルプリント基板９０の内部導体が外部へ露出しており、さらに、第一のコイル接点部３６と第一の外部接続端子部３１は表面絶縁層下に形成された第一の内部導体パターン３３を通じて電気的に接続され、第二のコイル接点部３５と第二の外部接続端子部３２は表面絶縁層下に形成された第二の内部導体パターン３４を通じて電気的に接続されている。そして、上記フレキシブルプリント基板９０に平面コイルが貼り付けられた時、上記第一のコイル接点部

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３６には当該平面コイルの内周部３７の巻き始め電線端部が電気的に接続され、上記第二のコイル接点部３５には当該平面コイルの外周部３８の巻き終わり電線端部が電気的に接続される。なお、この実施形態の場合、図１５及び図１６に示すように、フレキシブルプリント基板９０は、突出部３９を有し、この突出部３９に第一の外部接続端子部３１と第二の外部接続端子部３２が配されているが、突出部３９の形状については図１５，図１６の例に限定されるものではない。

[0045]　　上述のように、図１５～図１８に示した無接点電力伝送コイル２１ＷＤによれば、前述の図１～図４の例と同様に、第一のコイル接点部３６と第一の外部接続端子部３１とがフレキシブルプリント基板９０の第一の内部導体パターン３３を通じて電気的に接続され、第二のコイル接点部３５と第二の外部接続端子部３２とがフレキシブルプリント基板９０の第二の内部導体パターン３４を通じて電気的に接続されているため、当該無接点電力伝送コイル２１ＷＤの厚みを非常に薄くすることが可能になっている。

[0046]　　また、図１５～図１８の無接点電力伝送コイル２１ＷＤにおいては、平面コイルの平面部の形状に略々合致し且つ側面部にも略々密着するように磁性体層１００が形成されているため、当該携帯電話端末２の充電時にはクレードル１の無接点電力伝送コイルとの間で磁路が効率良く形成されて多くの鎖交磁束が形成されることになり、効率の良い電力伝送が可能となる。特に、電線４０が巻回された平面コイルに対して磁性体溶液を塗布するで磁性体層１００を形成した場合、電線４０の巻回により生ずる平面コイルの凹凸内に磁性体が入り込むことになるため、コイルと磁性体との間に隙間がなくなり、より効率良く磁路を形成することが可能となる。また、磁性体層を塗布により形成する場合には、磁性シートを貼り付ける場合よりも製造工程の削減、取り扱いの簡易化が可能となる。

[0047]　〔フレキシブルプリント基板に形成された平面コイル外周側面部にも磁性体層を形成した無接点電力伝送コイルの詳細〕

　　図１９～図２１には、多層フレキシブルプリント基板の渦巻き状の導体パターンからなる平面コイルパターンの平面部と側面部にも磁性体層１０１を形成した場合の本実施形態の無接点電力伝送コイル２１ＰＤの概略構成を示す。なお、図１９は平面コイルパターンが形成されたフレキシブルプリント基板を積層した多層構造の無接点電力伝送コイル２１ＰＤの概略構成を示し、図２０はこの例の無接点電力伝送コイル２１ＰＤの概略断面を、図２１は図２０中の楕円Ｅ６で囲った部分を拡大して示している。

[0048]　　図１９～図２１において、本実施形態の無接点電力伝送コイル２１ＰＤは、渦巻き状の導体パターン６０からなる平面コイルパターンの平面部に略々合致した形状を有した多層フレキシブルプリント基板からなる。当該多層フレキシブルプリント基板は、前述の図５の例と同様に、それぞれ例えばポリイミド樹脂などを基材としたシート状の基板上に渦巻き状の導体パターン６０が形成された第一層目基板６４ａ，第二層目基板６４ｂ，第三層目基板６４ｃ，第四層目基板６４ｄとを有し、第一層目基板６４ａの表面には表面絶縁層６２が形成され、第一層目基板６４ａと第二層目基板６４ｂとの間には接着層及び層間絶縁層６３ａが、第二層目基板６４ｂと第三層目基板６４ｃとの間には接着層及び層間絶縁層６３ｂが、第三層目基板６４ｃと第四層目基板６４ｄとの間には接着層及び層間絶縁層６３ｃが形成されている。また、この例において、最下層の第四層目基板６４ｄの裏面側及び当該多層フレキシブルプリント基板の外周側面部には、少なくとも絶縁層６５が形成されており、さらにその絶縁層６５の外側には、磁性シートの貼り付け若しくは磁性体溶液を塗布することにより磁性体層１０１が形成されている。なお、図示は省略しているが、磁性体層１０１の外側には必要に応じてアルミニウム等からなる金属シートが貼り付けられる。また、当該多層フレキシブルプリント基板の磁性体層が形成された平面部の反対側の面は、図示しない接着シートにより、携帯電話端末２のバッテリ蓋２０の内壁面に貼り付けられることになる。

[0049]　　また、この例の無接点電力伝送コイル２１ＰＤは、前述の図５の例と同様に、第一層目基板６４ａ～第四層目基板６４ｄの各導体パターン６０の内周部５７のパターン端部（巻き始め端部）は第一のスルーホール５６により電気的に接続され、第一層目基板６４ａ～第四層目基板６４ｄの各導体パターン６０の外周部５８のパターン端部（巻き終わり端部）は第二のスルーホール５５により電気的に接続され、各層の導体パターン６０の内周部５７側の第一のスルーホール５６は各層の導体パターン６０の外周部５８側のスルーホール６１と電気的に接続されている。さらに、当該無接点電力伝送コイル２１ＰＤにおいて、例えば第四層目基板６４ｄの第二のスルーホール５５は第二の内部導体パターン５４を通じて第二の外部接続端子部５２と電気的に接続されており、第四層目基板６４ｄの第一のスルーホール５６はスルーホール６１と第一の内部導体パターン５３を通じて第一の外部接続端子部５１と電気的に接続されている。なお、この実施形態の場合、図１９に示すように、多層構造のフレキシブルプリント基板は、突出部５９を有し、この突出部５９に第一の外部接続端子部５１と第二の外部接続端子部５２が配されているが、突出部５９の形状については図１９の例に限定されるものではない。

[0050]　　上述のように、図１９～図２１に示した実施形態の無接点電力伝送コイル２１ＰＤによれば、前述の図５の例と同様に、電線に比べて非常に薄い多層フレキシブルプリント基板上の導体パターン６０により平面コイルが形成されていると共に、導体パターン６０の内周部５７のパターン端部が第一のスルーホール５６及びスルーホール６１

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と第一の内部導体パターン５３を通じて第一の外部接続端子部５１と接続され、同様に、導体パターン６０の外周部５８のパターン端部が第二のスルーホール５５と第二の内部導体パターン５４を通じて第二の外部接続端子部５２と接続されているため、当該無接点電力伝送コイル２１ＰＤの厚みを非常に薄くすることが可能になっている。

[0051] また、図１９～図２１の無接点電力伝送コイル２１ＰＤにおいては、平面コイルパターンの平面部の形状に略々合致し且つ側面部にも略々密着するように磁性体層１０１が形成されているため、当該携帯電話端末２の充電時にはクレードル１の無接点電力伝送コイルとの間で磁路が効率良く形成されて多くの鎖交磁束が形成されることになり、効率の良い電力伝送が可能となる。

[0052] なお、上述の図２０及び図２１の例では、無接点電力伝送コイル２１ＰＤにおいて、平面コイルパターン（導体パターン６０）の内周部５７には、多層フレキシブルプリント基板に上記内周部５７よりも僅かに小さい径の穴が空けられ、その穴内部を略々完全に塞ぐように磁性体層が形成されているが、例えば図２２及び図２３に示すように、その穴内部に形成される磁性体層を当該多層フレキシブルプリント基板の厚みの途中までに留めるようにしても良い。但し、磁束を集中させることを考えた場合には、図２０及び図２１の例のように、多層フレキシブルプリント基板の厚み分の磁性体層を穴内部に形成することが望ましい。

[0053] 〔温度検知素子の実装例〕

本実施形態のように、無接点電力伝送コイルを用い、電磁誘導を利用して、クレードル１から携帯電話端末２へ電力伝送を行うような構成において、例えば、上記クレードル１の端末載置台上に例えばコインなどの金属異物が載ってしまったような場合、つまり金属異物がクレードル１の無接点電力伝送コイル１０に近接した位置に存在する場合には、その金属異物に渦電流が発生して異常過熱する虞がある。

[0054] このため、一般に、無接点電力伝送コイルの近傍に温度検知デバイスを取り付け、当該温度検知デバイスにて異常過熱を検出した時に、無接点電力伝送コイルへの電力供給を停止するような制御が行われている。

[0055] しかしながら、当該無接点電力伝送コイルの近傍に温度検知デバイスを取り付けるようにした場合、その温度検知デバイスそのものの厚みだけでなく、当該温度検知デバイスを取り付けるための部材の厚みも加わり、無接点電力伝送コイル部の薄型化の妨げになってしまう。

[0056] そこで、本実施形態では、図２４～図２６に示すように、フレキシブルプリント基板上の導体パターン中に、当該無接点電力伝送コイルの異常発熱を防止するための温度検知素子層１１０を直接形成すると共に、その温度検知素子層１１０からの配線パターンについてもフレキシブルプリント基板内に形成する。なお、これら図２４～図２６で示したような温度検知素子層１１０が形成された無接点電力伝送コイルは、送電側であるクレードル１側のコイルに設けられる。勿論、携帯電話端末２側のコイルに適用することも可能である。

[0057] 図２４及び図２５には、前述の図１５～図１８で説明したような巻回された電線４０からなる平面コイルを有する無接点電力伝送コイルにおいて、フレキシブルプリント基板９０の導体パターン内に温度検知素子層１１０を直接形成したときの概略構成を示している。なお、図２４はこの例の無接点電力伝送コイルの概略断面を示し、図２５は平面コイルが貼り付けられていない状態のフレキシブルプリント基板９０を正面から見た概略図を示している。

[0058] これら図２４及び図２５において、フレキシブルプリント基板９０の導体パターンには、温度検知素子層１１０が形成されている。また、この例の場合のフレキシブルプリント基板９０には、上記温度検知素子層１１０の温度検知信号を外部に取り出すための第三の外部接続端子部１１１及び第四の外部接続端子部１１２が設けられており、それら第三の外部接続端子部１１１及び第四の外部接続端子部１１２と上記温度検知素子層１１０との間には配線パターンが形成されている。

[0059] また、図２６には、前述の図１９～図２１で説明した導体パターン６０からなる平面コイルを有する多層フレキシブルプリント基板の無接点電力伝送コイルにおいて、例えば第一層目基板６４ａの導体パターン内に温度検知素子層１１０を直接形成したときの概略構成を示している。なお、図２６は無接点電力伝送コイルの概略断面のうち、温度検知素子層１１０が形成されている一部分のみを拡大した概略図である。

[0060] この図２６において、多層フレキシブルプリント基板の例えば第一層目基板６４ａの導体パターンには、温度検知素子層１１０が直接形成されている。なお、図示は省略しているが、この例の場合、上記温度検知素子層１１０の温度検知信号が伝送される配線パターンはスルーホール等を通じて、前記図２５と同様に第三の外部接続端子部１１１及び第四の外部接続端子部１１２に接続されている。

[0061] 上述のように、図２４～図２６に示した無接点電力伝送コイルによれば、温度検知素子層１１０が、フレキシブルプリント基板上の導体パターン中に直接形成されているため、無接点電力伝送コイルが厚くなることはない。また、この例の無接点電力伝送コイルの場合、温度検知素子層１１０は、電磁誘導を利用した電力伝送が行われる両

コイルが対向する側となるフレキシブルプリント基板内に設けられるため、つまり、前述の金属異物等のによる異常加熱が発生するような場合に、その金属異物に最も近い側となるフレキシブルプリント基板内設けられるため、異常過熱の発生を直ぐに検知することが可能となる。

[0062] なお、上述の例では、温度検知素子層１１０を一つとした例を挙げたが、温度検知素子は複数設けられていても良い。特にこの例の場合、温度検知素子が複数存在したとしても、無接点電力伝送コイルの厚さが増すことはない。

[0063] 上述した実施形態の説明は、本発明の一例である。このため、本発明は上述した各実施形態に限定されることなく、本発明に係る技術的思想を逸脱しない範囲であれば、設計等に応じて種々の変更が可能であることはもちろんである。

[0064] 上述の実施形態では、無接点電力伝送コイルの薄型化について携帯電話端末２を例に挙げて説明したが、クレードル１にも本発明は適用可能である。また、本実施形態では無接点電力伝送コイルは送電側或いは受電側の何れか一方の機能のみを有している例を挙げたが、送電側と受電側の両方の機能を備えた無接点電力伝送コイルにも本発明は適用可能である。

[0065] また、本実施形態では、携帯電話端末２とクレードル１の組み合わせを例に挙げたが、本発明はそれらに限定されず、例えばＰＤＡ（Personal Digital Assistants）等の各種の携帯端末とそのクレードルとの組み合わせや、非接触型ＩＣカードとそのリーダライタなどに用いられる平面のコイルにも適用可能である。

[0067] １ クレードル、２ 携帯電話端末、１０ クレードル側の無接点電力伝送コイル、１１ 制御基板部、１２ 電源コード、１３ クレードルの筐体壁、２０ バッテリ蓋、２１ 携帯電話端末側の無接点電力伝送コイル、２２ バッテリ、２３ 回路基板、２５ バッテリ蓋の壁、３０，９０ フレキシブルプリント基板、３１，５１ 第一の外部接続端子部、３２．５２ 第二の外部接続端子部、３３，５３ 第一の内部導体パターン、３４，５４ 第二の内部導体パターン、３５ 第二のコイル接点部、３６ 第一のコイル接点部、３７，５７ 平面コイル内周部、３８，５８ 平面コイル外周部、３９．５９ 突出部、４０ 渦巻き状に巻回された電線、４１，４２ 接着シート、４３，４４，４５ 磁性シート、５５ 第二のスルーホール、５６ 第１のスルーホール、６１ スルーホール、６０ 渦巻き状の導体パターン、６２ 表面絶縁層、６３ａ ６３ｂ．６３，ｃ６３ｄ 接着層及び層間絶縁層、６４ａ 第一層目基板、６４ｂ 第二層目基板、６４ｃ 第三層目基板、６４ｄ 第四層目基板、６５ 絶縁層、８０ クレードルの渦巻き状に巻回された電線、８３，８４，８５ クレードル側の磁性シート、１００，１０１ 磁性体層、１１０ 温度検知素子層、１１１ 第三の外部接続端子部、１１２ 第四の外部接続端子部

【請求項 1】
単線又は撚り線からなる線状導体を略々同一平面内に渦巻き状に巻回して形成された平面コイルと、

第一，第二の外部接続端子部と、上記渦巻き状に巻回された線状導体の内周側端部に接続される第一の接点部と、上記渦巻き状に巻回された線状導体の外周側端部に接続される第二の接点部と、上記第一の接点部と第一の外部接続端子部とを接続する第一の導体パターンと、上記第二の接点部と第二の外部接続端子部とを接続する第二の導体パターンとが形成されたプリント基板とを有し、

上記平面コイルの一方の平面部が上記フレキシブルプリント基板の表面上に取り付けられている、

ことを特徴とする無接点電力伝送コイル。

【請求項 2】
上記平面コイルの少なくとも他方の平面部上を覆う磁性体層が形成されていることを特徴とする請求項１記載の無接点電力伝送コイル。

【請求項 3】
上記プリント基板は、温度検知素子が形成された温度検知素子層と、上記温度検知素子により検知された温度検知信号を外部に取り出すための導体パターン及び外部接続端子部とを有することを特徴とする請求項１記載の無接点電力伝送コイル。

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【請求項 4】
二次電池と、

単線又は撚り線からなる線状導体を略々同一平面内に渦巻き状に巻回して形成された平面コイルと、第一，第二の外部接続端子部と、上記渦巻き状に巻回された線状導体の内周側端部に接続される第一の接点部と、上記渦巻き状に巻回された線状導体の外周側端部に接続される第二の接点部と、上記第一の接点部と第一の外部接続端子部とを接続する第一の導体パターンと、上記第二の接点部と第二の外部接続端子部とを接続する第二の導体パターンとが形成されたプリント基板とを有し、上記平面コイルの一方の平面部が上記プリント基板の表面上に取り付けられて成る無接点電力伝送コイルと、

上記無接点電力伝送コイルを通じて受電した電力を上記二次電池へ充電する制御を行う充電制御回路とを有する、

ことを特徴とする携帯端末。

【請求項 5】
上記無接点電力伝送コイルには、上記平面コイルの少なくとも他方の平面部上を覆う磁性体層が形成されていることを特徴とする請求項４記載の携帯端末。

【請求項 6】
上記無接点電力伝送コイルの上記プリント基板は、温度検知素子が形成された温度検知素子層と、上記温度検知素子により検知された温度検知信号を外部に取り出すための導体パターン及び外部接続端子部とを有することを特徴とする請求項４記載の携帯端末。

【請求項 7】
二次電池を備えた所定の携帯端末が載置される端末載置台と、

単線又は撚り線からなる線状導体を略々同一平面内に渦巻き状に巻回して形成された平面コイルと、第一，第二の外部接続端子部と、上記渦巻き状に巻回された線状導体の内周側端部に接続される第一の接点部と、上記渦巻き状に巻回された線状導体の外周側端部に接続される第二の接点部と、上記第一の接点部と第一の外部接続端子部とを接続する第一の導体パターンと、上記第二の接点部と第二の外部接続端子部とを接続する第二の導体パターンとが形成されたプリント基板とを有し、上記平面コイルの一方の平面部が上記プリント基板の表面上に取り付けられて成り、上記所定の携帯端末に搭載されているコイルとの間の電磁誘導を利用して、非接触により当該携帯端末の二次電池を充電するための電力伝送を行う無接点電力伝送コイルと、

上記無接点電力伝送コイルへの電力供給を制御する電力供給制御部とを有する、

ことを特徴とする端末充電装置。

【請求項 8】
上記無接点電力伝送コイルには、上記平面コイルの少なくとも他方の平面部上を覆う磁性体層が形成されていることを特徴とする請求項７記載の端末充電装置。

【請求項 9】
上記無接点電力伝送コイルの上記プリント基板は、温度検知素子が形成された温度検知素子層と、上記温度検知素子により検知された温度検知信号を外部に取り出すための導体パターン及び外部接続端子部とを有し、

上記電力供給制御部は、少なくとも、上記温度検知素子にて検知された温度検知信号に基づいて上記無接点電力伝送コイルへの電力供給を制御することを特徴とする請求項７記載の端末充電装置。

(57)【要約】
【課題】　無接点電力伝送コイルの薄型化を可能にして、携帯端末や端末充電装置の更なる薄型化を可能とする。

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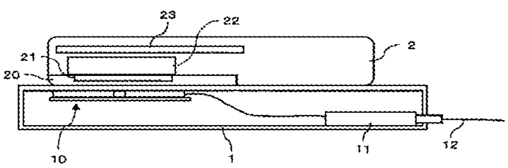
【解決手段】

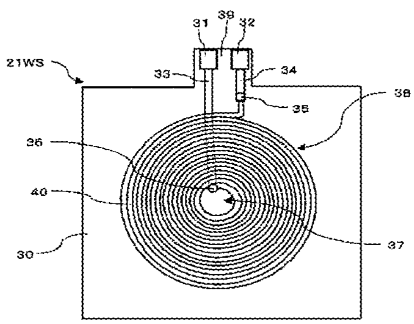
平面コイルは、単線又は撚り線からなる電線４０を渦巻き状に巻回して形成されている。フレキシブルプリント基板３０は、第一，第二の外部接続端子部３１，３２と、平面コイルの内周部３７の電線端部に接続される第一のコイル接点部３６と、平面コイルの外周部３８の電線端部に接続される第二のコイル接点部３５と、第一のコイル接点部３６と第一の外部接続端子部３１とを接続する第一の内部導体パターン３３と、第二のコイル接点部３５と第二の外部接続端子部３２とを接続する第二の内部導体パターン３４とが形成されている。そして、平面コイルの一方の平面部がそのフレキシブルプリント基板３０の表面上に貼り付けられている。

【選択図】　図２

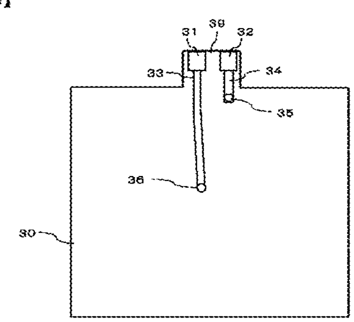
【図 1】



【図 2】

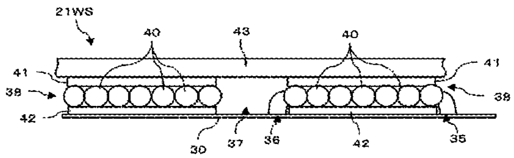


【図 3】

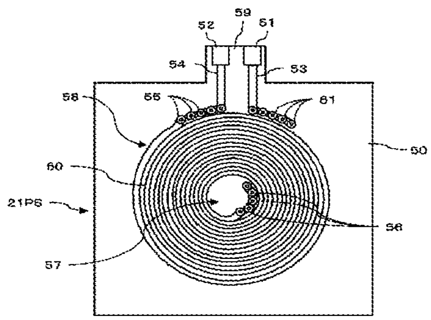


18-11

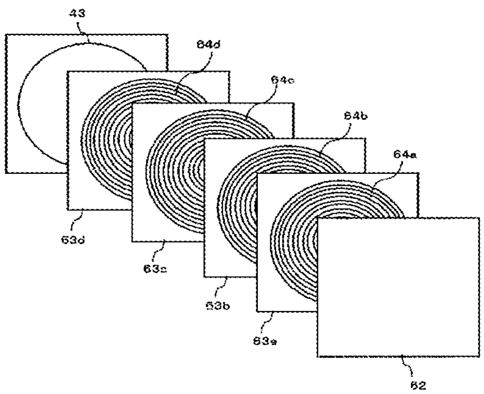
【圖 4】



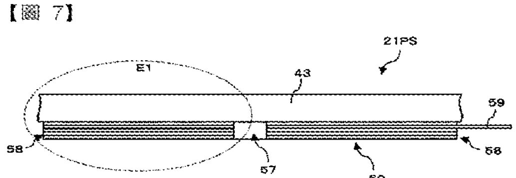
【圖 5】



【圖 6】

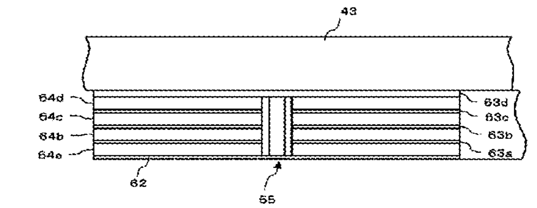


【圖 7】

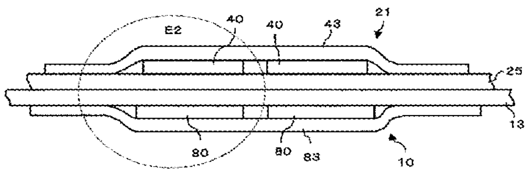


18-12

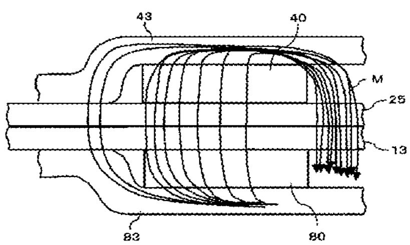
【도 8】



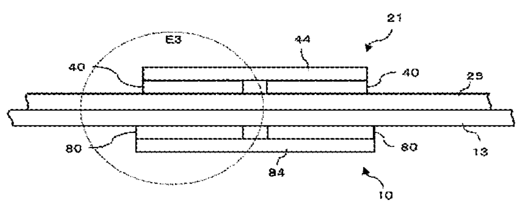
【도 9】



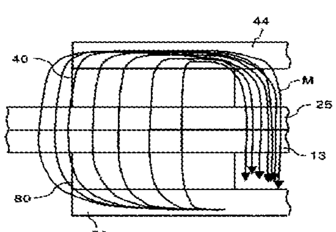
【도 10】



【도 11】

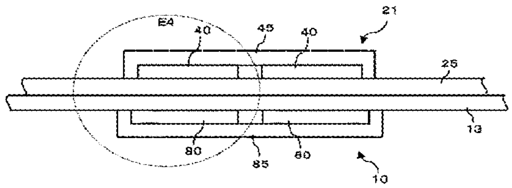


【도 12】

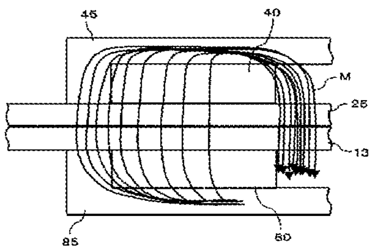


18-13

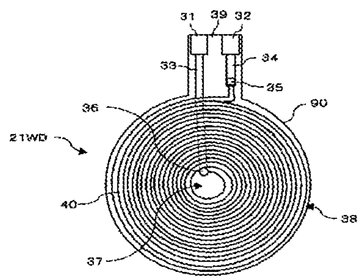
【図 13】



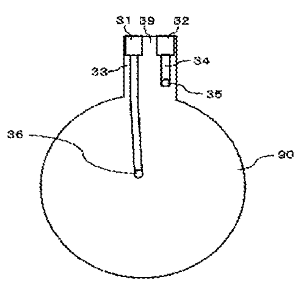
【図 14】



【図 15】

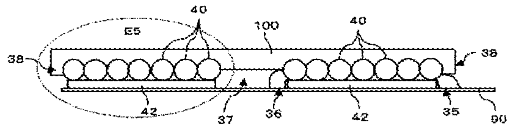


【図 16】

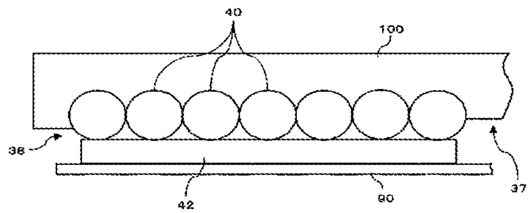


18-14

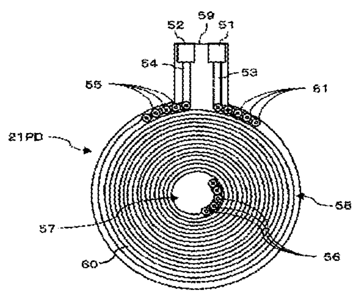
【圖 17】



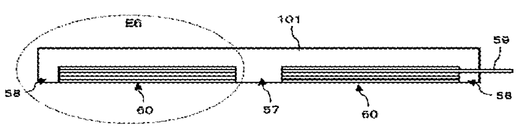
【圖 18】



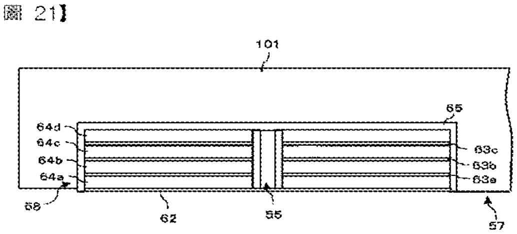
【圖 19】



【圖 20】



【圖 21】



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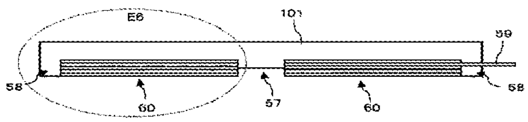
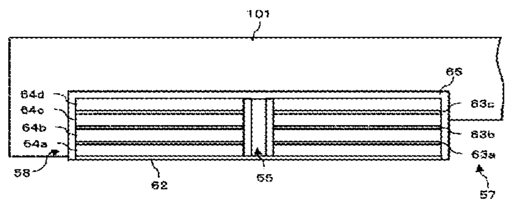
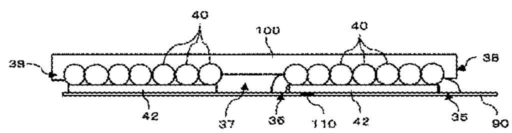
【도 22】



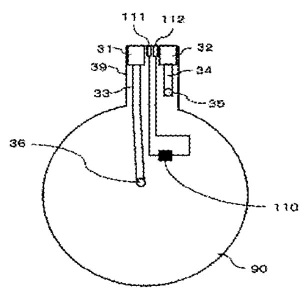
【도 23】



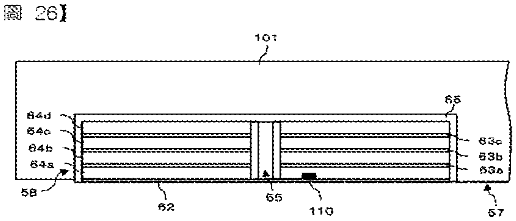
【도 24】



【도 25】

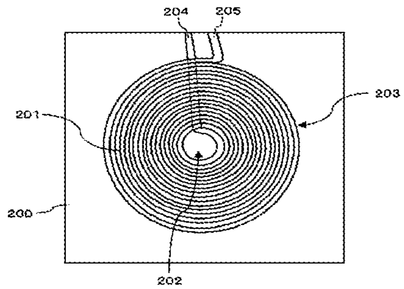


【도 26】

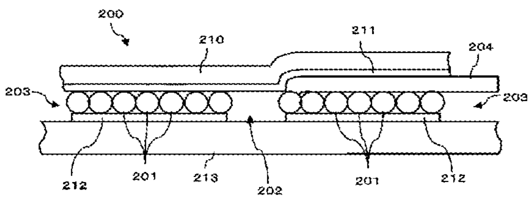


18-16

【図 27】



【図 28】



(72)発明者　鈴木　邦治
東京都港区港南１丁目８番１５号　ソニー・エリクソン・モバイルコミュニケーションズ株式会社内

(72)発明者　鈴木　克哉
東京都港区港南１丁目８番１５号　ソニー・エリクソン・モバイルコミュニケーションズ株式会社内

(72)発明者　山崎　学
東京都港区港南１丁目８番１５号　ソニー・エリクソン・モバイルコミュニケーションズ株式会社内

(72)発明者　近藤　陽一郎
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　大西　幸太
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　依田　健太郎
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　神　幹基
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　上條　貴宏

長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　曽我部　治彦

長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

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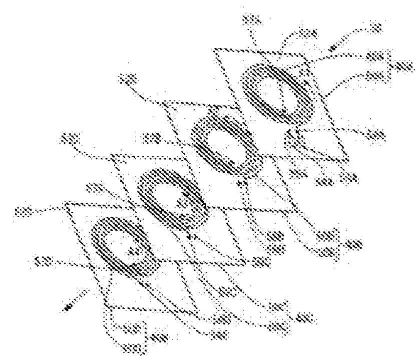
(71)Applicant : SEIKO EPSON CORP
(72)Inventor : HASEGAWA MINORU
KURODA MASAAKI

(54) LAMINATED COIL UNIT AND ELECTRONIC APPARATUS HAVING THE SAME, AND CHARGER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a laminated coil unit capable of improving transmission efficiency by devising the extraction of an electrode for connecting both ends of a multilayer-connected coil to the outside to flatten the transmission surface of contactless power transmission, to provide an electronic apparatus using the laminated coil unit, and to provide a charger.



SOLUTION: The laminated coil unit is used for at least one of primary- and secondary-side coils for contactless power transmission. The unit has a plurality of plane air cores, and respective coils are composed of a spiral conductive pattern formed on an insulating board and are laminated in the thickness direction of the insulating board. The plurality of plane air coils have both coil edges formed by connecting respective two coils. First and second electrode patterns to which both coil ends are connected are formed on the exposure surface of the insulating board positioned in an outermost end layer at the side of a non-transmission surface that is opposite to a transmission surface side opposite to one of the primary- and secondary-side coils.

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(71) 出願人　000002369

セイコーエプソン株式会社

東京都新宿区西新宿２丁目４番１号

(74) 代理人　100090479

弁理士　井上　一

(74) 代理人　100104710

弁理士　竹腰　昇

(74) 代理人　100124626

弁理士　榎並　智和

(74) 代理人　100124682

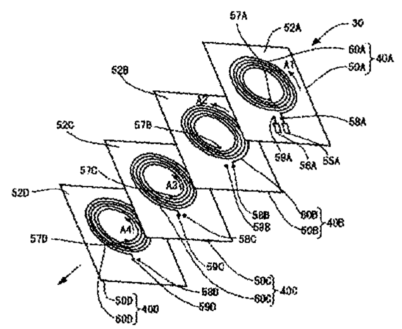
弁理士　黒田　泰

(72) 発明者　長谷川　稔

長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

最終頁に続く

(54)【発明の名称】積層コイルユニット並びにそれを用いた電子機器及び充電器



[0001]　本発明は、積層コイルユニット並びにそれを用いた電子機器及び充電器に関する。

[0002]　多層基板のパターンでコイルを製造する場合、各層間の接続方法によっては、ビルドアップ基板を用い、ブラインドビアでコイル間の接続を行なっていた（特許文献１）。このため、コストアップとなっていた。リジット基板とスルーホールを用いてコイルを作成する場合、スルーホールとパターンのレイアウトが煩雑になってしまう。さらに、コイルの中心部にスルーホールを多く設けなければならず、コイルの特性の悪化にもつながってしまう。

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[0003]　　また、フラットコイルとして、絶縁基板の同一面内に二重スパイラルのコイルを形成して短絡検査を容易にするもの（特許文献２）や、その二重スパイラルコイルを異なる層に形成して、各層のコイル同士を直列または並列に接続したものがある（特許文献３）。

[0004]　　上述した特許文献１～３に開示されたフラットコイルでは、複数のコイルをその厚さ方向に積層した際に、多層接続されたコイルの両端からの電極の取り出しに工夫がなく、積層コイルの片面を実質的にフラットにすることが困難であった。

[0005]　　なお、同一面内に形成した二重スパイラルのコイルは相互インダクタンスを確保できず、無接点電力伝送に用いるコイルとしてトータルインダクタンスを確保することができない。

【特許文献 1】 特開２０００－２０８３２７号公報

【特許文献 2】 特開平１０－１９９７２７号公報

【特許文献 3】 特開２００１－１８５４１９号公報

[0006]　　そこで、本発明の目的とするところは、多層接続されたコイルの両端を外部に接続するための電極の取り出しを工夫して、無接点電力伝送の伝送面をフラットにし、伝送効率を向上できる積層コイルユニット並びにそれを用いた電子機器及び充電器を提供することにある。

[0007]　　本発明の一態様は、無接点電力伝送のための一次側コイル及び二次側コイルの少なくとも一方に用いられる積層コイルユニットであって、

複数個の平面状空芯コイルを有し、

前記複数個の平面状空芯コイルの各々は、絶縁基板上に形成された渦巻状の導電パターンから構成されて、前記絶縁基板の厚さ方向にて積層され、

前記複数個の平面状空芯コイルは、前記複数個の平面状空芯コイルの各２個同士を接続することで形成されるコイル両端部を有し、

前記コイル両端部が接続される第１及び第２の電極パターンが、前記一次側コイル及び二次側コイルのいずれか他方と対向する伝送面とは逆側の非伝送面側の最端層に位置する前記絶縁基板の露出面に形成されていることを特徴とする。

[0008]　　こうすると、他の露出面にはコイル両端の取出し電極を設ける必要がなく、他の露出面を実質的にフラットにすることができる。この他の露出面を、無接点電力伝送の伝送面に配置すると、一次・二次コイルを近接配置することができ、伝送効率が向上する。また、本発明の一態様によれば、Ｎ個の平面状空芯コイル各導電パターンが重なることで、コイル間の相互インダクタンスを増加させることができ、無接点電力伝送に必要なトータルインダクタンスを確保できる。

[0009]　　本発明の一態様では、前記複数個の平面状空芯コイルの各２個の内端同士を接続するために、前記絶縁基板を貫通して形成された第１のスルーホールと、

前記複数個の平面状空芯コイルの各２個の外端同士を接続するために、前記絶縁基板を貫通して形成された第２のスルーホールと、

前記コイル両端部の一端を、前記第１及び第２の電極パターンの一方に接続するために、前記絶縁基板を貫通して形成された第３のスルーホールと、

を有することができる。

[0010]　　こうして、異なる絶縁基板にそれぞれ形成された複数の平面状空芯コイルを、直列及び／または並列にて接続することができる。

[0011]　　本発明の一態様では、前記複数個の平面状空芯コイルは、それぞれ異なる絶縁基板に形成されてもよい。あるいは、複数個の平面状空芯コイルが前記平面状空芯コイルの数よりも少ない数の絶縁基板に形成されてもよい。後者の場合、少なくとも一枚の絶縁基板の両面に、２個の平面状空芯コイルが一つずつ形成されればよい。こうすると

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、絶縁基板の数を削減でき、より薄型化が図れる。

[0012] 本発明の一態様では、前記第１、第２、第３のスルーホールを、前記複数個の平面状空芯コイルが形成された全ての絶縁基板に貫通形成することができる。こうすると、一部のスルーホールはダミーとなるが、積層コイルユニットを安価に形成できる。

[0013] 本発明の一態様では、前記絶縁基板をフレキシブル基板とすることができる。これにより、積層コイルユニットをより薄型化できる。

[0014] 本発明の一態様では、前記非伝送面側の最端層に位置する絶縁基板の前記露出面であって、該絶縁基板に形成された前記平面状空芯コイルを覆う位置に磁性体シートを積層することができる。こうすると、トータルインダクタンスや、コイルのQ値がさらに向上する。

[0015] 本発明の他の態様は、上述した積層コイルユニットを前記二次側コイルとして含み、充電器に設けられる前記一次側コイルとの間で無接点電力伝送する電子機器を定義している。

[0016] 本発明のさらに他の態様は、上述した積層コイルユニットを前記一次側コイルとして含み、電子機器に設けられる前記二次側コイルとの間で無接点電力伝送する充電器を定義している。

[0017] 以下、本発明の好適な実施の形態について詳細に説明する。なお以下に説明する本実施形態は特許請求の範囲に記載された本発明の内容を不当に限定するものではなく、本実施形態で説明される構成の全てが本発明の解決手段として必須であるとは限らない。

[0018] １．第１の実施形態

１．１．充電システム

図１は、充電器１０と、この充電器１０に電子機器例えば携帯電話機２０とを模式的に示す図である。充電器１０から携帯電話機２０への充電は、充電器１０のコイルユニット１２の一次側コイルと、その充電器１０に横置きされる携帯電話機２０のコイルユニット２２の二次側コイルとの間に生じる電磁誘導作用を利用し、無接点電力伝送により行われる。

[0019] １．２．積層コイルユニットの構造

図２は、コイルユニット１２または２２に好適な薄型でかつ伝送面が面一となる積層コイルユニット３０の分解斜視図である。なお、充電器１０と比較して、携帯電話機２０に搭載されるコイルユニット１２はより薄型が要求されるので、図２に示す積層コイルユニット３０は、コイルユニット１２に特に好適である。ここで、コイルユニット１２，２２の伝送面とは、図１に示すようにコイルユニット１２，２２が対向配置された際の対向面をいう。充電器１０のコイルユニット１２では伝送面より電力が伝送され、電子機器２０のコイルユニット２２では伝送面より電力が伝送される。

[0020] 図２では、Ｎ（第１の実施形態ではＮは４以上の偶数で、例えばＮ＝４）個の平面状空芯コイル４０Ａ，４０Ｂ，４０Ｃ，４０Ｄを有する。４個の平面状空芯コイル４０Ａ，４０Ｂ，４０Ｃ，４０Ｄは、例えばＮ＝４枚の絶縁基板５０Ａ，５０Ｂ，５０Ｃ，５０Ｄ上に形成された渦巻状の導電パターン６０Ａ，６０Ｂ，６０Ｃ，６０Ｄから構成されている。

[0021] 本実施形態では、Ｎ＝４個の平面状空芯コイル４０Ａ，４０Ｂ，４０Ｃ，４０Ｄが、厚さ方向にて積層されるＮ＝４枚の絶縁基板５０Ａ，５０Ｂ，５０Ｃに形成されている。ただし、（Ｎ－１）＝３枚の絶縁基板５０Ａ，５０Ｂ，５０Ｃを用いても良い。この場合、中央の絶縁基板５０Ｂの両面に、平面状空芯コイル４０Ｂ，４０Ｃを形成すれば良い。このように、２個の平面状空芯コイル４０Ｂ，４０Ｃを絶縁基板５０Ｂの両面に形成することで、別個の絶縁基板の片面に形成した場合と比較して、積層コイルユニット３０の厚さを、絶縁基板一枚分だけ薄く形成できる。

[0022] 図３は、携帯電話機２０の筐体２４に、二次側コイルユニットとして積層コイルユニット３０を配置した部分拡大断面図である。ただし、図３は、図２とは異なり、中央の絶縁基板５０Ｂの両面に平面状空芯コイル４０Ｂ，４０Ｃを形成して、（Ｎ－１）＝３枚の絶縁基板を用いた例である。図３では、破線は、図示しない充電器１０の一次側コイルユニット１２から発生する磁力線である。積層コイルユニット３０のうち、この磁力線により無接点で電力伝送を受ける最端面を伝送面７０と称する。図３の例では、絶縁基板５０Ｃの導電パターン６０Ｄが形成された面（モジュール面）が伝送面７０となる。換言すれば、モジュール面が伝送面７０と面一となる。なお、図２の構造の場合には、絶縁基板５０Ｄの非パターン面が伝送面７０と面一となる。

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[0023]　積層コイルユニット３０のうち、この伝送面７０とは逆側の最端面を非伝送面７２と称する。なお、図３には、積層コイルユニット３０の非伝送面７２に磁性体シート７４を配置している。この磁性体シート７４は必須ではないが、後述する通り、磁性体シート７４を設けることで積層コイルユニット３０のトータルインダクタンスを大きく確保できるなどの利点がある。また、図示していないが、磁性体シート７４を覆って磁気シールドシートをさらに追加しても良い。特に、図３のように携帯電話機２０等の電子機器に積層コイルユニット３０を配置する場合、電子機器内の他の金属に渦電流を生じさせる磁束漏れを防止できる。

[0024]　図２に示すように、４枚の絶縁基板５０Ａ～５０Ｄのうち、非伝送面７２側の最端層に位置する絶縁基板５０Ａの非伝送面７２側の片面５２Ａに、平面状空芯コイル４０Ａを形成するための導電パターン６０Ａが形成されている。

[0025]　さらに、この絶縁基板５０Ａの非伝送面７２側の片面５２Ａに、第１の電極パターン５５Ａ及び第２の電極パターン５６Ａが形成されている。なお、この第１，第２の電極パターン５５Ａ，５６Ａを除いて、導電パターン６０Ａを絶縁被覆することができる。

[0026]　同様に、２，３枚目の絶縁基板５０Ｂ，５０Ｃの各片面５２Ｂ，５２Ｃに、平面状空芯コイル４０Ｂ，４０Ｃが形成されている。そして、４枚の絶縁基板のうち、伝送面７０側の最端層に位置する絶縁基板５０Ｄの片面５２Ｄに、平面状空芯コイル４０Ｄが形成されている。

[0027]　１．３．積層コイルユニットの接続形態（２組の並列コイルを直列接続）

図４は図２に示す積層コイルユニット３０の接続形態を示し、図５はその等価回路図である。図４に示すように、４つの平面状コイルユニット４０Ａ～４０Ｄの内端は共通接続されている。図２で説明すると、３枚の絶縁基板５０Ａ，５０Ｂ，５０Ｃ，５０Ｄの各コイル内端に対応する同一位置に、それぞれ絶縁基板５０Ａ，５０Ｂ，５０Ｃ，５０Ｄを貫通する第１のスルーホール５７Ａ，５７Ｂ，５７Ｃ，５７Ｄが形成されている。これら第１のスルーホール５７Ａ，５７Ｂ，５７Ｃ，５７Ｄが導通することで、４つの平面状コイルユニット４０Ａ～４０Ｄの内端は共通接続されている。ただし、絶縁基板５０Ｄに形成されたスルーホール５７Ｄはコイル間接続に寄与しないダミーのスルーホールとなる。

[0028]　一方、平面状空芯コイル４０Ａ，４０Ｂの各外端同士は、絶縁基板５０Ａ，５０Ｂに形成された第２のスルーホール５８Ａ，５８Ｂを介して接続されている。この第２のスルーホール５８Ａは、絶縁基板５０Ａ上の導電パターンを介して第１の電極パターン５５Ａに接続されている。なお、絶縁基板５０Ａに形成された第２のスルーホール５８Ａと対応する位置にて、絶縁基板５０Ｃ，５０Ｄにも第２のスルーホール５８Ｃ，５８Ｄが形成されているが、これらは何れのパターンにも接続されないダミーのスルーホールであり、コイル間の接続には寄与しない。ただし、４枚の絶縁基板５０Ａ，５０Ｂ，５０Ｃ，５０Ｄの同一箇所に第２のスルーホール５８Ａ，５８Ｂ，５８Ｃ，５８Ｄを形成することで、スルーホール付き多層積層基板を安価に製造できる。

[0029]　他方、平面状空芯コイル４０Ｃ，４０Ｄの各外端同士は、絶縁基板５０Ｃ，５０Ｄに形成された第３のスルーホール５９Ｃ，５９Ｄを介して接続されている。この第３のスルーホール５９Ｃは、絶縁基板５０Ａ，５０Ｂに形成された第３のスルーホール５９Ａ，５９Ｂと、絶縁基板５０Ａ上の導電パターンとを介して、第２の電極パターン５６Ａに接続されている。なお、絶縁基板５０Ｄに形成されたスルーホール５９Ｄは、コイル間接続に寄与しないダミーのスルーホールである。

[0030]　このように接続すると、第１の実施形態の積層コイルユニット３０は、Ｎ＝４個のうちの２個の平面状空芯コイル４０Ａ，４０Ｂを並列（広義には直列及び並列の一方である第１の接続形態）接続した１組のコイル接続ユニット８０（図４，図５参照）と、Ｎ＝４個のうちの他の２個の平面状空芯コイル４０Ｃ，４０Ｄを並列（広義には第１の接続形態）接続した他の１組のコイル接続ユニット８２（図４，図５参照）とを含んでいる。つまり、積層コイルユニット３０は、（Ｎ／２）＝２個のコイル接続ユニット８０，８２を含んでいる。この２個のコイル接続ユニット８０，８２は、第１，第２の電極パターン５５Ａ，５６Ａ間にて、直列（広義には直列及び並列の他方である第２の接続形態）接続されている。

[0031]　なお、本実施形態では、絶縁基板５０Ａ～５０Ｄは四層のフレキシブル印刷回路基板（ＦＰＣ）にて形成されている。これに限らず、剛体の絶縁基板を用いても良いが、積層コイルユニット３０を薄く形成できる点で、ＦＰＣの利用が好ましい。

[0032]　１．４．積層コイルユニットの作用・効果

（１）コイルの特性を示すＱ

積層コイルユニット３０の第１の利点は、トータルインダクタンスを大きくし、トータル抵抗を小さく維持し、

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かつ、このコイルを含んで構成されるコイルの特性を表わすＱ（Quality factor）が向上する点である。Ｑは、コイルの特性あらわす量であり、値が大きいほど好ましい。

[0033] 積層コイルユニット３０のトータルインダクタンスをＬとし、トータル抵抗をＲとし、回路のキャパシタンスをＣとすると、$Q=(L/C)^{1/2}/R$となる。

[0034] ここで、積層コイルユニット３０では、平面状空芯コイル４０Ａ，４０Ｂの外端から内端に向かう電流方向Ａ１，Ａ２と、平面状空芯コイル４０Ｃ，４０Ｄの内端から外端に向かう電流方向Ａ３，Ａ４は、図２中にて反時計方向で全て一致する。さらに、４つの平面状空芯コイル４０Ａ～４０Ｄの各導電パターン６０Ａ～６０Ｄは、内端及び外端形状を除いて一致させることで、コイル間の相互インダクタンスを増加させることができる。

[0035] ところで、積層コイルユニット３０に対する第１の比較例として、４つのコイル４０Ａ～４０Ｄを直列接続したコイルユニット（図９～図１１に示す第３の実施形態参照）と、第２の比較例として４つのコイル４０Ａ～４０Ｄを並列接続したコイルユニット（図１２～図１４に三層並列コイルを第４の実施形態として示す）を想定する。ただし、これらコイルユニットを構成するコイルの線幅やターン数等の形状は、第１の実施形態と同一であるとする。積層コイルユニット３０も、第３，第４の実施形態も、共に４つのコイルを積層しているため、コイル自体のインダクタンスに加えて相互インダクタンスを確保できるので、単層コイルや、同一面内に形成した二重スパイラルコイルに比べて、トータルインダクタンスは増大する点で好ましい。特に、本実施形態のように、Ｎ＝４とすることで、積層による相互インダクタンスの増大効果は大きい。もちろん、Ｎは４以上の偶数として積層コイルユニット３０を構成することができ、Ｎが大きければトータルインダクタンスは大きくなる。

[0036] さらに、積層コイルユニット３０は、第３，第４の実施形態と対比して、Ｑを大きくし易い利点がある。つまり、直列接続のみで構成した第１の比較例（第３の実施形態）は、３つの中でトータルインダクタンスＬは最大となるが、抵抗Ｒも最大となる。よって、$Q=(L/C)^{1/2}/R$の分母も分子も大きくなり、Ｑを大きくすることが困難である。一方、並列接続のみで構成した第２の比較例（第４の実施形態）は、３つの中でトータルインダクタンスＬが最小となるが、抵抗Ｒも最小となる。よって、$Q=(L/C)^{1/2}/R$の分母も分子も小さくなり、Ｑを大きくすることが困難である。

[0037] これに対して、本実施形態の積層コイルユニット３０は、直列接続を含んでいる分、トータルインダクタンスを増大できると共に、並列接続を含んでいる分、トータル抵抗Ｒの増大を抑えることができる。従って、$Q=(L/C)^{1/2}/R$の分母は小さく分子は大きくなり、Ｑを大きくすることが容易となるのである。もし、本実施形態に係る積層コイルユニット３０と同等の特性を確保するのであれば、第１，第２の比較例でのコイルの線幅やターン数の変更やその組み合わせを、試行錯誤で検証して設計する必要がある。

[0038] （２）薄型化

本実施形態の積層コイルユニット３０は、絶縁基板５０Ａ，５０Ｂ，５０Ｃ，５０Ｄを例えばＦＰＣのように薄く形成すれば、導体パターン６０Ａ～６０Ｄの各厚さは０．０３５ｍｍと極薄に形成できる。よって、渦巻状に形成したコイル線を４層積層したものと対比すれば、積層コイルユニット３０の厚さ寸法の改善効果はかなり大きい。薄型化に関しては、図３に示すように、Ｎ＝４個の平面状空芯コイルを（Ｎ－１）＝３枚の絶縁基板に形成するとさらに良い。なお、Ｎの数が多くなれば、基板両面にコイルを形成できる基板数も増やすことができるので、Ｎ個のコイルを製造するのに（Ｎ－２）枚以下の基板を用いることができる。

[0039] 特に、図３に示すように、積層コイルユニット３０を電子機器に搭載する場合には、電子機器内にて積層コイルユニット３０が占めるスペースを縮小でき、電子機器の小型化を維持できる。

[0040] （３）電力伝送効率の向上

図３において、積層コイルユニット３０の伝送面７０は実質的にフラットとすることができる。なぜなら、絶縁基板５０Ｃ上に突出する導電パターン６０Ｄの厚さは０．０３５ｍｍであるからである。なお、図２に示すようにＮ＝４枚の絶縁基板を用いる場合には、伝送面７０は非パターン面とすることができ、伝送面７０をフラットにできる。

[0041] 加えて、積層コイルユニット３０の伝送面７０には、第１，第２の電極パターン５５Ａ，５６Ａや、部品は実装されないので、積層コイルユニット３０の伝送面７０をフラットに維持できる。換言すれば、本実施形態では、積層コイルユニット３０の非伝送面７２に第１，第２の電極パターン５５Ａ，５６Ａを設けているので、半田付けや実装部品の搭載は非伝送面７２側のみで行えば良い。

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[0042] なお、図２に示す第１，第２の電極パターン５５Ａ，５６Ａは、配線をハンダ付けするための形状である。これに代えて、積層コイルユニット３０の非伝送面７２が部品実装面となる場合には、第１，第２の電極パターン５５Ａ，５６Ａは、積層コイルユニット３０の２つの電極を部品実装面に導通させるためのパターンとして形成すれば良く、線幅を広げる必要はない。つまり、第１，第２の電極パターン５５Ａ，５６Ａは、積層コイルユニット３０の２つの端子を取り出すパターンとして機能するものであれば良い。

[0043] 積層コイルユニット３０の伝送面７０が実質的にフラットであると、図３に示すようにその伝送面７０を電子機器２０の筐体２４の内壁に密接することができる。こうして、一次・二次コイル間のギャップを、例えば数mm以内に設定することで、無接点電力伝送の効率を向上させることができる。

[0044] 電力伝送効率の向上の他の理由として、４つの平面状空芯コイル４０Ａ～４０Ｄの各空芯領域には、第１のスルーホール５７Ａ，５７Ｂ，５７Ｃ，５７Ｄ以外のパターンは形成しなくて済む。しかも、第１のスルーホール５７Ａ，５７Ｂ，５７Ｃ，５７Ｄは、４枚の絶縁基板５０Ａ～５０Ｄの平面上で同一位置にて貫通するように一つ設けるだけでよい。

[0045] 後述する他の接続形態では、第１のスルーホールは絶縁基板の平面上で同一位置にて貫通するように形成できず、複数個所となる。よって、本実施形態は、空芯領域に存在する導体パターン面積が最小となる。空芯領域は図３に示す磁力線の密度が最も高い領域であり、導体パターンの存在による磁力線への悪影響を最小限にとどめることができる。

[0046] ２．第２の実施形態（２組の直列コイルを並列接続）

図６～図８は、本発明の第２の実施形態を示している。この第２の実施形態の積層コイルユニット１００は、Ｎ＝４個のうちの２個の平面状空芯コイル１１０Ａ，１１０Ｂを直列（広義には直列及び並列の一方である第１の接続形態）接続した１組のコイル接続ユニット１５０（図７，図８参照）と、Ｎ＝４個のうちの他の２個の平面状空芯コイル１１０Ｃ，１１０Ｄを直列（広義には第１の接続形態）接続した他の１組のコイル接続ユニット１５２（図７，図８参照）とを含んでいる。つまり、積層コイルユニット１００は、（Ｎ／２）＝２個のコイル接続ユニット１５０，１５２を含んでいる。この２個のコイル接続ユニット１５０，１５２は、並列（広義には直列及び並列の他方である第２の接続形態）接続されている。

[0047] この第２の実施形態でも、図６に示すように、Ｎ＝４枚の絶縁基板１２０Ａ～１２０Ｄに４つの平面状空芯コイル１１０Ａ～１１０Ｄを形成するための渦巻状導電パターン１３０Ａ～１３０Ｄが設けられている。これに代えて、（Ｎ－１）＝３枚の絶縁基板１２０Ａ～１２０Ｃを用い、中央の絶縁基板１２０Ｂの両面に平面状空芯コイル１１０Ｂ，１１０Ｃが設けられてもよい。

[0048] この第２の実施形態でも、図６に示すように、非伝送面７２側の最端層に位置する絶縁基板１２０Ａの露出面に、（Ｎ／２）＝２組のコイル接続ユニット１５０，１５２のコイル両端部が接続される第１，第２の電極パターン１５６Ａ，１５７Ａが形成されている。

[0049] そして、２組のコイル接続ユニット１５０，１５２を図８のように並列接続し、かつ、そのコイル両端部を第１，第２の電極パターン１５６Ａ，１５７Ａに接続するための２箇所で貫通する２つの第１のスルーホール（１５２Ａ，１５２Ｂ，１５２Ｃ，１５２Ｄ），（１５３Ａ，１５３Ｂ，１５３Ｃ，１５３Ｄ）が、４枚の絶縁基板１２０Ａ，１２０Ｂ，１２０Ｃ，１２０Ｄに貫通形成されている。なお、図７に示すように、平面状空芯コイル１１０Ａ，１１０Ｂの内端同士はスルーホール１５２Ａ，１５２Ｂを介して接続され、他のスルーホール１５２Ｃ，１５２Ｄはダミーのスルーホールである。また、平面状空芯コイル１１０Ｃ，１１０Ｄの内端同士はスルーホール１５３Ｃ，１５３Ｄを介して接続され、他のスルーホール１５３Ａ，１５３Ｂはダミーのスルーホールである。

[0050] また、第１，第２の電極パターン１５６Ａ，１５７Ａを有する絶縁基板１２０Ａに形成された一つの平面状空芯コイル１１０Ａ及びそれに並列接続される他の平面状空芯コイル１１０Ｃの各外端を接続するために、４枚の絶縁基板１２０Ａ～１２０Ｄを貫通する第２のスルーホール（１５４Ａ，１５４Ｂ，１５４Ｃ，１５４Ｄ）が設けられている。ここで、平面状空芯コイル１１０Ａ，１１０Ｃの外端同士はスルーホール１５４Ａ，１５４Ｂ，１５４Ｃを介して、第１の電極パターン１５６Ａに接続されている。他のスルーホール１５４Ｄはダミーのスルーホールである。

[0051] 平面状空芯コイル１１０Ｂ及びそれに並列接続される平面状空芯コイル１１０Ｄの各外端を接続するために、４枚の絶縁基板１２０Ａ～１２０Ｄを貫通する第３のスルーホール（１５５Ａ，１５５Ｂ，１５５Ｃ，１５５Ｄ）が設けられている。なお、平面状空芯コイル１１０Ｂ，１１０Ｄの外端同士はスルーホール１５４Ａ～１５５Ｄを介してを介して、第２の電極パターン１５７Ａに接続されている。

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[0052]　　ここで、図６に示すように、積層コイルユニット１００では、平面状空芯コイル１１０Ａ，１１０Ｃの外端から内端に向かう電流方向Ｂ１，Ｂ３と、平面状空芯コイル１１０Ｂ，１１０Ｄの内端から外端に向かう電流方向Ｂ２，Ｂ４は、図６中にて反時計方向で全て一致する。さらに、４つの平面状空芯コイル１１０Ａ～１１０Ｄの各導電パターン１３０Ａ～１３０Ｄは、内端及び外端形状を除いて一致させることで、コイル間の相互インダクタンスを増加させることができる。

[0053]　　第２の実施形態においても、第１の実施形態と同じく、４つの平面状空芯コイルを直列接続及び並列接続しているので、コイルのQ値は第１の実施形態と同じとなり、コイルのQ値を改善できる。また、積層コイルユニット１００は第１の実施形態と同様に薄型化が可能である。なお、伝送効率に関して言えば、第１，第２の電極パターン１５６Ａ，１５７Ａを非伝送面に形成することで、伝送面をフラットにできる点で第１の実施形態と同じ効果が得られる。ただし、第２の実施形態では、コイルの内端同士を接続するための第１のスルーホール（１５２Ａ，１５２Ｂ，１５２Ｃ，１５２Ｄ），（１５３Ａ，１５３Ｂ，１５３Ｃ，１５３Ｄ）は２箇所に必要となる点で、空芯領域にスルーホールの数が増える。ただし、２箇所に形成される第１のスルーホールを空芯領域の中心からずれた位置に設定することで、磁束への悪影響を低減できる。

[0054]　３．第３の実施形態（４つのコイルの直列接続）

図９～図１１は、第３の実施形態を示している。この第３の実施形態に係る積層コイルユニット２００は、Ｎ＝４個のうちの２個の平面状空芯コイル２１０Ａ，２１０Ｂを直列接続した１組のコイル接続ユニット２５０（図１１参照）と、Ｎ＝４個のうちの他の２個の平面状空芯コイル２１０Ｃ，２１０Ｄを直列した他の１組のコイル接続ユニット２５２（図１１参照）とを含んでいる。この２個のコイル接続ユニット２５０，２５２が直列接続されることで、４つの平面状空芯コイル２１０Ａ～２１０Ｄが直列接続されている。

[0055]　　この第３の実施形態でも、図９に示すように、Ｎ＝４枚の絶縁基板２２０Ａ～２２０Ｄに４つの平面状空芯コイル２１０Ａ～２１０Ｄを形成するための渦巻状導電パターン２３０Ａ～２３０Ｄが設けられている。これに代えて、（Ｎ－１）＝３枚の絶縁基板２２０Ａ～２２０Ｃを用い、中央の絶縁基板２２０Ｂの両面に平面状空芯コイル２１０Ｂ，２１０Ｃが設けられてもよい。

[0056]　　この第３の実施形態でも、図９に示すように、非伝送面７２側の最端層に位置する絶縁基板２２０Ａの露出面に、（Ｎ／２）＝２組のコイル接続ユニット２５０，２５２のコイル両端部が接続される第１，第２の電極パターン２５６Ａ，２５７Ａが形成されている。

[0057]　　そして、２組のコイル接続ユニット２５０，２５２を図１１のように並列接続し、かつ、そのコイル両端部を第１，第２の電極パターン２５６Ａ，２５７Ａに接続するための２箇所で貫通する２つの第１のスルーホール（２５２Ａ，２５２Ｂ，２５２Ｃ，２５２Ｄ），（２５３Ａ，２５３Ｂ，２５３Ｃ，２５３Ｄ）が、４枚の絶縁基板２２０Ａ，２２０Ｂ２２０Ｃ，２２０Ｄに貫通形成されている。なお、図１０に示すように、平面状空芯コイル２１０Ａ，２１０Ｂの内端同士はスルーホール２５２Ａ，２５２Ｂを介して接続され、他のスルーホール２５２Ｃ，２５２Ｄはダミーのスルーホールである。また、平面状空芯コイル２１０Ｃ，２１０Ｄの内端同士はスルーホール２５３Ｃ，２５３Ｄを介して接続され、他のスルーホール２５３Ａ，２５３Ｂはダミーのスルーホールである。

[0058]　　また、平面状空芯コイル２１０Ｂ及び平面状空芯コイル２１０Ｃの各外端を接続するために、４枚の絶縁基板２２０Ａ～２２０Ｄを貫通する第２のスルーホール（２５４Ａ，２５４Ｂ，２５４Ｃ，２５４Ｄ）が設けられている。ここで、平面状空芯コイル２１０Ｂ，２１０Ｃの外端同士はスルーホール２５４Ｂ，２５４Ｃを介して接続され、他のスルーホール２５４Ａ，２５４Ｄはダミーのスルーホールである。

[0059]　　平面状空芯コイル２１０Ｄの外端を第２の電極パターン２５７Ａに接続するために、第３のスルーホール（２５５Ａ，２５５Ｂ，２５５Ｃ，２５５Ｄ）が設けられている。

[0060]　　ここで、図９に示すように、積層コイルユニット２００では、平面状空芯コイル２１０Ａ，２１０Ｃの外端から内端に向かう電流方向Ｃ１，Ｃ３と、平面状空芯コイル２１０Ｂ，２１０Ｄの内端から外端に向かう電流方向Ｃ２，Ｃ４は、図９中にて反時計方向で全て一致する。さらに、４つの平面状空芯コイル２１０Ａ～２１０Ｄの各導電パターン２３０Ａ～２３０Ｄは、内端及び外端形状を除いて一致させることで、コイル間の相互インダクタンスを増加させることができる。

[0061]　　ただし、第３の実施形態では、第１，第２の実施形態とは異なり、４つの平面状空芯コイルを全て直列接続しているので、インダクタンスＬも抵抗Ｒも大きくなり、コイルのQ値は改善されない。ただし、積層コイルユニット２００は第１，第２の実施形態と同様に薄型化が可能である。なお、伝送効率に関して言えば、第１，第２の電極パターン２５６Ａ，２５７Ａを非伝送面に形成することで、伝送面をフラットにできる点で第１，第２の実施形態と同じ効果が得られる。ただし、第３の実施形態では第２の実施形態と同じく、コイルの内端同士を接続するための

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第１のスルーホール（２５２Ａ，２５２Ｂ，２５２Ｃ，２５２Ｄ），（２５３Ａ，２５３Ｂ，２５３Ｃ，２５３Ｄ）は２箇所に必要となる点で、空芯領域にスルーホールの数が増える。ただし、２箇所に形成される第１のスルーホールを空芯領域の中心からずれた位置に設定することで、磁束への悪影響を低減できる。

[0062] ４．第４の実施形態（３つのコイルの並列接続）

図１２～図１４は、第４の実施形態を示している。この第４の実施形態に係る積層コイルユニット３００は、３個の平面状空芯コイル３１０Ａ，３１０Ｂ，３１０Ｃを並列接続したものである。

[0063] この第４の実施形態では、図１２に示すように、３枚の絶縁基板３２０Ａ～３２０Ｃに３つの平面状空芯コイル３１０Ａ～３１０Ｃを形成するための渦巻状導電パターン３３０Ａ～３３０Ｃが設けられ、他の一枚の絶縁基板３２０Ｄは配線専用パターンとして用いている。これに代えて、３枚の絶縁基板３２０Ａ～３２０Ｃを用い、中央の絶縁基板２２０Ｂの両面に平面状空芯コイル２１０Ｂ，２１０Ｃが設けられ、絶縁基板３２０Ｃを配線専用基板として用いてもよい。

[0064] この第４の実施形態でも、図１２に示すように、非伝送面７２側の最端層に位置する絶縁基板３２０Ａの露出面に、並列接続された３つの平面状空芯コイル３１０Ａ～３１０Ｃのコイル両端部が接続される第１，第２の電極パターン３５６Ａ，３５７Ａが形成されている。

[0065] そして、３つの平面状空芯コイル３１０Ａ～３１０Ｃを並列接続し、かつ、そのコイル両端部を第１，第２の電極パターン３５６Ａ，３５７Ａに接続するための第１のスルーホール（３５２Ａ，３５２Ｂ，３５２Ｃ，３５２Ｄ）が、４枚の絶縁基板３２０Ａ，２０Ｂ３２０Ｃ，２０Ｄに貫通形成されている。なお、図１３に示すように、３つの平面状空芯コイル３１０Ａ～３１０Ｃの内端同士はスルーホール３５２Ａ，３５２Ｂ，３５２Ｃを介して接続され、他のスルーホール３５２Ｄと、絶縁基板３２０Ｄに形成された配線パターン３５３Ｄを介して、後述するスルーホール３５５Ｄに接続されている。

[0066] また、３つの平面状空芯コイル３１０Ａ～３１０Ｃの各外端は、４枚の絶縁基板３２０Ａ～３２０Ｄを貫通する第２のスルーホール（３５４Ａ，３５４Ｂ，３５４Ｃ，３５４Ｄ）を介して互いに接続されている。ここで、スルーホール３５４Ｄはダミーのスルーホールである。

[0067] 平面状空芯コイル２１０Ｃの内端を第２の電極パターン３５７Ａに接続するために、第３のスルーホール（３５５Ａ，３５５Ｂ，３５５Ｃ，３５５Ｄ）が設けられている。絶縁基板３２０Ｄに形成されたスルーホール３５５Ｄは、絶縁基板３２０Ｄに形成された配線パターン３５３Ｄ及びスルーホール３５２Ｃ，３５２Ｄを介して、平面状空芯コイル３１０Ｃの内端に接続されている。

[0068] ここで、図１２に示すように、積層コイルユニット３００では、平面状空芯コイル３１０Ａ～３１０Ｃの外端から内端に向かう電流方向Ｄ１～Ｄ３は、図１２中にて反時計方向で全て一致する。さらに、３つの平面状空芯コイル３１０Ａ～３１０Ｃの各導電パターン３３０Ａ～３３０Ｃは、内端及び外端形状を除いて一致させることで、コイル間の相互インダクタンスを増加させることができる。

[0069] 第４の実施形態では、第１，第２の実施形態とは異なり、３つの平面状空芯コイルを全て並列接続しているので、インダクタンスＬも抵抗Ｒも小さくなり、コイルのQ値は改善されない。薄型化に関して言えば、配線パターン３５３Ｄを形成するための配線専用基板が必要となる分、第１，第２の実施形態及び第３の実施形態に対して劣っている。なお、伝送効率に関して言えば、第１，第２の電極パターン３５６Ａ，３５７Ａを非伝送面に形成することで、伝送面をフラットにできる点で第１，第２の実施形態及び第３の実施形態と同じ効果が得られる。また、第４の実施形態では第１の実施形態と同じく、コイルの内端同士を接続するための第１のスルーホール（３５２Ａ，３５２Ｂ，３５２Ｃ，３５２Ｄ）を１箇所に貫通形成すればよい点で、空芯領域にスルーホールの数が増えることはない。

[0070] ５．電気的特性の対比

図１５は、第１，第３及び第４の実施形態について、コイル形状を種々設定して測定したトータルインダクタンスＬ、トータル抵抗Ｒ及び特性Ｑの測定値を示している。ＮＯ．１～ＮＯ．９が第４の実施形態を、ＮＯ．１０～ＮＯ．１８が第３の実施形態を、ＮＯ．１９～ＮＯ．２４が第１の実施形態を示している。

[0071] 共通条件として、コイルの外形とパターン間のギャップを一定にし、かつ、導体厚（パターン厚）を例えば０．０３５mmとした。変更条件は、導体幅（パターン幅）、片側ターン数と、接続形態（第１，第３，第４の実施形態）及び磁性体シート７４（図２参照）の有無である。なお、導体厚については、０．００３５mmに限らず、他の数値を用いることができる。

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[0072]　図１５から、磁性体シート７４を設けることで、トータルインダクタンスが大きくなり、コイルのQ値も改善されていることが分かる。

[0073]　また、上述した理由から、第１の実施形態であるＮＯ．１９～ＮＯ．２４では、導体幅Ｗや片側ターン数を第３，第４の実施形態ほど極端に変更しなくても、コイルのQ値が向上していることが分かる。

[0074]　なお、第２の実施形態については未測定であるが、第１の実施形態とほぼ同じ結果が得られると期待できる。

[0075]　第３の実施形態であるＮＯ．１０～ＮＯ．１８では、導体幅Ｗを比較的広くし、片側ターン数を少なくして、直列接続によるトータル抵抗の増加を抑えている。一方、第４の実施形態であるＮＯ．１～ＮＯ．９では、並列接続により抵抗増加が抑えられるため、導体幅Ｗを比較的狭くして片側ターン数を多く確保することで、トータルインダクタンスを確保できる。

[0076]　なお、上記のように本実施形態について詳細に説明したが、本発明の新規事項および効果から実体的に逸脱しない多くの変形が可能であることは当業者には容易に理解できるものである。従って、このような変形例はすべて本発明の範囲に含まれるものとする。例えば、明細書又は図面において、少なくとも一度、より広義または同義な異なる用語と共に記載された用語は、明細書又は図面のいかなる箇所においても、その異なる用語に置き換えることができる。

[0077]　本実施の形態は、無接点電力伝送に係るものであったが、電磁誘導原理を用いた無接点信号伝送にも同様に適用することができる。

[0078]　本実施の形態は、電力伝送や信号伝送を行うすべての電子機器に適用可能であり、たとえば、腕時計、電動歯ブラシ、電動ひげ剃り、コードレス電話、パーソナルハンディフォン、モバイルパソコン、ＰＤＡ（Personal Digital Assistants）、電動自転車などの二次電池を備える被充電機器と充電機器とに適用可能である。

[0080]　１０　充電器、１２　コイルユニット、２０　電子機器、２２　コイルユニット、２４　筐体、３０，１００，２００，３００　積層コイルユニット、４０Ａ～４０Ｄ、１１０Ａ～１１０Ｄ、２１０Ａ～２１０Ｄ、３１０Ａ～３１０Ｃ　平面状空芯コイル、５０Ａ～５０Ｂ、１２０Ａ～１２０Ｄ、２２０Ａ～２２０Ｄ、３２０Ａ～３２０Ｄ　絶縁基板、６０Ａ～６０Ｄ、１３０Ａ～１３０Ｄ、２３０Ａ～２３０Ｄ、３３０Ａ～３３０Ｃ　導電パターン、５５Ａ，１５６Ａ，２５６Ａ，３５６Ａ　第１の電極パターン、５６Ａ，１５７Ａ，２５７Ａ，３５７Ａ　第２の電極パターン、５７Ａ～５７Ｄ、１５２Ａ～１５２Ｄ、１５３Ａ～１５３Ｄ、２５２Ａ～２５２Ｄ、２５３Ａ～２５３Ｄ　第１のスルーホール、５８Ａ～５８Ｄ、１５４Ａ～１５４Ｄ、２５４Ａ～２５４Ｄ　第２のスルーホール、５９Ａ～５９Ｄ、１５５Ａ～１５５Ｄ、２５５Ａ～２５５Ｄ　第３のスルーホール、８０，１５０　第１のコイルユニット、８２，１５２　第２のコイルユニット

【請求項 1】

無接点電力伝送のための一次側コイル及び二次側コイルの少なくとも一方に用いられる積層コイルユニットであって、

複数個の平面状空芯コイルを有し、

前記複数個の平面状空芯コイルの各々は、絶縁基板上に形成された渦巻状の導電パターンから構成されて、前記絶縁基板の厚さ方向にて積層され、

前記複数個の平面状空芯コイルは、前記複数個の平面状空芯コイルの各２個同士を接続することで形成されるコイル両端部を有し、

前記コイル両端部が接続される第１及び第２の電極パターンが、前記一次側コイル及び二次側コイルのいずれか他方と対向する伝送面とは逆側の非伝送面側の最端層に位置する前記絶縁基板の露出面に形成されていることを特徴とする積層コイルユニット。

【請求項 2】

請求項１において、

前記複数個の平面状空芯コイルの各２個の内端同士を接続するために、前記絶縁基板を貫通して形成された第１

のスルーホールと、

前記複数個の平面状空芯コイルの各２個の外端同士を接続するために、前記絶縁基板を貫通して形成された第２のスルーホールと、

前記コイル両端部の一端を、前記第１及び第２の電極パターンの一方に接続するために、前記絶縁基板を貫通して形成された第３のスルーホールと、

を有することを特徴とする積層コイルユニット。

【請求項 3】
請求項１または２において、

前記複数個の平面状空芯コイルは、それぞれ異なる絶縁基板に形成されていることを特徴とする積層コイルユニット。

【請求項 4】
請求項１乃至３のいずれかにおいて、

複数個の平面状空芯コイルが前記平面状コイルの数よりも少ない数の絶縁基板に形成され、少なくとも１枚の絶縁基板の両面に、２個の平面状空芯コイルが一つずつ形成されていることを特徴とする積層コイルユニット。

【請求項 5】
請求項２において、

前記第１、第２、第３のスルーホールが、前記複数個の平面状空芯コイルが形成された全ての絶縁基板に貫通形成されていることを特徴とする積層コイルユニット。

【請求項 6】
請求項１乃至５のいずれかにおいて、

前記絶縁基板はフレキシブル基板であることを特徴とする積層コイルユニット。

【請求項 7】
請求項１乃至６のいずれかにおいて、

前記非伝送面側の最端層に位置する絶縁基板の前記露出面であって、該絶縁基板に形成された前記平面状空芯コイルを覆う位置に磁性体シートが積層されていることを特徴とする積層コイルユニット。

【請求項 8】
請求項１乃至７のいずれかに記載の前記積層コイルユニットを前記二次側コイルとして含み、充電器に設けられる前記一次側コイルとの間で無接点電力伝送することを特徴とする電子機器。

【請求項 9】
請求項１乃至７のいずれかに記載の前記積層コイルユニットを前記一次側コイルとして含み、電子機器に設けられる前記二次側コイルとの間で無接点電力伝送することを特徴とする充電器。

(57)【要約】
【課題】多層接続されたコイルの両端を外部に接続するための電極の取り出しを工夫して無接点電力伝送の伝送面をフラットにし、伝送効率を向上できる積層コイルユニット並びにそれを用いた電子機器及び充電器の提供。

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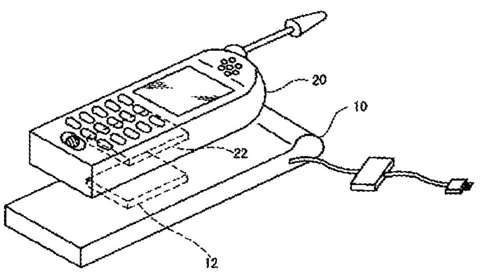
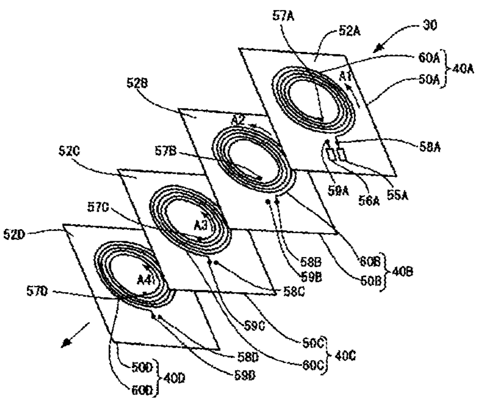
【解決手段】無接点電力伝送のための一次側コイル及び二次側コイルの少なくとも一方に用いられる積層コイルユニットは、複数個の平面状空芯コイルを有し、その各々が絶縁基板上に形成された渦巻状の導電パターンから構成されて、絶縁基板の厚さ方向にて積層される。複数個の平面状空芯コイルは、各２個同士を接続することで形成されるコイル両端部を有する。このコイル両端部が接続される第１及び第２の電極パターンが、一次側コイル及び二次側コイルのいずれか他方と対向する伝送面とは逆側の非伝送面側の最端層に位置する絶縁基板の露出面に形成されている。

【選択図】図２

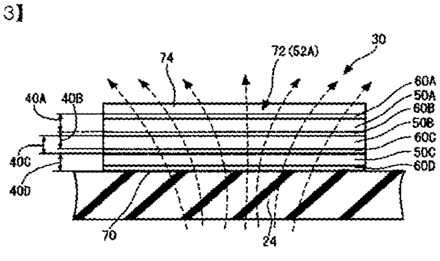
【図 1】



【図 2】



【図 3】



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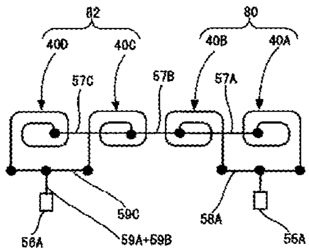
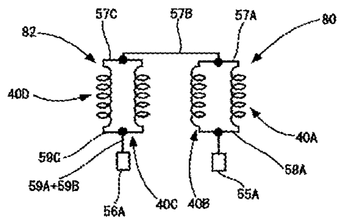
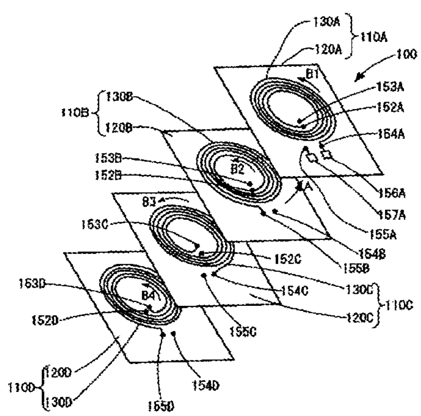
【図 4】


82
80
40D
40C
40B
40A
57C
57B
57A
59C
58A
56A
59A+59B
56A

【図 5】


57C
57B
57A
80
82
40D
40A
59C
58A
59A+59B
56A
40C
40B
55A

【図 6】


130A
120A
110A
100
B1
153A
152A
154A
110B
130B
120B
153B
152B
B2
156A
157A
155A
154B
155B
B3
153C
152C
154C
130C
110C
120C
155C
153D
B4
152D
110D
120D
130D
154D
155D

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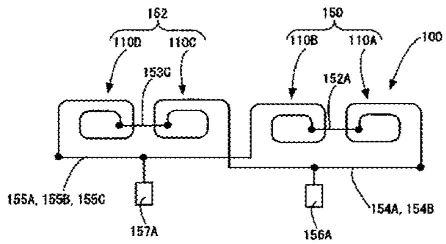
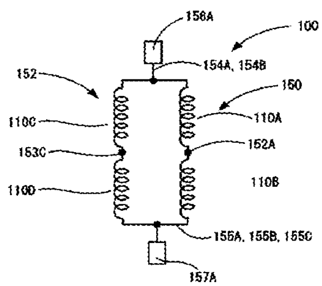
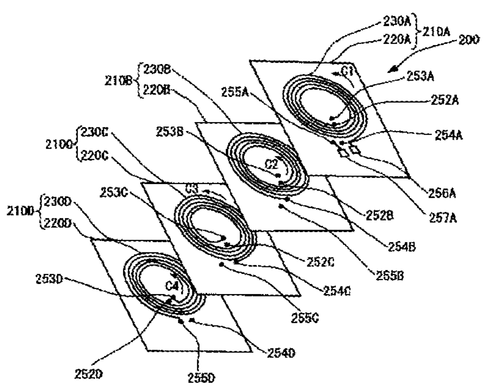
【図 7】


162
110D
110C
153C
150
110B
110A
100
152A
155A, 155B, 155C
157A
156A
154A, 154B

【図 8】


156A
100
154A, 154B
152
150
110C
110A
153C
152A
110D
110B
155A, 155B, 155C
157A

【図 9】


230A
220A
210A
200
210B
230B
220B
255A
C1
253A
252A
254A
253B
210C
230C
220C
C2
256A
257A
252B
254B
255B
C3
253C
210D
230D
220D
252C
254C
255C
253D
C4
254D
252D
255D

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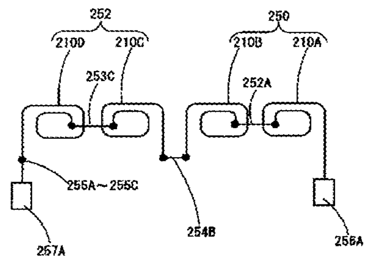
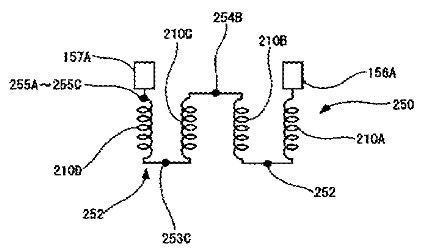
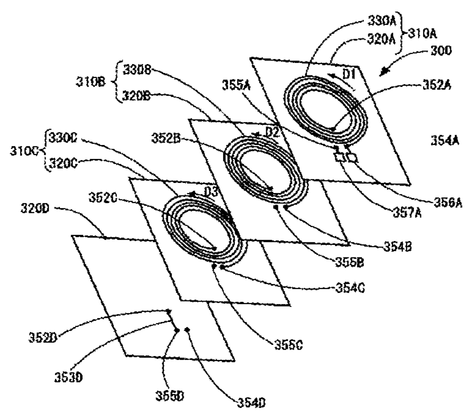
【도 10】



【도 11】



【도 12】



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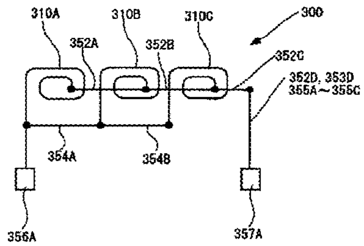
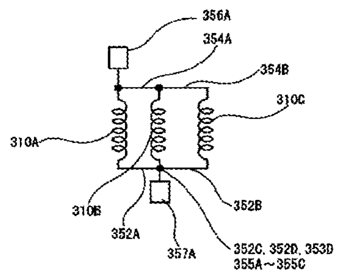
【図 13】



【図 14】



【図 15】

NO.	導体厚	片側ターン	ギャップg	接続	備考	磁性体なし			磁性体あり		
						L	R	Q	L	R	Q
1	0.035	20.0	0.1	3層並列	4層目は引き出し線	7.806	0.875	7.3	12.332	0.771	10
2	0.035	18.0	0.1	3層並列	4層目は引き出し線	7.161	0.642	7	11.256	0.731	9.7
3	0.035	18.0	0.1	3層並列	4層目は引き出し線	8.364	0.834	6.3	9.861	0.718	8.6
4	0.035	16.0	0.1	3層並列	4層目は引き出し線	5.022	0.434	7.3	7.801	0.501	9.9
5	0.035	14.0	0.1	3層並列	4層目は引き出し線	4.475	0.394	7.1	6.993	0.457	9.6
6	0.035	12.0	0.1	3層並列	4層目は引き出し線	3.815	0.355	6.8	5.981	0.406	9.2
7	0.035	14.0	0.1	3層並列	4層目は引き出し線	3.657	0.312	7.3	5.709	0.371	9.7
8	0.035	12.0	0.1	3層並列	4層目は引き出し線	3.211	0.281	8.9	6.012	0.336	9.4
9	0.035	10.0	0.1	3層並列	4層目は引き出し線	2.672	0.247	6.8	4.146	0.286	9.1
10	0.035	5	0.1	4層直列		7.288	0.615	7.4	11.235	0.952	7.4
11	0.035	4	0.1	4層直列		5.955	0.496	7.5	9.125	0.725	7.9
12	0.035	3	0.1	4層直列		4.251	0.366	7.3	6.459	0.507	8
13	0.035	5	0.1	4層直列		6.142	0.584	6.6	9.375	0.945	6.2
14	0.035	4	0.1	4層直列		5.204	0.465	7	7.958	0.704	7.1
15	0.035	3	0.1	4層直列		3.846	0.344	7	5.836	0.487	7.5
16	0.035	5	0.1	4層直列		5.114	0.583	5.7	7.728	0.957	5.1
17	0.035	4	0.1	4層直列		4.537	0.446	6.4	6.895	0.697	6.2
18	0.035	3	0.1	4層直列		3.478	0.338	6.5	5.305	0.484	6.9
19	0.035	10	0.1	4層（α巻きの並列）		7.641	0.494	9.7	11.834	0.651	11.5
20	0.035	8	0.1	4層（α巻きの並列）		8.203	0.424	9.2	9.645	0.544	11.2
21	0.035	6	0.1	4層（α巻きの並列）		4.442	0.335	6.3	6.83	0.419	10.2
22	0.035	6	0.1	4層（α巻きの並列）		4.887	0.34	9	7.604	0.488	10.2
23	0.035	6	0.1	4層（α巻きの並列）		3.7	0.272	8.5	5.692	0.36	9.9
24	0.035	4	0.1	4層（α巻きの並列）		2.244	0.198	7.2	3.383	0.244	6.7

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(72)発明者　黒田　真朗
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内
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16-16

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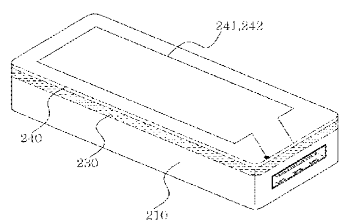
(71) Applicant: • ANYQUITOUS CO., LTD.
(72) Inventor: • KIM, JU JUNG

(54) APPARATUS FOR CHARGING A BATTERY OF A MOBILE COMMUNICATION TERMINAL USING WIRELESS FREQUENCY OF RFID READER, CHARGING A BATTERY WITH A POWER INDUCED WITH A MAXIMUM POWER TRANSMISSION EFFICIENCY USING AN RF RESONANT CHARACTERISTIC

(57) Abstract:

PURPOSE: An apparatus for charging a battery of a mobile communication terminal using a wireless frequency of an RFID(Radio Frequency Identifier) reader is provided to charge a battery without an additional charging device by having a hybrid type antenna which produces an induced power and performs an RFID communication.

CONSTITUTION: An apparatus for charging a battery of a mobile communication terminal using a wireless frequency of an RFID reader includes a battery cell(210), a charging circuit module, a ferrite sheet(230), and an FPCB(Flexible Printed Circuit Board)(240). The battery cell has a positive terminal and a negative terminal. The battery cell charges and discharges a power induced through an antenna of the FPCB. The charging circuit module is coupled to a side of the battery cell, separates an RFID communication signal and a battery charging signal, and generates an induced current. The charging circuit module generates and charges a voltage and a current proper for the battery. The ferrite sheet is arranged on an upper part of the battery cell, and removes a noise and a wave of several dozens MHz to several GHz frequencies. The ferrite sheet is formed to increase an efficiency of the induced current which flows on the battery cell through the charging circuit module. An RFID antenna(241) and an RF power receiving antenna (242) are installed on an upper part of the ferrite sheet, and transmits and receives the information with an external RFID reader. The RFID antenna and the RF power receiving antenna are formed on the same line along an edge circumference of the FPCB.



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(71) 출원인
(주)애니퀘터스
경기 안산시 상록구 사동 1271-18 한국생산기술연구원 C동 306호
(72) 발명자
김수정
경기 수원시 권선구 당수동 743번지 한라비발디1차 아파트 105동1601호
(74) 대리인
정상섭

전체 청구항 수 : 총 6 항

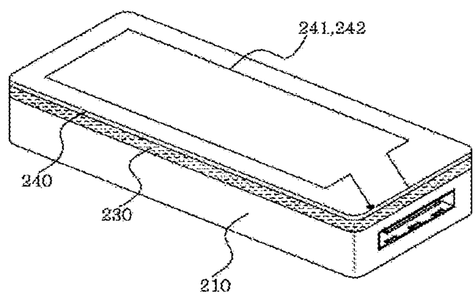
발명의 국문명칭R F I D 리더기의 무선 주파수를 이용한 이동 통신 단말기배터리 충전 장치

(57) 요 약

본 발명은 기존의 유선을 통한 충전 방식이 아니라 RF 공진 특성을 이용하여 이동 통신 단말기의 배터리를 충전하는 것으로, 보다 상세하게는 RFID 안테나가 내장된 이동 통신 단말기에서 안테나를 통해서 유기되는 전력을 이용하여 배터리를 충전하고, 충전시, RFID의 통신 기능에는 전혀 영향을 주지 않도록 하며, 현재 이동통신 단말기에 적용되어진 13.56Mhz RFID 안테나를 이용하여 충전이 가능하도록 구성된다.

그리고, 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)되거나, 또는 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나를 적용하여 외부 RFID 리더기와 정보를 송수신함과 동시에 무선 충전하도록 구성되어, 현재 전세계적으로 구축이 되어 있는 RFID Reader 단말기가 설치된 곳이면 어디서든지 별도의 충전 장치가 없어도 충전이 자유롭게 가능하며, RFID 통신을 이용하는 중에도 자동적으로 배터리 충전을 할 수 있는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치를 제공하는데 그 목적이 있다.

대 표 도 - 도2



특허청구의 범위

청구항 1

이동통신 단말기 본체(100)와, 그 이동통신 단말기 본체(100)의 일측면에 탈부착되면서 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 이용하여 배터리 셀(210)을 충전하는 배터리 팩(200)으로 이루어진 이동통신 단말기에 있어서,

상기 배터리 팩(200)에는 양단자와 음단자를 구비하며 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 충전 및 방전하는 배터리 셀(210)이 형성되고, 그 배터리 셀(210) 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 충전회로 모듈(220)이 PCB기판으로 형성되며, 그 배터리 셀(210) 상단부에 배치되어 수십 MHz~수 GHz의 전파 및 노이즈를 제거하고, 충전회로 모듈을 통해 배터리 셀로 흐르는 유도전류의 효율이 높아지도록 페라이트 시트(230)가 형성되고, 그 페라이트 시트(230)의 상부에 설치되어 외부 RFID 리더기(300)와 정보를 송수신함과 동시에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)(240)의 가장자리 둘레를 따라 동일선상에 13.56MHz RFID 안테나(241)와 RF 전원 수신 안테나(242)가 배선(Wiring)되어 형성되고;

상기 이동통신 단말기 본체(100)에는 배터리 팩(200)의 충전회로 모듈(220)에서 전달된 RFID 통신신호를 분석하고, 처리한 후 응답 신호를 발생시켜 충전회로 모듈(220)로 전송시키는 스마트 카드 및 스마트 IC칩(110)이 내장되어 형성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치.

청구항 2

제1항에 있어서, 충전회로 모듈(220)은

RFID 리더기로부터 유도된 전파를 RF 공진하여 유도 전류를 발생시킴과 동시에 RFID 통신에 필요한 신호와, 배터리 충전에 필요한 신호를 분리하여 전력변환회로부로 전달하는 매칭(공진)·신호 분리 회로부(221,222)와,

그 신호 분리 회로부(222)로부터 배터리 충전용 신호를 받아 충전이 가능한 DC 전압을 생성하는 전력 변환 회로부(223)와,

그 전력 변환 회로부(223)를 통해 생성된 유도 전류를 배터리 전원(4.2V)에 적합한 전압, 전류를 생성하는 배터리 충전회로부(224)와,

그 배터리 충전회로부(224)로부터 생성된 전압, 전류가 배터리에 충전시 과전압 충전 및 과방전 충전되는 것을 방지하는 배터리보호회로부(PCM)(225)로 구성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치.

청구항 3

제2항에 있어서, 신호분리회로부(222)는 그 매칭(공진)회로부에서 선택된 RFID 신호인 신호1(SIG1), 신호2(SIG2)가 입력되면, 캐패시터 C7, C8을 통해 RFID 신호를 전력 변환회로부로 전달하고, 그 캐패시터 C7, C8에 의해서 공급된 신호를 다이오드 D1, D2, D3, D4, 캐패시터 C9에 의해서 DC로 변환시키며, 캐패시터 C11을 통해 평활하여 하이브리드형 안테나 또는 충전 전용 안테나를 접속시에 안테나의 주파수 선택도를 높여주도록 하며, 저항 R1을 통해 충전회로에 전류 공급시 회로상에 과전류가 흐르는 것을 방지하고, 캐패시터 C10, 다이오드 D5를 통해 서지(Surge) 또는 과전압으로 인하여 충전회로가 손상되는 것을 방지하도록 구성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치.

청구항 4

이동통신 단말기 본체(100)와, 그 이동통신 단말기 본체(100)의 일측면에 탈부착되면서 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 이용하여 배터리 셀(210)을 충전하는 배터리 팩(200)으로 이루어진 이동통신 단말기에 있어서,

상기 배터리 팩(200)에는 양단자와 음단자를 구비하며 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 충전 및 방전하는 배터리 셀(210)이 형성되고, 그 배터리 셀(210) 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 충전회로 모듈(220a)이 PCB기판으로 형성되며, 그 배터리 셀(220) 상단부에 배치되어 수십 MHz~수 GHz의 전파 및 노이즈를 제거하고, 충전회로 모듈을 통해 배터리 셀로 흐르는 유도전류의 효율이 높아지도록 페라이트 시트(230)가 형성되고, 그 페라이트 시트(230)의 상부에 설치되어 외부 RFID 리더기(300)와 정보를 송수신함과 동시에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)(240)의 가장자리 둘레를 따라 RFID 안테나(241)가 배선(Wiring)되고, 그 RFID 안테나(241)의 중앙부를 따라 RF 전원 수신 안테나(242)가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나(240a)가 형성되고;

상기 이동통신 단말기 본체(100)에는 배터리 팩의 충전회로 모듈(220a)에서 전달된 RFID 통신신호를 분석하고, 처리한 후 응답 신호를 발생시켜 충전회로 모듈(220a)로 전송시키는 스마트 카드 및 스마트 IC칩(110)이 내장되어 형성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치.

청구항 5

제3항에 있어서, 충전회로 모듈(220a)은 RFID 리더기(300)로부터 유도된 전파 중 RFID 안테나(241)로부터 전송된 RFID 통신신호를 입력받아 이동통신 단말기의 본체에 있는 스마트 카드 및 스마트 IC칩으로 전송하는 제1 안테나 매칭(공진)회로부(220a-1)와,

FID 리더기로부터 유도된 전파 중 RF 전원 수신 안테나로부터 전송된 배터리 충전신호를 입력받아 전력 변환 회로부로 전송하는 제2 안테나 매칭(공진)회로부(220a-2)와,

그 제2 안테나 매칭(공진)회로부(220a-2)로부터 배터리 충전용 신호를 받아 충전이 가능한 DC 전압을 생성하는 전력 변환 회로부(220a-3)와,

그 전력 변환 회로부(220a-3)를 통해 생성된 유도 전류를 배터리 전원(4.2V)에 적합한 전압, 전류를 생성하는 배터리 충전회로부(220a-4)와,

그 배터리 충전회로부(220a-4)로부터 생성된 전압, 전류가 배터리에 충전시 과전압 충전 및 과방전 충전되는 것을 방지하는 배터리보호회로부(PCM)(220a-5)로 구성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기배터리충전장치.

청구항 6

이동통신단말기 본체 일측에 매칭(공진)·신호 분리 회로부(221,222), 전력 변환 회로부(223), 배터리 충전회로부(224), 배터리보호회로부(PCM)(225)로 이루어진 충전회로 모듈(220)을 IC칩으로 설치하여, 그 매칭(공진)·신호 분리 회로부(221,222))에서 RFID 리더기(300)로부터 유도된 전파를 RF 공진하여 유도 전류를 발생시킴과 동시에 RFID 통신에 필요한 신호는 다운시키고, 배터리 충전에 필요한 신호만을 분리하여 전력변환회로부로 전달하여 13.56MHz RFID 안테나(241)를 RF 전원 수신 전용 안테나(242)로 변환되도록 구성되는 것을 특징으로 하는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기배터리충전장치.

명 세 서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

[0021] 본 발명은 이동 통신 단말기에 있어서 무선 충전 장치와 안테나 설계 기술에 따른 회로 구성에 관한 것이다.

[0022] 최근, 통신 및 정보 처리 기술이 발달됨에 따라 휴대폰 등과 같이 휴대하기 편리한 휴대용 디바이스들의 사용이

점차적으로 증가되고 있으며, 기술의 발달에 따라 성능이 향상된 새로운 모델의 단말기가 계속적으로 보급되는 추세이다.

[0023] 그리고, 현재 가장 많이 사용되고 있는 이동 통신 단말기의 충전 방식은 도 1에서 도시한 바와 같이, 전용 충전기를 이동 통신 단말기에 접속하거나, 또는 USB 충전기 단자를 이용하여 충전이 있었다.

[0024] 하지만, 이러한 접촉형 충전 방식이나 접촉 단자가 외부로 노출됨에 따른 접촉형 충전 방식의 문제점을 해결하기 위하여 전기적 접촉 없이 자기 결합을 이용하여 배터리를 충전하는 무접점 충전 방식이 사용되고 있다.

[0025] 무접점 충전기에 해당하는 기술로는 선출원 공개된 공개특허공보 제2002-0035242호 '유도 결합에 의한 휴대 이동 장치용 축전지의 비접촉식충전 장치'와 같이 자성체 코어를 이용하여 배터리팩과 충전 장치 사이에 무선통신에 의하여 충전하는 방식, 선출원 공개된 공개특허공보 제2002-0057469호 '코어 없는 초박형 프린트회로기판 변압기 및 그 프린트회로기판 변압기를 이용한 무접점 배터리 충전기'와 같이 권선을 프린트회로기판(PCB : Printed Circuit Board)에 형성한 변압기를 사용하여 자성체 코어의 문제점을 해결하는 방식 등이 제안된 바 있었다.

[0026] 또한, 기존 13.56Mhz RFID 안테나를 이동통신 단말기의 배터리 팩에 설치하여 RFID 리더기와의 무선충전하는 방법이 제시된 바 있었다.

[0027] 하지만, 이러한 종래의 기술들은 정적인 상태의 무선통신을 통한 비접촉식 충전만 할 뿐, 동적인 상태, 즉 이동하고 있는 상태에서 RFID 리더기에 접촉하면 무선충전이 되면서 동시에 외부 RFID리더기와의 통신을 해서 정보교환(모바일 뱅킹, 지하철/버스 요금 결제 등)을 하는 기능은 전혀 구현할 수가 없었다.

[0028] 또한, 배터리 충전 신호와 RFID 통신 신호가 분리되지 않아, 서로간의 간섭에 의해 신호가 상쇄되어 RFID 통신이 불통되는 문제점이 발생되었다.

발명이 이루고자 하는 기술적 과제

[0029] 상기의 문제점을 해결하기 위해 본 발명에서는, RF 공진 특성을 이용하여 최대 전력 전달 효율로 유도된 전력 배터리 충전 가능한 전력으로 변환하여 배터리에 충전하고, RFID 통신이 정상 동작하도록 할 수 있고,

[0030] 현재 이동 통신 단말기에서 사용중인 13.56Mhz RFID 안테나를 이용할 수 있도록 함으로써 기존에 구축된 환경과의 호환성을 유지함과 동시에 별도의 안테나 개발을 필요로 하지 않게 함으로써 본 기술을 즉시 적용할 수 있도록 하며,

[0031] 아울러 안테나 구성을 일체형으로 RFID 통신와 유도 전력을 생산할 수 있는 하이브리드형 안테나를 갖추게 됨으로써 이동 통신 단말기 및 RFID 특성 변화에도 동일한 배터리 충전 효율을 제공할 수 있는 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치를 제공하는데 그 목적이 있다.

발명의 구성 및 작용

[0032] 상기의 목적을 달성하기 위해 본 발명에 따른 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치는,

[0033] 이동통신 단말기 본체(100)와, 그 이동통신 단말기 본체(100)의 일측면에 탈부착되면서 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 이용하여 배터리 셀(210)을 충전하는 배터리 팩(200)으로 이루어진 이동통신 단말기로 이루어지고,

[0034] 상기 배터리 팩(200)에는 양단자와 음단자를 구비하며 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 충전 및 방전하는 배터리 셀(210)이 형성되고, 그 배터리 셀(210) 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 충전회로 모듈(220)이 PCB기판으로 형성되며, 그 배터리 셀(210) 상단부에 배치되어 수십 MHz~수 GHz의 전파 및 노이즈를 제거하고, 충전회로 모듈을 통해 배터리 셀로 흐르는 유도전류의 효율이 높아지도록 페라이트 시트(230)가 형성되고, 그 페라이트 시트(230)의 상부에 설치되어 외부 RFID 리더기(300)와 정보를 송수신함과 동시

에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)(240)의 가장자리 둘레를 따라 동일선상에 13.56MHz RFID 안테나(241)와 RF 전원 수신 안테나(242)가 배선(Wiring)되어 형성되고;

[0035] 상기 이동통신 단말기 본체(100)에는 배터리 팩(200)의 충전회로 모듈(220)에서 전달된 RFID 통신신호를 분석하고, 처리한 후 응답 신호를 발생시켜 충전회로 모듈(220)로 전송시키는 스마트 카드 및 스마트 IC칩(110)이 내장되어 형성됨으로서 달성된다.

[0036] 또한, 본 발명에 따른 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치는,

[0037] 이동통신 단말기 본체(100)와, 그 이동통신 단말기 본체(100)의 일측면에 탈부착되면서 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 이용하여 배터리 셀(210)을 충전하는 배터리 팩(200)으로 이루어진 이동통신 단말기로 이루어지고,

[0038] 상기 배터리 팩(200)에는 양단자와 음단자를 구비하며 플렉시블 프린트 서킷 보드(FPCB)의 안테나를 통해서 유기되는 전력을 충전 및 방전하는 배터리 셀(210)이 형성되고, 그 배터리 셀(210) 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 충전회로 모듈(220a)이 PCB기판으로 형성되며, 그 배터리 셀(220) 상단부에 배치되어 수십 MHz~수 GHz의 전파 및 노이즈를 제거하고, 충전회로 모듈을 통해 배터리 셀로 흐르는 유도전류의 효율이 높아지도록 페라이트 시트(230)가 형성되고, 그 페라이트 시트(230)의 상부에 설치되어 외부 RFID 리더기(300)와 정보를 송수신함과 동시에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)(240)의 가장자리 둘레를 따라 RFID 안테나(241)가 배선(Wiring)되고, 그 RFID 안테나(241)의 중앙부를 따라 RF 전원 수신 안테나(242)가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나(240a)가 형성되고;

[0039] 상기 이동통신 단말기 본체(100)에는 배터리 팩의 충전회로 모듈(220a)에서 전달된 RFID 통신신호를 분석하고, 처리한 후 응답 신호를 발생시켜 충전회로 모듈(220a)로 전송시키는 스마트 카드 및 스마트 IC칩(110)이 내장되어 형성됨으로서 달성된다.

[0040] 본 발명에서는 배터리 셀 상단부에 설치되는 플렉시블 프린트 서킷 보드(FPCB)에, 도 2 및 도 13에서 도시한 바와 같이, 그 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)되도록 구성하거나,

[0041] 또는, 도 3 및 도 14에서 도시한 바와 같이, 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 13.56 MHz RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나를 구성함으로서, 외부 RFID 리더기와 정보를 송수신함과 동시에 무선 충전할 수 있도록 하는데 그 특징이 있다.

[0042] 이하 본 발명의 바람직한 실시예를 첨부된 도면들에 의거하여 상세하게 설명한다.

[0043] 먼저, 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조에 관해 설명한다.

[0044] 도 2는 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)되어 구성된 배터리 팩 구조를 도시한 사시도에 관한 것이고, 도 4는 본 발명에 따른 배터리 팩 구성 요소을 도시한 분해 사시도에 관한 것으로, 이는 배터리 셀(210), 충전회로 모듈(220), 페라이트 시트(230), 플렉시블 프린트 서킷 보드(FPCB)(240)으로 구성된다.

[0045] 상기 배터리 셀(210)은 양단자와 음단자를 구비하며 플렉시블 프린트 서킷 보드(FPCB)의 안테나을 통해서 유기되는 전력을 충전 및 방전한다.

[0046] 상기 충전회로 모듈(220)은 PCB기판으로 이루어져, 배터리 셀 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 것으로, 이는 매칭(공진)·신호 분리 회로부(221,222), 전력 변환 회로부(223), 배터리 충전회로부(224), 배터리보호회로부(PCM)(225)로 구성된다.

[0047] 매칭(공진)·신호 분리 회로부(221,222))는 RFID 리더기(300)로부터 유도된 전파를 RF 공진하여 유도 전류를 발생시킴과 동시에 RFID 통신에 필요한 신호와, 배터리 충전에 필요한 신호를 분리하여 전력변환회로부로 전달하는 역할을 한다.

[0048] 여기서, 매칭(공진)회로부(221)는 도 6에서 도시한 바와 같이, 13.56 MHz RFID 안테나(=ANT1, ANT2)들로부터 유도된 인덕터(L)를 캐패시터 C5, C6와 공진을 형성한다.

[0049] 이때 생성된 공진 주파수는 수학식 1과 같이 표현할 수가 있다.

수학식 1

$$f = \frac{1}{2\pi\sqrt{LC_1}}$$

[0050]

[0051] 여기서, C1=C5+C6이다.

[0052] 이러한 RFID 안테나(=ANT1, ANT2)와 캐패시터 C5, C6공진에 최대 효율을 갖는 RFID 신호는 신호1(SIG1), 신호2(SIG2)를 통해서 신호분리회로부(222)로 전달된다.

[0053] 그리고, 캐패시터 C3, C4는 블로킹 캐패시터로서, RFID 신호를 이동 통신 단말기의 SIM 카드 또는 스마트 IC 칩에 신호를 전달하는 역할과 함께 다른 회로에서 DC전압이 인가되는 것을 방지하는 역할을 한다.

[0054] 캐피시터 C1, C2는 SIM 카드 또는 스마트 IC 칩의 급격한 충격 신호를 방지하는 서지보호 캐패시터(Surge Protection Capacitor)이다.

[0055] 그리고, 신호분리회로부(222)에는 도 7에서 도시한 바와 같이, 매칭(공진)회로부에서 선택된 RFID 신호인 신호1(SIG1), 신호2(SIG2)가 입력된다.

[0056] 캐패시터 C7, C8은 RFID 신호를 전력 변환회로부로 전달하는 역할을 하고, 캐패시터 C11은 하이브리드형 안테나 또는 충전 전용 안테나를 접속시에 안테나의 주파수 선택도를 높여주는 역할을 한다.

[0057] 캐패시터 C7, C8에 의해서 공급된 신호는 다이오드 D1, D2, D3, D4, 그리고, 캐패시터 C9에 의해서 DC로 변환된다.

[0058] 저항 R1은 충전회로에 전류 공급시 회로상에 과전류가 흐르는 것을 방지하는 역할을 하고, 캐패시터 C10, 다이오드 D5는 서지(Surge) 또는 과전압으로 인하여 충전회로가 손상되는 것을 방지하는 역할을 한다.

[0059] 전력 변환 회로부(223)는 그 신호 분리 회로부(222)로부터 배터리 충전용 신호를 받아 충전이 가능한 DC 전압을 생성한다.

[0060] 배터리 충전회로부(224)는 그 전력 변환 회로부를 통해 생성된 유도 전류를 배터리 전원(4.2V)에 적합한 전압, 전류를 생성하여 배터리보호회로부(PCM)로 전달하는 역할을 한다.

[0061] 배터리보호회로부(PCM)(225)는 그 배터리 충전회로부로부터 생성된 전압, 전류가 배터리에 충전시 과전압 충전 및 과방전 충전되는 것을 방지하는 역할을 한다.

[0062] 이러한 본 발명에 따른 매칭(공진)·신호 분리 회로부(221,222), 전력 변환 회로부(223), 배터리 충전회로부(224), 배터리보호회로부(PCM)(225)로 이루어진 충전회로 모듈(220)은 도 8에 도시한 바와 같이, PCB기판으로 형성되어 배터리팩에 구성하고, 스마트 카드 및 스마트 IC 칩(110)은 이동통신 단말기 본체에 구성할 수가

있다.

[0063] 여기서, 매칭(공진)·신호 분리 회로부(221,222)는 배터리 팩에서 RFID 통신신호를 수신받아 이동통신단말기에 내장된 스마트 카드 및 스마트 IC 칩(110)에 전달한다. 그리고, 이동통신 단말기 본체(100)에 설치된 스마트 카드 및 스마트 IC 칩(110)에서는 RFID 통신신호를 분석하고 처리한 후 응답 신호를 발생하여 배터리 팩에 설치된 충전회로 모듈부의 매칭(공진)·신호 분리 회로부(221,222)로 전송한다. 이때 신호분리 회로부(222)는 응답 신호를 다른 회로의 영향으로 인해서 신호의 감쇄 및 오류가 없도록 제어한 후 RFID 안테나(241)를 통해서 RFID 리더기(300)로 다시 전달한다.

[0064] 또한, 도 9에 도시한 바와 같이, 전력 변환 회로부(223), 배터리 충전회로부(224), 배터리보호회로부(PCM)(225)로 충전회로 모듈을 형성하여 배터리 팩(210)에 구성하고, 이동통신 단말기 본체(100)에 스마트 카드 및 스마트 IC 칩(110), 그리고 매칭(공진)·신호 분리 회로부(221,222)를 구성할 수가 있다.

[0065] 여기서, RFID 안테나(241)로부터 전달된 RFID 통신신호는 배터리 팩(210)을 거치지 않고, 바로 이동통신 단말기 본체의 매칭(공진)·신호 분리 회로부(221,222)로 전달할 수가 있다.

[0066] 또한, 도 10에 도시한 바와 같이, 배터리보호회로부(PCM)(225)만을 배터리 팩(210)에 구성하고, 매칭(공진)·신호 분리 회로부(221,222), 전력 변환 회로부(223), 배터리 충전회로부(224)로 이루어진 충전회로 모듈을 이동통신 단말기 본체의 스마트 카드 및 스마트 IC 칩 일측에 구성할 수가 있다.

[0067] 여기서, RFID 안테나(241)로부터 전달된 RFID 통신신호는 배터리 팩을 거치지 않고, 바로 이동통신 단말기 본체(100)의 매칭(공진)·신호 분리 회로부(221,222)로 전달하고, 배터리 충전회로부(224)에서 생성된 전압, 전류를 배터리 보호회로부(PCM)(225)로 전달하여 배터리를 충전시킬 수가 있다.

[0068] 또한, 도 11에 도시한 바와 같이, 매칭(공진)·신호 분리 회로부(221,222)와, 배터리보호회로부(PCM)(225)로 이루어진 충전회로 모듈을 배터리 팩(210)에 구성하고, 전력 변환 회로부(223), 배터리 충전회로부(224)를 이동통신 단말기 본체의 스마트 카드 및 스마트 IC 칩(110) 일측에 구성할 수가 있다.

[0069] 여기서, 매칭(공진)·신호 분리 회로부(221,222)는 배터리 팩(110)에서 RFID 통신신호를 수신받아 이동통신단말기(100)에 내장된 스마트 카드 및 스마트 IC 칩(110)에 전달한다. 그리고, 이동통신 단말기 본체(100)에 설치된 스마트 카드 및 스마트 IC 칩(110)에서는 RFID 통신신호를 분석하고 처리한 후 응답 신호를 발생하여 배터리 팩(210)에 설치된 충전회로 모듈부의 매칭(공진)·신호 분리 회로부(221,222)로 전송한다. 이때 신호분리 회로부는 응답 신호를 다른 회로의 영향으로 인해서 신호의 감쇄 및 오류가 없도록 제어한 후 RFID 안테나(241)를 통해서 RFID 리더기(300)로 다시 전달하고, 배터리 충전용 신호를 이동통신 단말기 본체의 전력변환회로부로 전달하여 배터리를 충전시킬 수가 있다.

[0070] 상기 페라이트 시트(230)는 평판형상으로 배터리 셀과 플렉시블 프린트 서킷 보드(FPCB) 사이에 형성되어, 배터리 셀 상단부에 배치되어 수십 MHz~수 GHz의 전파 및 노이즈를 제거하고, 충전회로 모듈을 통해 배터리 셀로 흐르는 유도전류의 효율이 높아지도록 구성되는 것으로, 본 발명에 사용되는 페라이트 시트는 자성재료로, 사용 주파수가 5kHz ~ 2MHz이고, 용량이 5W-100W이며, 얇은 강판으로 형성된다. 이러한 페라이트 시트는 기존 권선형 트랜스포머에 비해 열적저항(thermal resistance)이 낮고, 권선형 제품보다 무게와 크기를 혁신적으로 줄일 수 있고(approx. 1cc per 40W), 효율(Efficiency)이 기존제품보다 10% 향상되며, 낮은 누설 인덕턴스와 전자파 장애를 최소화할 수 있는 특성을 가진다.

[0071] 본 발명에서는 이러한 페라이트 시트 대신에 압소버(Absorber), 플렉스-서프레서(Flex-Suppressor)를 사용할 수가 있다.

[0072] 상기 플렉시블 프린트 서킷 보드(FPCB)(240)는 안테나 역할을 하는 동선 패턴의 단선을 방지하는 역할을 하는 것으로, 이는 도 2에서 도시한 바와 같이, 페라이트 시트의 상부에 설치되어 외부 RFID 리더기와 정보를 송수신함과 동시에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56MHz RFID 안테나(241)와 RF 전원 수신 안테나(242)가 배선(Wiring)되어 형성된다.

[0073] 여기서, 플렉시블 프린트 서킷 보드(FPCB)(240)의 가장자리 둘레를 따라 동일선상에 13.56MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)되어 형성될 수 있는 이유는, 그 플렉시블 프린트 서킷 보드(FPCB)의 하단에

설치된 충전회로 모듈의 신호 분리 회로부에서 RFID 통신에 필요한 신호와, 배터리 충전에 필요한 신호를 분리하여 전력변환회로부로 전달할 수 있기 때문이다.

[0074] 그리고, 본 발명에서는 도 15에서 도시한 바와 같이, 기존의 외부 RFID 리더기와 정보를 송수신하는 기능만을 단독으로 수행하도록 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 13.56MHz RFID 안테나(241)만 배선(Wiring)되어 형성된 곳에, 그 13.56MHz RFID 안테나(241)가 RF 전원 수신 안테나(242) 기능을 갖도록 하여 무선충전을 하도록 구성할 수가 있다.

[0075] 그 이유는 이동통신단말기 본체 일측에 매칭(공진)·신호 분리 회로부(221,222), 전력 변환 회로부(223), 배터리 충전회로부(224), 배터리보호회로부(PCM)(225)로 이루어진 충전회로 모듈(220)을 IC칩으로 설치하게 되면, 그 매칭(공진)·신호 분리 회로부(221,222))에서 RFID 리더기(300)로부터 유도된 전파를 RF 공진하여 유도 전류를 발생시킴과 동시에 RFID 통신에 필요한 신호는 다운시키고, 배터리 충전에 필요한 신호만을 분리하여 전력변환회로부로 전달할 수 있기 때문에 기존의 13.56MHz RFID 안테나(241)를 RF 전원 수신 전용 안테나(242)로 변환시킬 수가 있다.

[0076] 다음으로, 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB) (240)의 가장자리 둘레를 따라 13.56 MHz RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나(241)의 중앙부를 따라 RF 전원 수신 안테나(242)가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나(240a) 구조에 관해 설명한다.

[0077] 도 3은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB) (240)의 가장자리 둘레를 따라 RFID 안테나(241)가 배선(Wiring)되고, 그 RFID 안테나(241)의 중앙부를 따라 RF 전원 수신 안테나(242)가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나(240a) 구조를 도시한 사시도에 관한 것으로, 이는 배터리 셀(210), 충전회로 모듈(220a), 페라이트 시트(230), 플렉시블 프린트 서킷 보드(FPCB) (240)로 구성된다.

[0078] 상기 배터리 셀(210), 페라이트 시트(230)는 앞에서 설명한 내용과 동일한 구성으로 이루어진다.

[0079] 상기 충전회로 모듈(220a)은 도 12에 도시한 바와 같이, PCB기판으로 이루어져, 배터리 셀 일측에 연결되어 RFID 통신 신호와 배터리 충전 신호를 분리하고, 유도전류를 생성하며, 배터리에 적합한 전압, 전류를 생성하여 충전시키는 것으로, 이는 도 12에 도시한 바와 같이, 제1 안테나 매칭(공진)회로부(220a-1), 제2 안테나 매칭(공진)회로부(220a-2), 전력 변환 회로부(220a-3), 배터리 충전회로부(220a-4), 배터리보호회로부(PCM) (220a-5)로 구성된다.

[0080] 제1 안테나 매칭(공진)회로부(220a-1)는 RFID 리더기로부터 유도된 전파 중 RFID 안테나로부터 전송된 RFID 통신신호를 입력받아 이동통신 단말기의 본체에 있는 스마트 카드 및 스마트 IC칩으로 전송하는 역할을 한다.

[0081] 제2 안테나 매칭(공진)회로부(220a-2)는 FID 리더기로부터 유도된 전파 중 RF 전원 수신 안테나로부터 전송된 배터리 충전신호를 입력받아 전력 변환 회로부로 전송하는 역할을 한다.

[0082] 전력 변환 회로부(220a-3)는 그 제2 안테나 매칭(공진)회로부(220a-2)로부터 배터리 충전용 신호를 받아 충전이 가능한 DC 전압을 생성한다.

[0083] 배터리 충전회로부(220a-4)는 그 전력 변환 회로부를 통해 생성된 유도 전류를 배터리 전원(4.2V)에 적합한 전압, 전류를 생성하는 역할을 한다.

[0084] 배터리보호회로부(PCM) (220a-5)는 그 배터리 충전회로부로부터 생성된 전압, 전류가 배터리에 충전시 과전압 충전 및 과방전 충전되는 것을 방지하는 역할을 한다.

[0085] 상기 플렉시블 프린트 서킷 보드(FPCB) (240)는 안테나 역할을 하는 동선 패턴의 단선을 방지하는 역할을 하는 것으로, 이는 도 3에서 도시한 바와 같이, 페라이트 시트의 상부에 설치되어 외부 RFID 리더기와 정보를 송수신함과 동시에 무선 충전이 가능하도록 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나(240a)가 형성된다.

[0086] 그리고, 도 3에서 도시한 바와 같이, RF 전원 수신 안테나가 나선형상으로 배선(Wiring)되어 유도 코일이 형성된다.

[0087] 이처럼 RFID 안테나(241)와, RF 전원 수신 안테나(242)가 플렉시블 프린트 서킷 보드(FPCB)(240)내에 일체형으로 구성됨으로서, 신호분리회로부가 없어도 외부 RFID 리더기로 전달된 RFID 통신신호 및 무선 충전신호를 정확하게 식별하여 플렉시블 프린트 서킷 보드(FPCB)의 하단에 설치된 충전회로 모듈의 신호 분리 회로부에서 RFID 통신에 필요한 신호와, 배터리 충전에 필요한 신호를 분리하여 전력변환회로부로 전달할 수가 있다.

[0088] 또한, RFID 안테나의 가장자리를 따라 RF 전원 수신 안테나가 나선형 또는 최적의 형태로 유도 코일이 형성됨으로서, 도 5에서 도시한 바와 같이, RF 전원 수신 안테나에서 발생되는 유도 전파가 배터리셀에서 RF전원 수신 안테나를 방해하는 2차 유도 역전파가 발생하여 충전 효율이 떨어지고, 역전파에 의한 RFID 통신불능이 되는 것을 방지하며, 고주파 노즈를 제거하여 소비전력의 손실을 최소화 시켜 유도 전류의 효율을 극대화시킬 수 있다.

[0089] 이하, RFID 안테나의 가장자리를 따라 RF 전원 수신 안테나가 나선형 또는 구조물의 적합한 유도 코일을 형성하고, 페라이트 시트에 의해서 최상의 유도전류가 발생되는 과정을 구체적으로 설명하기로 한다.

[0090] 일예로, RF 전원 수신 안테나에서 구동되는 최대주파수 140kHz를 통해 나선형상의 유도코일에서 발생되는 초기인덕턴스(L_{pri} : Primary Inductance)는 일예로 수학식 2과 같이 표현할 수가 있다.

수학식 2

$$L_{pri}=\frac{\alpha\max\text{s}\, V_{i(\min)}}{I_{PK}\text{s} f_{\max}}=\frac{0.5\text{s}127V}{0.82V\text{s}140kHz}=553\mu H$$

[0091]

[0092] 여기서, I_{PK}는 정상상태인 경우, RF 전원 수신 안테나의 유도코일에서 흐르는 피크(최고점)전류이고, $V_i(min)$는 플렉시블 프린트 서킷 보드(FPCB)로부터 입력되는 최저직류전압이다.

[0093] 그리고, RF 전원 수신 안테나의 유도코일에 일정시간이 지난 후 낮은 입력전압이 흘렀을때, 그 유도코일 상단부에 형성된 페라이트 시트로 전달되는 최대자속밀도[$B_{max}(Io)$: maximum operating Magnetic flux density]는 일예로 수학식3와 같이 표현할 수가 있다.

수학식 3

$$B_{\max(Io)}\left(\frac{B_{sat(\min)}}{2\sqrt{2}}=\frac{3500G}{2\sqrt{2}}=1237G\right.$$

[0094]

[0095] 여기서, Bsat(min)는 본 발명의 재료인 페라이트 시트(100℃)가 낮은 입력전압상에서 축적되는 자속밀도를 나타낸다.

[0096] 또한, 상기와 같은 초기인덕턴스 및 최대자속밀도를 이용하여 플렉시블 프린트 서킷 보드(FPCB)의 RF 전원 수신 안테나에 부착된 유도 코일간의 최소한의 공극간격(I_g)는 일예로 수학식4과 같이 표현할 수가 있다.

수학식 4

$$I_g=\frac{0.4\pi\text{s}\, L_{Pri}\text{s}\, I_{pk}{}^2\text{s}\, 10^8}{A_C\text{s}\, B_{\max}{}^2}=\frac{0.4\pi\text{s}553\mu H\text{s}\, 0.82A^2\text{s}\, 10^8}{0.6\, cm^2\text{s}\, 1300G^2}=0.046cm$$

[0097]

[0098] 여기서, Ac는 플렉시블 프린트 서킷 보드(FPCB) 일측면에 차지하는 유도코일간의 단면적에 관한 것이다.

[0099] 이러한 특성을 이용하여 본 발명에 따른 유도코일의 공극간격(I_g)는 0.04~0.5㎝로 하여 도 3에서 도시한 바와 같이 플렉시블 프린트 서킷 보드(FPCB) 중앙부에 나선형으로 부착되어 형성된다.

[0100] 여기서, 본 발명에서는 이러한 유도코일의 하단 일측에 페라이트 시트를 구성함으로서, 고주파노이즈를 제거할 수 있어, 소비전력의 손실을 막을 수 있고, 그로 인해 유도전류의 효율이 높아지는 효과가 있다.

[0101] 이하, 본 발명에 따른 RFID 리더기의 무선 주파수를 이용한 이동 통신 단말기 배터리 충전 장치의 구체적인 동작과정에 관해 설명한다.

[0102] 도 8에 도시한 바와 같이, RFID 리더기로부터 방사된 RF 전파가 이동 통신 단말기의 안테나에 도달하게 되고, 여기에 도달된 신호는 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 배선(Wiring)된 13.56 MHz RFID 안테나와 RF 전원 수신 안테나로 유도되어 충전회로 모듈의 매칭(공진)회로부로 전달된다.

[0103] 그 매칭(공진)회로부에서는 유도된 전파가 최대의 효율을 발생하도록 하여 최상의 유도 전류를 생성함과 동시에 RFID 리더기와 이동통신 단말기간의 RFID 통신이 이루어지도록 하는 주파수 선택 기능을 하게 된다.

[0104] 그 매칭(공진)회로부에서 최대의 공진이 이루어질 경우에, 최대의 유도전류를 발생시킴과 동시에 최상의 RFID 통신상태를 전송시킬 수가 있다.

[0105] 이어서, 매칭(공진)회로부에서 이루어진 최대의 공진은 신호분리 회로부에서 RFID 통신에 필요한 신호와, 배터리 충전에 필요한 신호를 분리하여 전력변환 회로부로 전달한다.

[0106] 이어서, 신호분리 회로부는 RFID 리더기에서 발생되는 신호가 전력변환회로부와 배터리 충전회로부에 의해서 신호의 감쇠로 인하여 RFID 통신이 불통되는 현상을 방지할 뿐만 아니라, 이동통신단말기에서 발생되는 RF 통신신호가 정상적으로 RFID 리더기로 방사되도록 하는 역할을 한다.

[0107] 이어서, RFID 리더기로 연속하여 지속적으로 충전을 할 경우에 원하지 않게 RFID 리더기와 이동통신 단말기간의 통신이 발생하게 되므로 이동통신 단말기 프로그램에서 RFID 리더기와의 통신 기능을 일시 중단하거나 분리하여 사용할 수가 있다.

[0108] 이어서, 그 매칭(공진) 및 신호분리 회로부에서 분리된 신호 중 RFID 통신에 필요한 신호는 이동통신단말기에 내장된 스마트 카드 및 스마트 IC 칩을 통해 그 RFID 통신 신호를 분석하고 처리한 후 응답 신호를 발생시켜 매칭(공진) 및 신호분리 회로부로 전송한다. 신호분리회로부에서는 응답 신호를 다른 회로의 영향으로 인해서 신호의 감쇄 및 오류가 없도록 제어한 후 안테나를 통해서 RFID 리더기에 전달한다.

[0109] 또한, 신호분리회로부에서 분리된 신호 중 배터리 충전용 신호는 전력변환 회로에 전달되어 유도전류를 생성하게 되고, 그 생성된 유도전류는 배터리 충전회로에서 배터리에 적합한 전압, 전류를 생성하게 된다.

[0110] 이어서, 배터리 충전회로부에서 생성된 전압, 전류는 배터리보호회로(PCM)를 통해서 배터리를 충전하게 된다.

[0111] 또 다른 일실시예로, 도 12에 도시한 바와 같이, 이는 RFID 통신 안테나 라인과 충전용 안테나 라인이 분리되어 있으므로, 신호분리회로부가 필요없게 된다.

[0112] 그리고, 안테나 라인이 분리되어 있으므로 최고의 공진 효율을 얻기 위해서 각 안테나 라인에 필요로 하는 공진회로를 통해 공진시킨다.

[0113] RFID 리더기로 연속하여 지속적으로 충전을 할 경우 원하지 않게 RFID 리더기와 이동통신 단말기간의 통신이 발생하게 되므로 이동통신 단말기 프로그램에서 RFID 리더기와의 통신기능을 일시 중단하거나 분리하여 사용할 수가 있다.

발명의 효과

[0114] 이상에서 설명드린 바와 같이, 본 발명에서는 RF 공진 특성을 이용하여 최대 전력 전달 효율로 유도된 전력 배터리 충전 가능한 전력으로 변환하여 배터리에 충전하고, RFID 통신이 정상 동작하도록 할 수 있고,

[0115] 현재 이동 통신 단말기에서 사용중인 13.56Mhz RFID 안테나를 이용할 수 있도록 함으로써 기존에 구축된 환경과의 호환성을 유지함과 동시에 별도의 안테나 개발을 필요로 하지 않게 함으로써 본 기술을 즉시 적용할 수 있도록 하며,

[0116] 아울러 안테나 구성을 일체형으로 RFID 통신와 유도 전력을 생산할 수 있는 하이브리드형 안테나를 갖추게 됨으로써, 현재 전세계적으로 구축이 되어 있는 RFID Reader 단말기가 설치된 곳이면 어디서든지 별도의 충전 장치가 없어도 충전이 자유롭게 가능하며, RFID 통신을 이용하는 중에도 자동적으로 배터리 충전을 할 수 있는 좋은 효과가 있다.

도면의 간단한 설명

[0001] 도 1은 종래 전용 충전기를 이용한 기존 충전 방식을 도시한 일실시예도.

[0002] 도 2는 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)되어 구성된 배터리 팩 구조를 도시한 사시도.

[0003] 도 3은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나 구조를 도시한 사시도.

[0004] 도 4는 본 발명에 따른 배터리 팩 구성 요소을 도시한 분해 사시도.

[0005] 도 5는 본 발명에 따른 RFID 리더기의 방출 웨이브(Emitted Wave)를 이용한 이동 통신 단말기 배터리 충전 방식를 도시한 일실시예도.

[0006] 도 6은 본 발명에 따른 충전회로 모듈의 구성요소 중 매칭(공칭)회로도.

[0007] 도 7은 본 발명에 따른 충전회로 모듈의 구성요소 중 신호분리회로 및 전력변환회로도.

[0008] 도 8은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조와 연결된 충전회로 모듈의 구성요소를 도시한 블록도.

[0009] 도 9은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조와 연결된 또 다른 충전회로 모듈의 구성요소를 도시한 블록도.

[0010] 도 10은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조와 연결된 또 다른 충전회로 모듈의 구성요소를 도시한 블록도.

[0011] 도 11은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조와 연결된 또 다른 충전회로 모듈의 구성요소를 도시한 블록도.

[0012] 도 12는 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나와 연결된 충전회로 모듈의 구성요소를 도시한 블록도.

[0013] 도 13은 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 동일선상에 13.56 MHz RFID 안테나와 RF 전원 수신 안테나가 배선(Wiring)된 구조를 도시한 일실시예도.

[0014] 도 14는 본 발명에 따른 플렉시블 프린트 서킷 보드(FPCB)의 가장자리 둘레를 따라 RFID 안테나가 배선(Wiring)되고, 그 RFID 안테나의 중앙부를 따라 RF 전원 수신 안테나가 나선형상으로 추가로 배선(Wiring)되어 라인 분리된 하이브리드형 안테나 구조를 도시한 일실시예도.

[0015] 도 15는 본 발명에 따른 충전회로 모듈을 이동통신단말기 본체에 설치됨으로서, 기존의 13.56MHz RFID 안테나(241)가 RF 전원 수신 안테나(242) 기능을 갖도록 한 호환형 안테나 구조를 도시한 일실시예도.

[0016] ※ 도면 부호의 간단한 설명 ※

[0017] 100 : 이동통신 단말기 본체 110 : 스마트 카드 및 스마트 IC칩

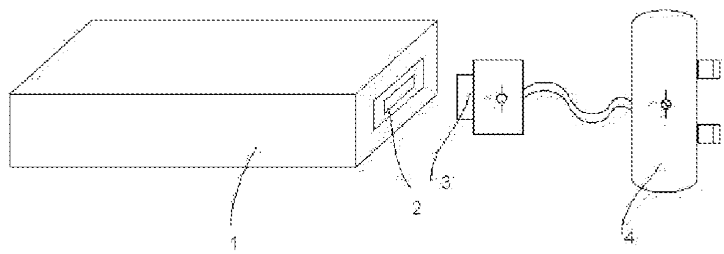
[0018] 200 : 배터리 팩 210 : 배터리 셀

[0019] 220 : 충전회로 모듈 230 : 페라이트 시트

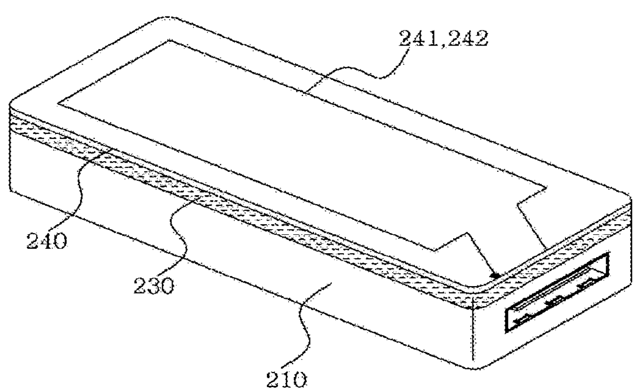
[0020] 240 : 플렉시블 프린트 서킷 보드

도면

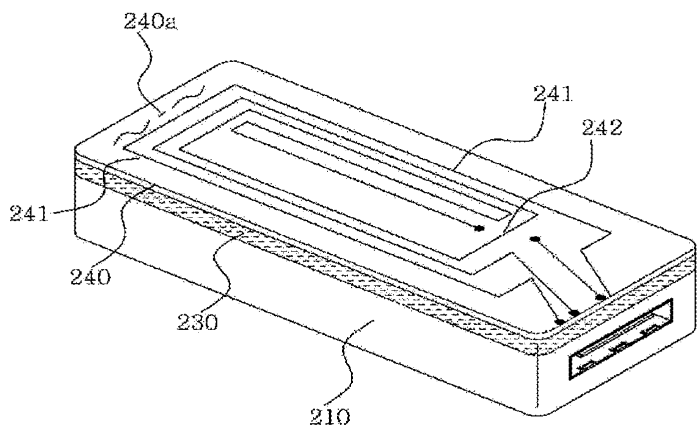
도면1



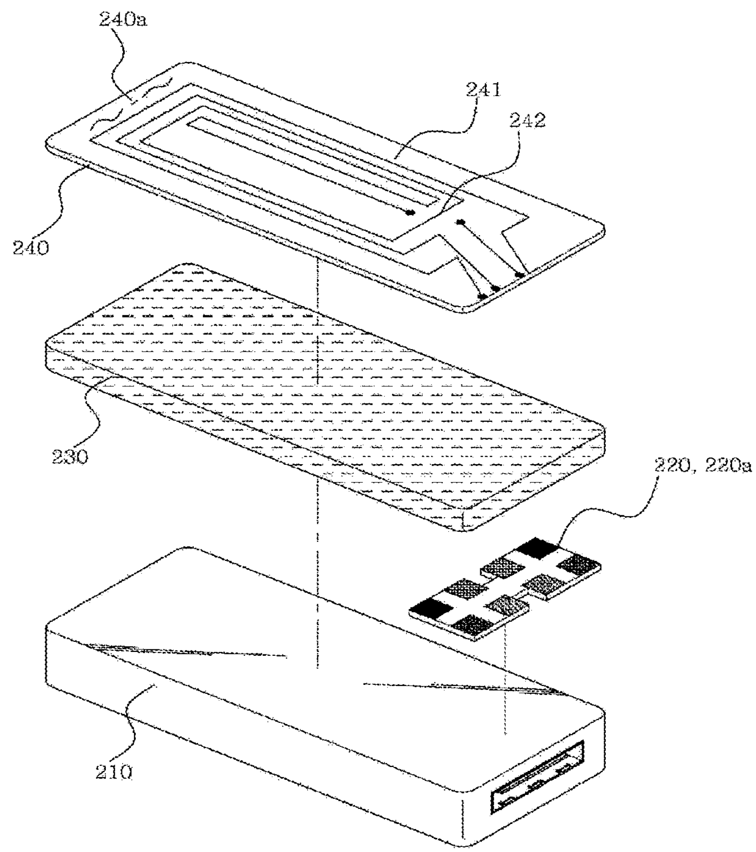
도면2



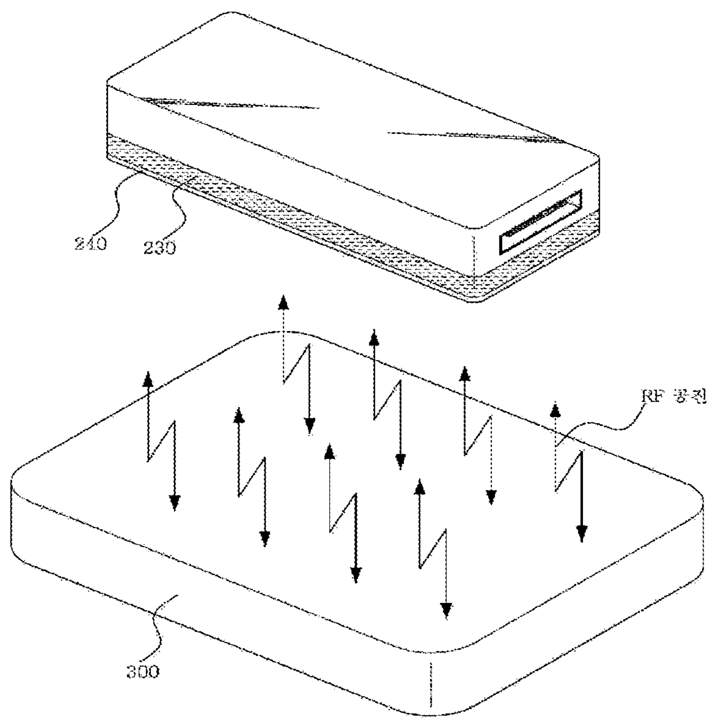
도면3



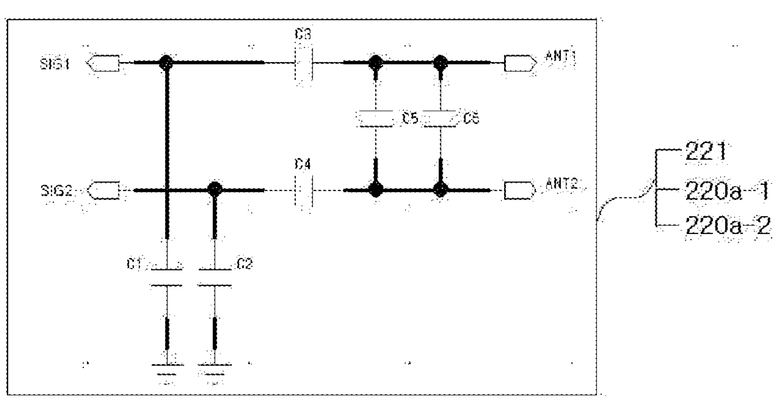
도면4



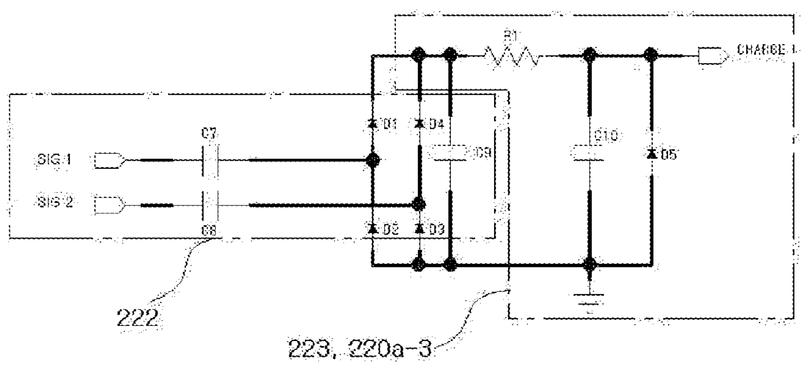
도면5


240
230
RF 공진
300

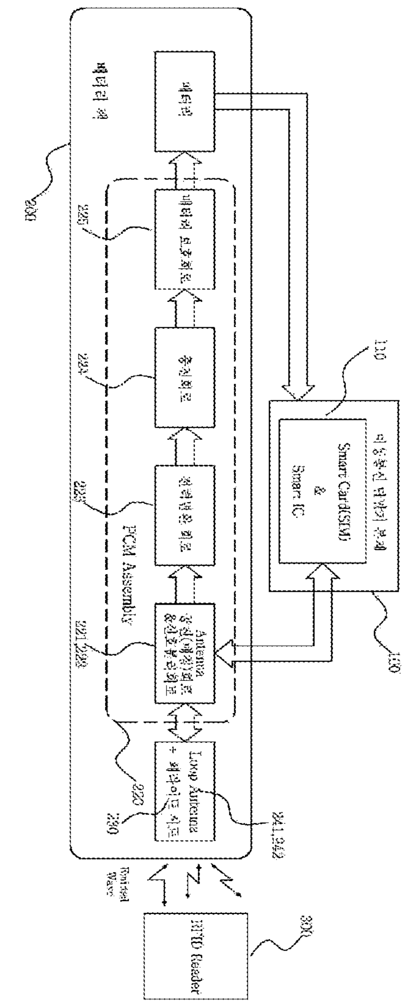
도면6


SIG1
SIG2
C3
C4
C5
C6
C1
C2
ANT1
ANT2
221
220a-1
220a-2

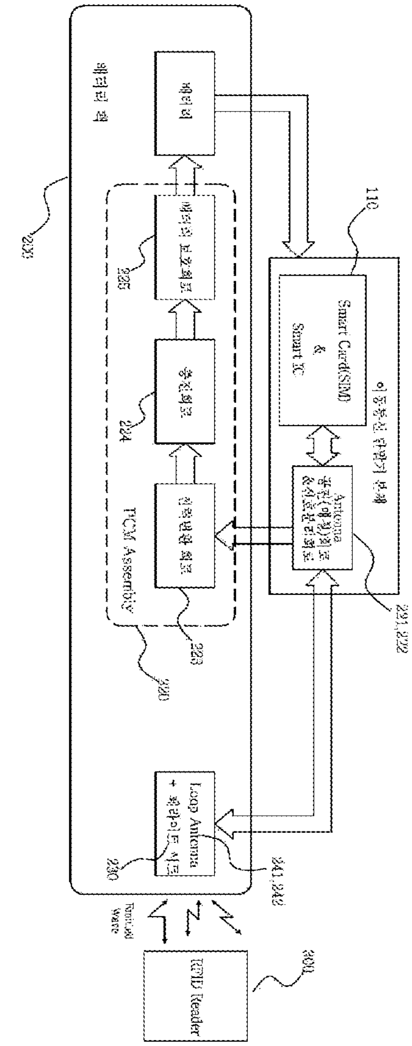
도면7



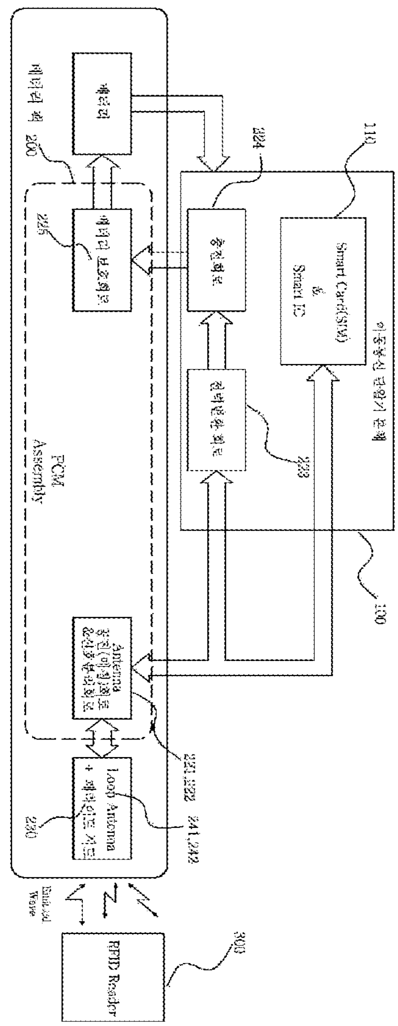
도면8


PCM Assembly
Loop Antenna
Antenna
Smart Card(SIM)
&
Smart IC
RFID Reader
Radiated
Wave
200
110
120
221,228
222
223
224
225
220
230
241,242
300

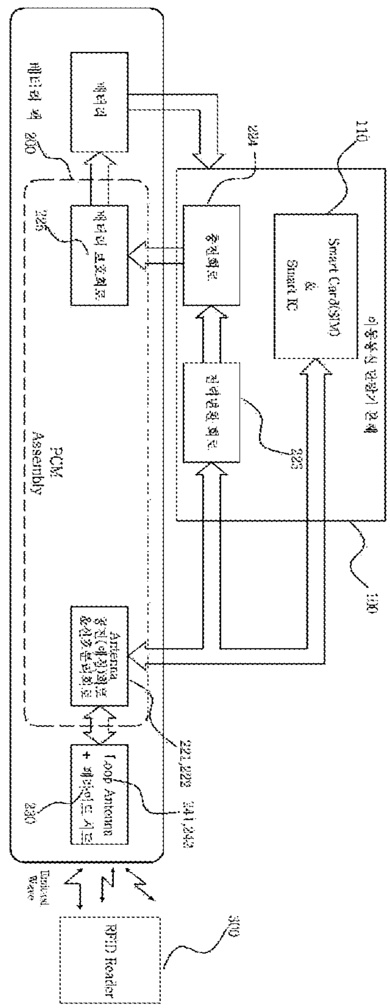
도면9


110
Smart Card(SIM)
&
Smart IC
Antenna
TCM Assembly
Loop Antenna
RFID Reader
220
223
224
225
230
221,222
241,242
300

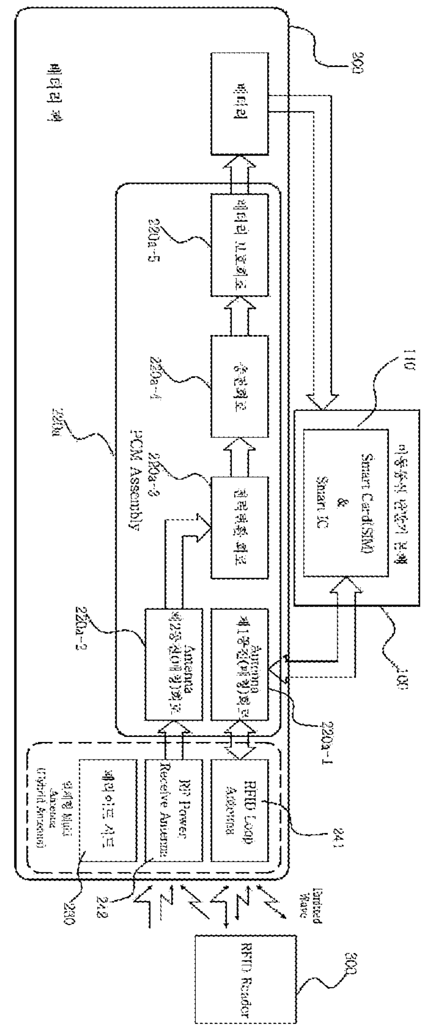
도면10


Smart Card(SIM)
&
Smart IC
PCM
Assembly
Antenna
Loop Antenna
RFID Reader
110
224
225
200
223
100
221,222
241,242
230
300

도면11

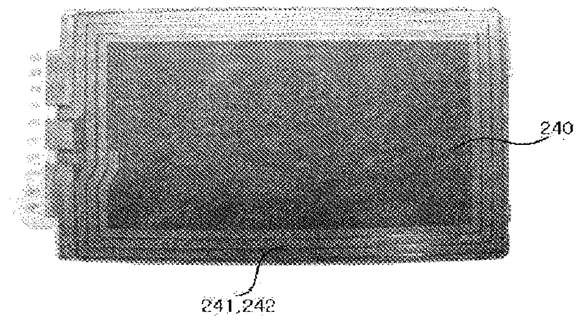

PCM Assembly
Smart Card(SIM) & Smart IC
Antenna
Loop Antenna
RFID Reader
Induced Wave

도면12

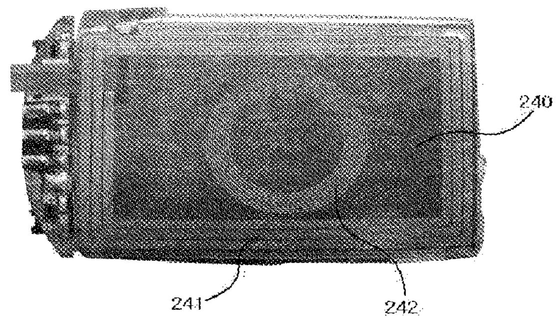

PCM Assembly
Smart Card(SIM)
&
Smart IC
RFID Loop Antenna
RF Power Receive Antenna
RFID Reader
Antenna
Antenna
200
220a
220a-1
220a-2
220a-3
220a-4
220a-5
110
100
241
242
230
300

- 21 -

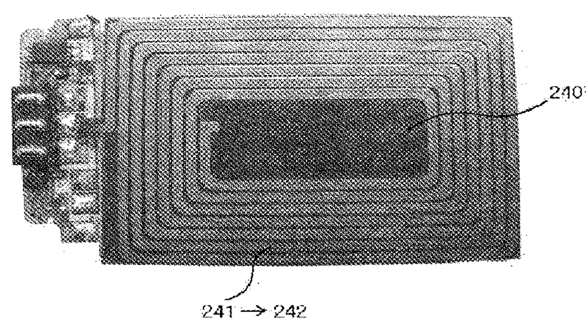
도면13



도면14



도면15



Espacenet

Bibliographic data: KR20120016778 (A) — 2012-02-27

BUILT-IN ANTENNA AND METHOD FOR IMPROVING ANTENNA EFFICIENCY

No documents available for this priority number.

Inventor(s): EOM SANG JIN [KR]; BANG JIN KYU [KR]; KIM HO SAENG [KR]; KIM YONG JIN [KR]; KIM JIN U [KR] + (EOM, SANG JIN, ; BANG, JIN KYU, ; KIM, HO SAENG, ; KIM, YONG JIN, ; KIM, JIN U)

Applicant(s): SAMSUNG ELECTRONICS CO LTD [KR] + (SAMSUNG ELECTRONICS CO., LTD)

Classification: - international: ***H01Q1/16; H01Q1/24; H01Q1/48***
- cooperative: **H01Q1/243; H01Q5/0058; H01Q5/0062; H01Q9/42**

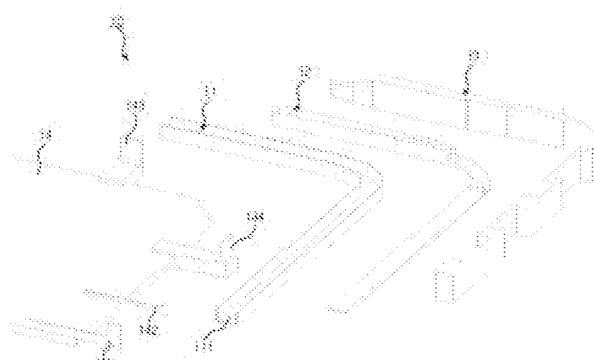
Application number: KR20100079223 20100817

Priority number (s): KR20100079223 20100817

Also published as: US2012044114 (A1)

Abstract of KR20120016778 (A)

PURPOSE: An integrated antenna unit and a method for improving antenna performance are provided to prevent radiation property deterioration by forming one or more parts of a metal structure into a minutely opened structure.
CONSTITUTION: A first conductor(13) is used for ground and has a length. A second conductor(11) has a constant interval in order to be coupled with the first conductor and is arranged side by side with the first conductor. The second conductor is used for power feed. A separating means is placed between the first conductor and the second conductor in order to separate the first conductor and the second conductor. The separating means is a dielectric, a magnetic substance, or hybrid type materials. A metal frame is installed according to a border of a portable terminal. The first conductor and the second conductor are installed side by side with a longitudinal direction of the metal frame.



(19) 대한민국특허청(KR)
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(51) 국제특허분류(Int. Cl.)
H01Q 1/24 (2006.01) *H01Q 1/16* (2006.01)
H01Q 1/48 (2006.01)
(21) 출원번호 10-2010-0079223
(22) 출원일자 2010년08월17일
심사청구일자 없음

(71) 출원인
삼성전자주식회사
경기도 수원시 영통구 삼성로 129 (매탄동)
(72) 발명자
엄상진
인천광역시 계양구 주부토로472번길 33, 4동 292호 (작전동, 삼우아파트)
방진규
경기도 수원시 영통구 덕영대로1555번길 20, 벽적골9단지아파트 945동 510호 (영통동)
(뒷면에 계속)
(74) 대리인
이정순, 권혁록

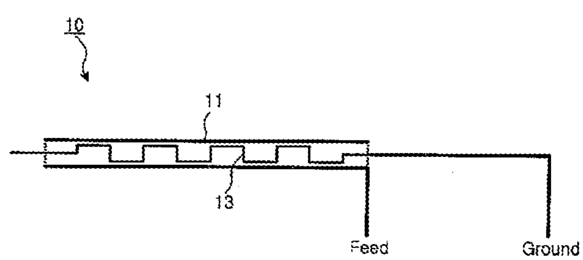
전체 청구항 수 : 총 23 항

발명의 국문명칭내장형 안테나 장치 및 안테나 성능 향상 방법

(57) 요 약

본 발명은 휴대용 단말기의 내장형 안테나 장치에 관한 것으로서, 길이를 가지며 그라운드를 위하여 사용되는 제 1도체와, 상기 제 1도체와 커플링되도록 일정 간격을 가지며 나란히 배치시키되, 급전을 위하여 사용되는 제 2도체 및 상기 제 1도체와 상기 제 2도체를 상호 이격시키기 위하여 그 사이에 개재되는 이격 수단을 포함하여, 금속 구조물이 적용되더라도 항상 원활한 방사 성능이 발현될 수 있으며, 이로 인한 기기의 강성 향상, 미려한 외관 및 슬림화를 구현할 수 있고, 안테나 성능 향상 방법에 따르면 간단한 공정만으로 기존 안테나 방사체의 방사 특성 열화를 방지할 수 있으며, 금속 구조물을 방사체로 이용할 수 있다.

대 표 도 - 도2



(72) 발명자

김호생

경기도 안양시 만안구 안양2동 31-2 2층

김용진

서울특별시 서초구 바우뫼로 91, 105동 1507호 (양재동, 우성아파트)

김진우

서울특별시 관악구 신림동5길 9, 4층 (신림동)

특허청구의 범위

청구항 1

휴대용 단말기의 내장형 안테나 장치에 있어서,

길이를 가지며 그라운드를 위하여 사용되는 제 1도체;

상기 제 1도체와 커플링되도록 일정 간격을 가지며 나란히 배치시키되, 급전을 위하여 사용되는 제 2도체; 및

상기 제 1도체와 상기 제 2도체를 상호 이격시키기 위하여 그 사이에 개재되는 이격 수단을 포함함을 특징으로 하는 내장형 안테나 장치.

청구항 2

제 1항에 있어서,

상기 제 1도체와 제 2도체는 직선, 곡형, 지그재그, 다양한 방향으로 다수번 절곡된 형태 중 어느 하나 또는 그 이상의 조합으로 형성됨을 특징으로 하는 내장형 안테나 장치.

청구항 3

제 1항에 있어서,

상기 제 1도체와 제 2도체의 길이는 서로 같거나 같지 않음을 특징으로 하는 내장형 안테나 장치.

청구항 4

제 1항에 있어서,

상기 제 1도체는 상기 제 2도체와 접촉하지 않으면서 상호 요합되도록 배치됨을 특징으로 하는 내장형 안테나 장치.

청구항 5

제 4항에 있어서,

상기 제 1도체의 단면은 장방형, 원형, 역삼각형, 다수번 절곡된 형태의 역사다리꼴 중 어느 하나로 형성되며, 상기 제 2도체의 단면은 상기 제 1도체를 수용할 수 있는 대응 형상의 단면으로 형성됨을 특징으로 하는 내장형 안테나 장치.

청구항 6

제 1항에 있어서,

상기 제 1도체 및 상기 제 2도체의 단면은 장방형, 원형, 역삼각형, 다수번 절곡된 형태의 역사다리꼴 형태 중 어느 하나로 형성됨을 특징으로 하는 내장형 안테나 장치.

청구항 7

제 1항에 있어서,

상기 제 1도체는 적어도 하나의 부분이 상기 휴대용 단말기의 적소에서 그라운드 됨을 특징으로 하는 내장형 안테나 장치.

청구항 8

제 1항에 있어서,

상기 제 2도체는 적어도 하나의 부분이 상기 휴대용 단말기의 메인 보드에 급전됨을 특징으로 하는 내장형 안테나 장치.

청구항 9

제 1항에 있어서,

상기 이격 수단은 유전체 또는 자성체 또는 하이브리드 타입 물질임을 특징으로 하는 내장형 안테나 장치.

청구항 10

제 9항에 있어서,

상기 이격 수단은 상기 제 1도체와 제 2도체 사이에 개재시키되 적어도 하나의 부분에서 일정 두께 및 폭을 갖도록 배치시킴을 특징으로 하는 내장형 안테나 장치.

청구항 11

제 9항에 있어서,

제 1도체와 제 2도체는 상기 유전체에 인서트 몰딩되는 방식으로 고정됨을 특징으로 하는 내장형 안테나 장치.

청구항 12

제 1항에 있어서,

상기 휴대용 단말기의 테두리를 따라 금속 프레임이 설치되며, 상기 제 1도체와 상기 제 2도체는 상기 금속 프레임의 길이 방향과 나란한 방향으로 설치됨을 특징으로 하는 내장형 안테나 장치.

청구항 13

제 12항에 있어서,

상기 제 1도체는 상기 금속 프레임에 전기적으로 연결되어 그라운드되어짐을 특징으로 하는 내장형 안테나 장치.

청구항 14

제 1항에 있어서,

상기 내장형 안테나 장치는 상기 휴대용 단말기의 메인 보드에 고정시키되, 소정의 지지체에 의해서 고정되거나, 상기 메인 보드상에 본딩되는 방식으로 직접 고정됨을 특징으로 하는 내장형 안테나 장치.

청구항 15

제 1항에 있어서,

상기 제 1도체 또는 제 2도체의 외주면에는 전체 또는 일부분에 유전체 또는 자성체 또는 하이브리드 타입 물질 중 어느 하나로 둘러싸여짐을 특징으로 하는 내장형 안테나 장치.

청구항 16

제 1항에 있어서,

상기 내장형 안테나 장치는 다중 대역 안테나 장치임을 특징으로 하는 내장형 안테나 장치.

청구항 17

제 1항에 있어서,

상기 제 1도체와 제 2도체는 나란히 배치시키되 각 도체의 단면 형상과 길이 방향의 형상은 서로 같지 않음을 특징으로 하는 내장형 안테나 장치.

청구항 18

제 1항 내지 제 17항 중 어느 한 항에 따른 내장형 안테나 장치를 포함함을 특징으로 하는 휴대용 단말기.

청구항 19

휴대용 단말기의 일부에 금속 구조물이 설치 또는 형성되며, 상기 금속 구조물 주변의 단말기 내부에 내장형 안테나 방사체가 설치되는 휴대용 단말기의 안테나 성능 향상 방법에 있어서,

상기 내장형 안테나 방사체 주변의 금속 구조물의 적어도 한 부분을 커팅하여 비교적 미세한 열린 구조로 형성함으로써 상기 금속 구조물을 확장된 그라운드 및 안테나 방사체로써 동작하도록 함을 특징으로 하는 방법.

청구항 20

제 1항에 있어서,

상기 열린 구조는 상기 내장형 안테나 방사체의 급전 부분과 가장 가까운 위치의 금속 구조물에 형성시킴을 특징으로 하는 방법.

청구항 21

제 1항에 있어서,

상기 금속 구조물의 열린 부분은 비도전성 물질로 충진시켜 기계적 강성을 보강함을 특징으로 하는 방법.

청구항 22

제 1항에 있어서,

상기 금속 구조물의 열린 구조 주변에는 기계적 강성 보강을 위하여 보다 폭이 넓은 보강부를 더 형성시킴을 특징으로 하는 방법.

청구항 23

제 19항 내지 제 22항 중 어느 한 항에 있어서,

상기 금속 구조물은 상기 휴대용 단말기의 전면 금속, 전면 데코, 전면에 노출된 브라켓, 단말기의 금속 장식물, 상기 휴대용 단말기의 케이스 프레임 내면에 증착되는 도전성 증착물, 상기 단말기의 내부에 설치되는 가요성 인쇄회로(FPC), 상기 단말기의 테두리를 따라 형성되는 금속 프레임 중 어느 하나 또는 둘 이상의 조합을 사용함을 특징으로 하는 방법.

명 세 서

기 술 분 야

[0001] 본 발명은 내장형 안테나 장치 및 안테나 성능 향상 방법에 관한 것으로서, 특히 단말기의 외관 향상 및 기계적 강성을 확보하기 위하여 적용되는 금속 구조물로 인한 방사 열화를 미연에 방지하고 안테나 방사 특성 향상을 위한 내장형 안테나 장치 및 안테나 성능 향상 방법에 관한 것이다.

배 경 기 술

[0002] 기술의 발전에 따라 이동 통신 기기 뿐만 아니라 미디어 재생기, 전자사전, 타블렛 같은 휴대용 전자기기에 무선 통신 기능이 포함되고 있으며, 이러한 무선 통신 기능을 포함한 휴대용 전자 기기의 사용이 일상화되고 있다. 휴대용 전자 기기를 사용하는 소비자는 다양한 기능을 가지면서 더욱 작은 크기의 기기를 요구하고 있고, 이러한 소비자의 요구를 충족시키기 위해 제조업자들은 휴대용 전자 기기에 사용되는 부품의 크기를 줄이고, 여러 가지 기능을 하나의 부품으로 통합하려는 노력을 하고 있다.

[0003] 이러한 변화는 전파를 송수신하는데 사용되는 안테나 장치에서도 동일하게 일어나고 있다. 다양한 서비스에 필요한 주파수 대역을 하나의 안테나 장치로 가능하게 만들면서 더욱 더 작게 크기를 줄이고자 하는 노력이 끊임없이 진행되고 있다.

[0004] 통상적으로 휴대용 전자 기기에 사용되는 내장형 안테나 장치는 회로 기판상에 금속층을 패턴화하여 안테나 방사체로 사용하도록 제작되거나, 안테나 방사체를 지지하는 유전체 구조물 위에 금속 시트를 패턴화되어 제작되어 지고 있다.

[0005] 일반적으로, 휴대용 전자 기기에 널리 사용되고 있는 내장형 안테나 장치로는 역 F 안테나(PIFA; Planar Inverted F Antenna)와 모노폴 안테나(monopole antenna)가 사용되고 있는데, 이들 안테나 장치의 경우 그 성능 대비 크기를 상호 보완적으로 설계할 수 없는 단점이 있다. 특히 금속 기구물 및 금속 부품이 안테나 가까이 위치하고 있는 경우, 안테나의 방사 효율의 저하와 대역 감소라는 문제점을 가지고 있다.

[0006] 과거 휴대용 전자기기의 경우 안테나가 실장되는 공간이 충분하고 금속과의 충분한 이격 거리를 가지고 있었으며, 제품의 외부 재질 또한 플라스틱 같은 유전체를 이용하는 것이 많아 안테나 디자인에 큰 어려움이 없었다. 하지만 현재의 휴대용 전자 기기는 그 크기가 점점 작아지고 얇아짐에 따라 안테나 장치의 실장을 위한 공간이 더욱 더 줄어 들었고, 주변 금속기구 및 금속 부품과의 거리가 더욱 더 가까워지고 있다.

[0007] 상술한 금속 구조는 기계적 강성의 향상은 물론, 미려한 외관 그리고 기기의 슬림화에 기여하는 바가 크므로 이를 휴대 기기의 일부, 특히 프레임에 적용시키기 위한 시도를 끊임 없이 수행하고 있다.

[0008] 그러나, 상술한 종래의 일반 내장형 안테나 장치는 이러한 극한 주변조건에서 소형화, 효율증대, 넓은 대역과 같은 요구 조건을 충족시키기 어려운 문제를 가지고 있다.

[0009] 이러한 문제점을 해결하기 위한 종래의 방법은 기존의 안테나 장치를 이용하여 좁은 실장 공간 안에서 가능한 금속 기구물과 멀도록 안테나 패턴을 배치시키거나, 안테나가 위치하는 부분의 금속 기구물을 사출로 변경하거나, 안테나가 위치하는 부분의 두께를 늘림으로써 안테나의 성능을 구현해오고 있다. 하지만 안테나 패턴을 금속 부품 및 금속 기구물과 멀리 배치하는 것은 안테나의 실장 공간이 더욱더 작아 짐에 따라 더 이상 공간 확보가 어려우며, 안테나 부분을 사출처리 하는 방법은 방사 성능을 확보하는 것이 용이하나 디자인 측면에서 금속과 사출의 불연속이 존재하여 외관을 디자인을 해치게 된다. 역시, 휴대용 전자기기의 두께를 증가시키는 방법

또한 방사 성능 확보가 가능하나 현재 휴대용 전자기기의 디자인 경향인 슬림화를 만족할 수 없다.

[0010] 역시, 상술한 금속 기구물이 휴대 기기의 전면부에 배치될 경우 메인 그라운드와 연결하여 사용하여 왔다. 이러한 구성은 전형적인 방사 열화 현상을 보인다. 즉, 안테나 전면부에 그라운드에서 연장된 금속 구조가 존재하는 경우, Near-Field는 해당 금속체에 Current를 유기시키고 근처 Lossy Volume 과 함께 Thermal Loss 및 Radiation Loss를 발생시켜 전체적인 방사성능 열화를 일으키게 된다.

[0011] 이러한 문제점을 해결하기 위하여, 안테나 부분의 금속 부분을 사출 처리하고, 나머지 전면부를 금속 처리하는 방법이 사용되었으나, 디자인 측면에서 금속과 사출의 불연속이 존재하는 문제점이 발생하며, 기기의 전면 전체를 금속 처리하고 단말기 두께를 증가시켜 안테나와 전면 금속을 최대한 이격 하는 방법이 있으나, 이는 현재 단말기 설계 경향인 슬림화를 만족할 수 없으며, 단말기 전면부 금속을 메인 그라운드와 분리시키는 방법은 전면 금속을 방사체로 이용할 수 있으나, ESD(Electro-Static Discharge)문제나 인체 영향에 의한 방사 성능 열화 문제를 야기할 수 있다.

[0012]

발명의 내용

해결하려는 과제

[0013] 상술한 문제점을 해결하기 위하여 안출된 것으로서, 본 발명의 목적은 금속 기구물이 존재하더라도 넓은 대역폭 및 우수한 방사 특성을 갖도록 구현되는 내장형 안테나 장치 및 안테나 성능 향상 방법을 제공하는데 있다.

[0014] 본 발명의 다른 목적은 안테나 장치의 우수한 방사 성능을 구현함과 동시에 금속 기구물을 소망하는 위치에 배치하여 단말기의 슬림화 및 강성화에 기여할 수 있도록 구현되는 내장형 안테나 장치 및 안테나 성능 향상 방법을 제공하는데 있다.

[0015] 본 발명의 또 다른 목적은 금속 구조물의 간단한 가공만으로 안테나 장치의 방사 특성 열화를 방지할 수 있고, 상기 금속 구조물을 안테나 방사체로 활용할 수 있도록 구현되는 내장형 안테나 장치 및 안테나 성능 향상 방법을 제공하는데 있다.

과제의 해결 수단

[0016] 상술한 목적을 해결하기 위하여 안출된 것으로서, 본 발명은 휴대용 단말기의 내장형 안테나 장치에 있어서, 길이를 가지며 그라운드를 위하여 사용되는 제 1도체와, 상기 제 1도체와 커플링되도록 일정 간격을 가지며 나란히 배치시키되, 급전을 위하여 사용되는 제 2도체 및 상기 제 1도체와 상기 제 2도체를 상호 이격시키기 위하여 그 사이에 개재되는 이격 수단을 포함한다.

[0017] 바람직하게도, 상기 제 1도체와 제 2도체는 나란히 배치되는 조건하에 각각 다양한 형상의 단면 및 길이 방향으로의 다양한 형상을 가질 수 있다. 이러한 조건은 안테나 방사체를 소형화하면서 방사 특성을 더욱 향상시키는데 일조할 것이다.

[0018] 바람직하게도, 상술한 길이 방향의 커플링 타입 내장형 안테나 장치는 휴대용 단말기의 일부로 적용되는 금속 프레임에 의해 방사 특성 열화를 미연에 방지하는데 도움을 준다. 이는 상기 제 1도체와 상기 제 2도체간의 충분한 길이 방향의 커플링이 매우 큰 커패시턴스를 생성하기 때문에 주변 금속의 영향을 최소화시키는데 기인한다.

[0019] 본 발명은 또한 단말기에 적용되는 금속 구조물에 의한 내장형 안테나 방사체의 방사 특성 열화를 방지하기 위한 방법을 제공한다.

[0020] 따라서 본 발명은 휴대용 단말기의 일부에 금속 구조물이 설치 또는 형성되며, 상기 금속 구조물 주변의 단말기 내부에 내장형 안테나 방사체가 설치되는 휴대용 단말기의 안테나 성능 향상 방법에 있어서, 상기 내장형 안테나 방사체 주변의 금속 구조물의 적어도 한 부분을 커팅하여 비교적 미세한 열린 구조로 형성함으로써 상기 금속 구조물을 확장된 그라운드 및 안테나 방사체로써 동작하도록 함을 특징으로 한다.

[0021] 상기 열린 구조는 상기 안테나 방사체의 급전 부분에서 가장 가까운 부분의 금속 구조물에 적용하는 것이 바람직하다.

발명의 효과

[0022] 본 발명에 따른 내장형 안테나 장치는 기기에 금속 구조물이 적용되더라도 항상 원활한 방사 성능이 발현될 수 있으며, 이로 인한 기기의 강성 향상, 미려한 외관 및 슬림화를 구현할 수 있고, 안테나 성능 향상 방법에 따르면 간단한 공정만으로 기존 안테나 방사체의 방사 특성 열화를 방지할 수 있으며, 금속 구조물을 방사체로 이용할 수 있는 효과가 있다.

도면의 간단한 설명

[0023] 도 1은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 적용된 휴대용 단말기의 도면;

도 2는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 개략적인 구조도;

도 3은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 분리사시도;

도 4는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 결합된 상태를 도시한 사시도;

도 5는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 최적화 전후의 반사 손실 및 대역폭의 변화를 도시한 그래프와, 내장형 안테나 장치의 최적화 전후의 방사 효율을 도시한 그래프;

도 6은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 다양한 형상을 도시한 도면;

도 7은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 개략적인 구조도;

도 8은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 분리사시도;

도 9는 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 결합된 상태를 도시한 사시도;

도 10은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 방사 효율을 도시한 그래프;

도 11은 본 발명의 바람직한 제 3실시예에 따른 내장형 안테나 장치에 적용되는 금속 프레임의 구조를 도시한 도면;

도 12는 본 발명의 바람직한 제 3실시예에 따른 금속 프레임 구조와 기존 금속 프레임 구조에 따른 안테나 방사체의 방사 효율을 비교한 도면;

도 13은 본 발명의 바람직한 제 4실시예에 따른 다양한 금속 프레임의 구조를 도시한 도면;

도 14는 본 발명의 바람직한 제 4실시예에 따른 도 13에 각각 도시된 금속 프레임에 대한 안테나 방사체의 주파수 대역별 방사 효율을 비교한 그래프;

도 15는 본 발명의 바람직한 제 5실시예에 따른 금속 프레임 구조를 도시한 도면; 및

도 16은 본 발명의 바람직한 제 5실시예에 따른 기계적강성 보강 전, 후에 따른 안테나 방사체의 주파수 대역별 방사 효율을 비교한 그래프.

발명을 실시하기 위한 구체적인 내용

[0024] 이하 본 발명의 바람직한 실시예를 첨부된 도면을 참조하여 상세히 설명하면 하기와 같다. 그러나 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우 그 상세한 설명을 생략한다.

[0025] 본 발명에서는 바 타입 단말기를 도시하고 이에 적용되는 휴대용 단말기를 예로 들어 설명하였으나, 이에 국한되지 않는다. 예컨대, 외관을 미려하게 하거나 강성 보강을 위하여 단말기의 일부분 또는 전부로 금속 프레임이 적용되는 다양한 형태의 단말기에 적용 가능할 것이다.

[0026] 도 1은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 적용된 휴대용 단말기(100)의 도면이다.

[0027] 본 도면에서는 바 타입(bar type) 휴대용 단말기를 도시하였으며, 상기 휴대용 단말기(100)의 바디(101)의 테두리를 둘러싸도록 금속 프레임(110)이 적용된다. 상기 금속 프레임(110)은 상기 휴대용 단말기(100)의 외관을 미려하게 할 뿐만 아니라, 강성 보강을 위해서 적용될 수 있을 것이다.

[0028] 이렇게 휴대용 단말기(100)의 바디(101)를 둘러싸며, 전체 또는 일부분에 설치되는 금속 프레임(110)은 상기 휴대용 단말기(100)의 내부에 설치되는 내장형 안테나 장치의 방사 특성을 열화시키고 성능을 저하기시키 때문에 본 발명에 따른 길이 방향을 갖는 내장형 안테나 장치(일명 '레일 안테나 장치')(도 2의 10)를 적용하였다.

[0029] 도 2는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치(10)의 개략적인 구조도로써, 제1도체와 제2도체를 갖는다. 상기 제1도체는 내부 도체(13)로 표현될 수 있으며, 상기 제2도체는 외부 도체(11)로 표현될 수 있을 것이다. 상기 내부 도체(13)와, 상기 외부 도체(11)는 나란히 배치될 수 있을 것이다. 여기서 상기 내부 도체(13)는 상기 휴대용 단말기(100)의 그라운드부에 전기적으로 연결될 것이며, 외부 도체(11)는 상기 휴대용 단말기(100)의 급전부에 전기적으로 연결될 것이다. 그러나 이에 국한되지 않으며, 상기 외부 도체에 그라운드부가, 내부 도체에 급전부가 전기적으로 연결될 수도 있을 것이다.

[0030] 바람직하게도, 상기 내부 도체(13)와 외부 도체(11)는 나란히 길이 방향으로 가지며 지나가되, 서로 물리적 접촉이 되지 않도록 하여 상호 커플링이 발생하도록 한다. 따라서, 상기 내부 도체(13)와 외부 도체(11) 사이에는 상기 내부 도체(13)와 외부 도체(11)를 일정 간격으로 이격시켜줄 수 있는 유전체(도 3의 12) 또는 자성체가 개재될 수 있다. 더욱 바람직하게도, 상기 유전체는 상기 내부 도체와 외부 도체의 길이 방향 모두를 채울 필요는 없으며, 일부에 규칙적으로 또는 불규칙적으로 적어도 하나 이상 채워질 수 있을 것이다. 더욱 더 바람직하게도, 상기 내부 도체(13)와 외부 도체(11)는 같은 길이를 가질 필요가 없으며, 해당 대역의 안테나 방사 특성에 맞도록 길이와 폭을 각각 조절 배치 가능할 것이다.

[0031] 또한, 본 발명에 따른 내장형 안테나 장치(10)는 상기 내부 도체(13)가 상기 외부 도체(11)의 내부에 일정 간격으로 이격되도록 장입된 상태를 도시하고 있으나 이에 국한되지 않는다. 상기 내부 도체(13)와 외부 도체(11)는 길이 방향으로 나란히 배치시키되, 상기 유전체 또는 자성체에 의해 일정 간격으로 이격되도록 분리 배치될 수도 있을 것이다.

[0032] 도 3은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 분리사시도이고, 도 4는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 결합된 상태를 도시한 사시도이다.

[0033] 도 3 및 도 4에 도시한 바와 같이, 상기 휴대용 단말기(100)의 메인 보드(14)에는 그라운드부(141)와 급전부(142)가 설치 또는 형성된다. 도시된 바와 같이, 상기 그라운드부(141)와 급전부(142)는 핀 타입으로 설치되었으나, 상기 메인 보드(14)상에 패턴 타입으로 형성될 수도 있으며, 공지의 가요성 인쇄회로(FPC; Flexible Printed Circuit)로 연결되어도 무방하다.

[0034] 또한, 상기 메인 보드(14)에는 상기 내장형 안테나 장치(10)를 지지하기 위한 적어도 하나의 지지체(143, 144)가 돌출 설치될 수 있다. 그러나 이에 국한되지 않으며, 상기 지지체(143, 144) 없이 직접 내부 도체(13) 또는 외부 도체(11)가 상기 메인 보드에 직접 본딩 등의 공정을 통해 고정될 수도 있을 것이다.

[0035] 상기 외부 도체(11)는 'U' 형상의 슬롯(111)을 포함하도록 형성되며, 메인 보드(14)의 절곡면을 따라 곡형으로 절곡되도록 형성된다. 상기 외부 도체(11)의 슬롯(111)에는 상기 내부 도체(13)가 안착되는 방식으로 길이 방향으로 배치된다. 이때, 상기 내부 도체(13)와 외부 도체(11)는 서로 물리적으로 접촉이 되지 않으며, 이러한 구성을 위하여 테진과 같은 유전체 또는 자성체 또는 하이브리드 타입 블럭 형태가 상기 내부 도체(13)와 외부 도체(11) 사이에 개재 된다. 상기 유전체 (12)또는 자성체는 열손실 방지를 위하여 상기 내부 도체(13)와 외부 도체(11) 사이에 적어도 하나의 부분에서 일부만 개재되는 방식으로 배치될 수 있을 것이다. 상기 내부 도체(130 는 다양한 형상으로 형성될 수 있는데 이는 접지 면적의 확장을 도모할 수 있다. 역시 상기 유전체(12) 또는 자성체는 상기 도체를 감싸거나 지지하는 방식으로 더 설치될 수 있으며, 유전체와 자성체 이외에도 하이브리드 블럭 형태 등 다양한 형태가 사용될 수 있을 것이다. 또한, 상기 유전체(12)에 상기 내부 도체(13) 및/또는 상기 외부 도체(11)가 인서트 몰딩(insert molding)되는 방식으로 설치될 수 있을 것이다.

[0036] 따라서, 상기 내부 도체(13)는 상기 휴대용 단말기(100)의 메인 보드(14)의 그라운드부(141)에 전기적으로 연결될 것이며, 외부 도체(11)는 상기 휴대용 단말기(100)의 메인 보드(14)의 급전부(142)에 전기적으로 연결될 것이다. 그러나 이에 국한되지 않으며, 상기 외부 도체(11)는 상기 금속 프레임에(110) 전기적으로 연결되어 상기 금속 프레임(110)을 접지체로 활용할 수도 있을 것이다. 필요하다면 상기 외부 금속(11)은 적어도 하나의 부분이 상기 급전부(142)와 전기적으로 연결될 수 있으며, 상기 내부 금속(13) 역시 적어도 하나의 부분이 그라운드부(141)에 전기적으로 연결 가능하다. 또는 상기 외부 금속과 내부 금속은 적어도 하나의 부분이 각각 급전 포인트 또는 그라운드 포인트로 연결될 수도 있을 것이다.

[0037] 결과적으로, 본 발명에 따른 안테나 장치(레일 안테나 장치) (10)는 공진 금속과 커플링 금속 사이의 매우 큰 커

패시턴스로 인해 주변 금속(금속 프레임)의 영향을 최소화시킴으로써(영향을 받지 않도록 함으로써) 소망 안테나 방사 패턴 및 비교적 넓은 주파수 대역에서 동작하는 내장형 안테나 방사체를 구현시킬 수 있는 것이다.

[0038] 도면에서 도시한 바와 같이, 내부 금속(13) 및 외부 금속(11)은 상기 메인 보드(14)의 절곡 부분을 따라 곡형으로 절곡되도록 배치되었으나, 이에 국한되지 않으며, 소망하는 충분한 안테나 방사 패턴이 구현된다면 직선형으로 배치되어도 무방할 것이다.

[0039] 도 5는 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 그래프로써, (a)는 최적화 과정 전후의 반사 손실 및 대역폭의 변화를 도시한 그래프이고, (b)는 내장형 안테나 장치의 최적화 과정 전후의 방사 효율을 도시한 그래프이다.

[0040] 여기서, 최적화 과정이란 해당 내부 도체 및 외부 도체의 길이, 형상 등을 고려하고, 개재되는 유전체의 폭, 갯수 등을 결정하며, 급전부 및/또는 그라운드부의 접속 라인에 매칭 회로 등을 사용하여 최적의 안테나 방사체의 최적 방사 특성을 조절하는 과정을 말한다.

[0041] (a)에 도시된 바와 같이, 최전화 전 약 200Mhz이던 대역폭이 최적화 후 810Mhz에서 1120Mhz까지 약 310Mhz정도 확장되는 것을 알 수 있다. 이는 최적화 전 대비 약 32%정도 대역폭이 확장되는 것이다.

[0042] 역시, (b)에 도시된 바와 같이, 최적화 후 소망 대역(LTE 700 및 GSM/CDMA 대역)에서 적어도 80%이상의 방사 효율이 발현됨을 알 수 있었다.

[0043] 도 6은 본 발명의 바람직한 일 실시예에 따른 내장형 안테나 장치의 다양한 형상을 도시한 도면으로써, (a)에 도시한 바와 같이, 본 발명에 따른 안테나 장치는 다양한 형태로 구현될 수 있다. 예를 들어, 한 번 절곡된 형상, 다수번 절곡된 형상, 요철 구조를 가지는 형상 또는 역곡선을 가지는 형상 등 다양한 형태로 적용될 수 있을 것이다.

[0044] 또한, (b)에 도시된 바와 같이, 내부 금속의 단면 역시 다양한 형태로 적용될 수 있는데, 장방형, 원형, 역삼각형, 계단식 역삼각형 등 다양한 형상으로 적용될 수 있으며, 이에 대응되도록 외부 금속 역시 (c)에 도시된 바와 같이 적용될 수 있을 것이다.

[0045] 도 7은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 개략적인 구조도이다.

[0046] 본 발명의 일 실시예에서는 단일 대역을 갖는 내장형 안테나 장치(10)를 기술하였다면, 도 7 내지 도 10은 다중 대역을 갖는 내장형 안테나 장치(20)를 개시하고 있다. 그러나, 기본적으로 길이를 갖는 외부 금속과 상기 외부 금속과 나란히 배치되는 내부 금속의 구조는 유사할 것이다. 역시, 상기 외부 금속과 내부 금속을 비접촉으로 커플링시켜 일정 크기의 커패시턴스를 형성시키기가 위한 다수의 유전체 또는 자성체 또는 하이브리드 타입 블럭을 사용하게 된다.

[0047] 도 7에 도시한 바와 같이, 외부 금속은 일체로 형성되어 있으나, 상대적으로 저주파수 대역에서 동작하는 제1방사부(211)와 고주파수 대역에서 동작하는 제2방사부(212)를 포함한다. 역시 내부 금속은 일체로 형성되어 있으나 상기 제1방사부(211)와 대응되는 제1그라운드부(231)와 상기 제2방사부(212)와 대응되는 제2그라운드부(232)가 배치된다. 각각의 금속의 중앙에는 급전핀과 그라운드핀이 각각 일체로 돌출 형성될 수 있다.

[0048] 도 8은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 분리사시도이고, 도 9는 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 결합된 상태를 도시한 사시도로써, 도 9의 A부분은 도 7의 A부분과 상응하며, 도 9의 B부분은 도 7의 B부분과 상응한다.

[0049] 도 8 및 도 9에 도시한 바와 같이, 내장형 안테나 장치는 다중 대역 안테나 방사체로서 동작한다. 예를 들어, 도 9에 도시한 바와 같이, 점선 A부분은 상대적으로 저주파수 대역에서 동작할 것이며, 점선 B부분은 고주파수 대역에서 동작할 것이다. 그러나, 내부 금속(23)과 상기 내부 금속(23)이 배치되는 외부 금속(21)은 각 방사 영역이 일체로 형성된다.

[0050] 상기 외부 금속(21)은 중앙에 급전핀(213)이 돌출되어 있으며, 상기 급전핀(213)을 중심으로 좌우에 각각 제1방사부(211)와 제2방사부(212)가 길이 방향으로 연장 형성된다. 역시, 상기 내부 금속(23)은 중앙에 그라운드핀(233)이 돌출되어 있으며, 상기 그라운드핀(233)을 중심으로 각각 제1그라운드부(231)와 제2그라운드부(232)가 길이 방향으로 상기 제1방사부(211)와 상기 제2방사부(212)에 나란하게 배치된다. 이때, 상기 내부 금속(23) 및 외부 금속(21) 사이에는 일정 크기를 갖는 적어도 하나의 유전체(22)가 개재될 수 있다. 상기 유전체 대신 자성체 또는 하이드러드 타입 블럭이 개재될 수도 있을 것이다.

[0051] 역시, 상기 내부 금속(23)이 상기 외부 금속(21)에 나란히 안착되는 방식뿐만 아니라 상기 유전체(22)에 의해 상호 이격된 상태에서 상호 요합되지 않고 나란히 배치되는 방식으로 설치될 수도 있을 것이다.

[0052] 상기 외부 금속(21)의 급전핀(213)은 휴대용 단말기의 내부에 설치되는 메인 보드(14)에 급전될 것이며, 상기 내부 금속(21)의 그라운드핀(233)은 상기 휴대용 단말기의 외관의 일부로 적용되는 금속 프레임(110)에 그라운드될 것이다. 그러나 이에 국한되지 않으며, 상기 급전핀(213)은 1개소가 아니라 적어도 하나의 부분에서 급전될 수 있으며, 상기 그라운드핀(233) 역시 메인 보드(14)에 그라운드될 수도 있고, 적어도 하나의 부분이 휴대용 단말기의 상기 금속 프레임(110)을 포함한 주변의 다양한 도전체에 그라운드될 수도 있는 것이다.

[0053] 또한, 본 발명의 일 실시예에서 개시된 바와 같이, 내장형 안테나 장치(20)의 형상이나, 내부 금속(23) 및 이에 대응되는 외부 금속(21)의 단면 형상은 다양한 방식으로 형성될 수 있을 것이다. 즉, 내부 금속(23)의 형상은 요철 구조로 하여 비교적 짧은 전체 길이를 가지면서도 보다 넓은 접지 면적을 확보할 수 있게 되는 것이다.

[0054] 도 10은 본 발명의 바람직한 제 2실시예에 따른 내장형 안테나 장치의 방사 효율을 도시한 그래프로써, 저주파수 대역과 고주파수 대역에서의 방사 효율을 순차적으로 도시하였다.

[0055] 도 10에 도시한 바와 같이, 일반 내장형 안테나 장치의 방사 효율이 30~40%인 것을 감안하면, 저주파수 대역에서 방사 효율이 60%를 상회하며, 고주파수 대역에서도 방사 효율이 40%이상을 상회할 정도로 우수한 특성이 발현됨을 알 수 있었다.

[0056] 도 11은 본 발명의 바람직한 제 3실시예에 따른 내장형 안테나 장치(30)에 적용되는 금속 프레임의 구조를 도시한 도면으로써, 내장형 안테나 장치(30)가 배치되는 주변에 금속 프레임(110)이 적용되는 경우에 사용된다. 상기 금속 프레임(110)은 휴대용 단말기(150)의 데코 역할을 할 뿐만 아니라, 강성 보강 등을 목적으로 사용된다. 그러나, 안테나 방사체(30) 주변에 이러한 이어지는(폐루프 구조의)금속 프레임(110)을 사용하게 되면 그라운드 확장 효과는 있으나, 산란체로 동작하여 내장형 안테나 장치의 방사 효율을 급격히 열화시키게 된다.

[0057] 그러나 도 11에 도시한 바와 같이, 상기 내장형 안테나 방사체(30) 주변의 금속 프레임의 부분(도 11의 C부분)을 미세하게 열린 구조로 형성하면 상기 금속 프레임의 구조가 안테나 방사체(30)의 그라운드 확장 효과를 가짐과 동시에 일종의 안테나 방사체로 동작하여 방사 효율을 개선시킬 수가 있는 것이다.

[0058] 도 11은 휴대용 단말기(150)에 테두리를 따라 금속 프레임(110)이 적용된 상태이고, 상기 금속 프레임(110) 주변에 내장형 안테나 방사체(30)가 설치되며, 단말기 내부에서 상기 내장형 안테나 방사체(30)의 급전부(31)와 그라운드부(32)가 전기적으로 연결된 상태를 도시하고 있다. 이때, 상기 급전부(31)와 가장 가까운 금속 프레임 부분(C부분)을 커팅하여 미세한 열린 구조를 형성함으로써 상기 안테나 방사체(30)의 방사 특성을 개선하였다.

[0059] 도 12는 본 발명의 바람직한 제 3실시예에 따른 금속 프레임 구조와 기존 금속 프레임 구조에 따른 안테나 방사체의 방사 효율을 비교한 도면이다.

[0060] 도 12의 (a)에 도시한 바와 같이, 기존의 닫힌 구조를 갖는 금속 프레임이 적용된 안테나 방사체는 GSM 850, GSM 900, DCS 및 CDMA 대역에서 각각 17%, 18%, 23% 및 27%의 방사 효율을 갖는 반면, (b)에 도시한 바와 같이, 본 발명에 따른 미세한 열린 구조를 갖는 금속 프레임이 적용된, 안테나 방사체는 GSM 850, GSM 900, DCS 및 CDMA 대역에서 각각 26%, 28%, 52% 및 43%의 방사 효율 가짐으로써, 방사 효율이 개선됨을 알 수 있으며, 각 도면의 좌측 방사 패턴도를 보면 고주파수 대역에서의 광대역화가 구현됨을 알 수 있었다.

[0061] 도 13은 본 발명의 바람직한 제 4실시예에 따른 다양한 금속 프레임의 구조를 도시한 도면이다. 도 13에 도시한 바와 같이, (a)는 금속 프레임의 좌, 우를 동시에 커팅한 상태로써, 급전부와 가장 가까운 좌측 부분(C부분)과, 상기 급전부와 가장 먼 이격 거리를 갖는 우측 부분(D부분)이 함께 커팅되어 미세한 열린 구조를 가지고 있다. (b)의 경우는 도 11의 경우와 같으며, (c)의 경우는 상기 급전부와 가장 먼 이격 거리를 갖는 우측 부분(D부분)만 커팅되어 미세한 열린 구조를 갖도록 형성되어 있다.

[0062] 도 14는 본 발명의 바람직한 제 4실시예에 따른 도 13에 각각 도시된 금속 프레임에 대한 안테나 방사체의 주파수 대역별 방사 효율을 비교한 그래프로써, 저주파수 대역과 고주파수 대역에서 모두 급전부와 가장 가까운 위치(C부분)에서 커팅되어 미세한 열린 구조를 갖도록 형성된 도 13의 (b)의 경우가 가장 무난한 동작을 수행함을 알 수 있었다.

[0063] 예컨대, 도 13 및 도 14에 개시된 바와 같이, 상대적으로 방사 특성의 차이는 있으나, 상기 금속 프레임에 어느 곳이든 적어도 하나의 미세한 열린 구조를 갖도록 형성하게 되면, 폐구조를 갖는 금속 프레임보다 좀더 우수한

방사 효율이 발현됨을 확인할 수 있는 것이다.

[0064] 상술한 바와 같이, 닫힌 구조를 갖는 금속 프레임을 적어도 하나의 미세한 열린 구조로 구현하게 되면, 상기 금속 프레임이 적용되는 본래의 목적인 강성 보강에 문제가 발생하게 된다. 따라서, 이러한 문제점을 보완하기 위한 대책이 필요하게 된다.

[0065] 도 15는 본 발명의 바람직한 제 5실시예에 따른 금속 프레임 구조를 도시한 도면으로써, 역시 휴대용 단말기(150)의 내부에 급전부(31)와 그라운드부(32)가 전기적으로 연결되는 내장형 안테나 방사체(30)가 배치된다. 또한, 상기 내장형 안테나 방사체(30) 주변으로 테두리를 따라 금속 프레임(110)이 배치된다. 상기 금속 프레임(110)은 상기 내장형 안테나 방사체(30)의 급전부(31)와 가장 가까운 부분(도 15의 C부분)이 미세한 열린 구조를 가지고 있으며, 금속 프레임의 대향측(도 15의 E부분)에는 내측 방향으로 보강부(115)가 더 형성되어 있다. 상기 보강부(115)는 상기 금속 프레임(110)의 기계적 강성을 보강하기 위한 것으로, 대체적으로 상기 금속 프레임(110)의 단면에서 내측으로 일정 넓이 만큼 연장되어 형성된다.

[0066] 도 16은 본 발명의 바람직한 제 5실시예에 따른 기계적강성 보강 전, 후에 따른 안테나 방사체의 주파수 대역별 방사 효율을 비교한 그래프로써, (A)는 저주파수 대역에서의 방사 효율을 도시하고 있으며, (B)는 고주파수 대역에서의 방사 효율을 도시하고 있다. 도시된 바와 같이, 기계적 강성 보강을 위한 보강부를 적용하기 전과 적용 후의 효율이 현저히 차이가 나지 않음을 알 수 있었다. 즉, 상기 보강부를 추가하여도 소망 방사 특성을 구현할 수 있음을 알 수 있었다.

[0067] 분명히, 청구항들의 범위내에 있으면서 이러한 실시예들을 변형할 수 있는 많은 다양한 방식들이 있다. 다시 말하면, 이하 청구항들의 범위를 벗어남 없이 본 발명을 실시할 수 있는 많은 다른 방식들이 있을 수 있을 것이다.

부호의 설명

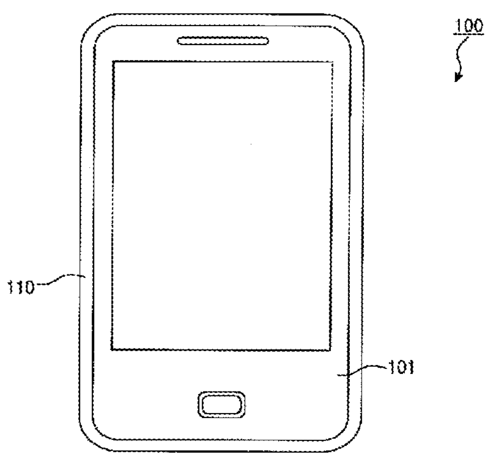
[0068] 10, 20: 내장형 안테나 장치 11, 21: 외부 도체

13, 23: 내부 도체 12, 22: 유전체

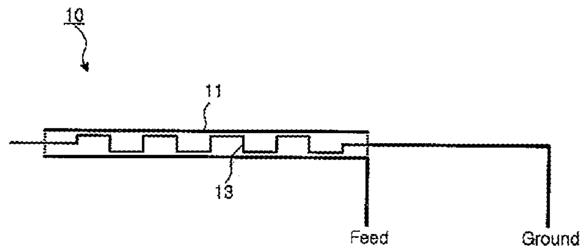
14: 메인 보드

도면

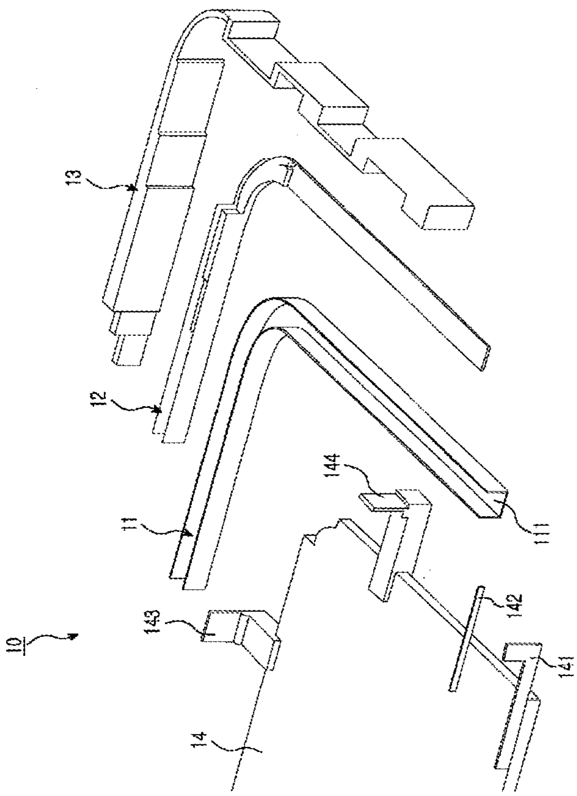
도면1



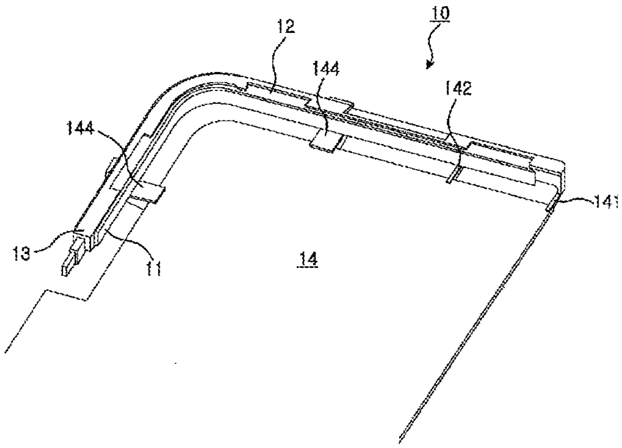
도면2



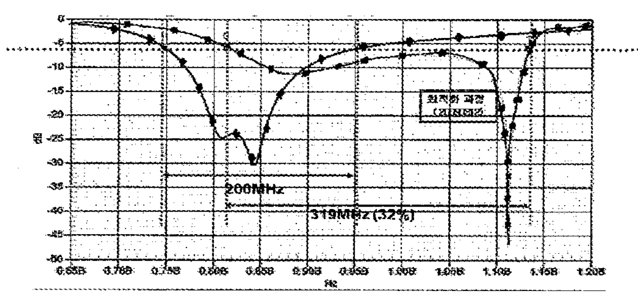
도면3



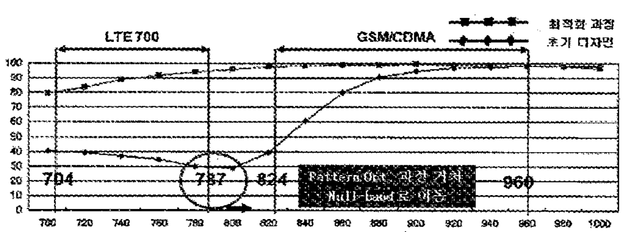
도면4


10
12
144
142
144
141
13
11
14

도면5

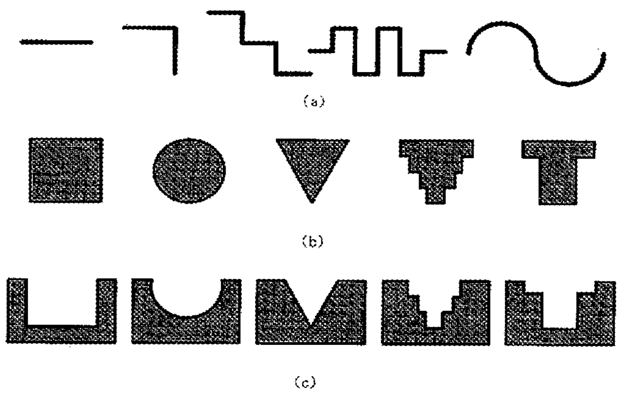

0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
200MHz
319MHz (32%)
최적화 과정
0.65B
0.70B
0.75B
0.80B
0.85B
0.90B
0.95B
1.00B
1.05B
1.10B
1.15B
1.20B

(a)

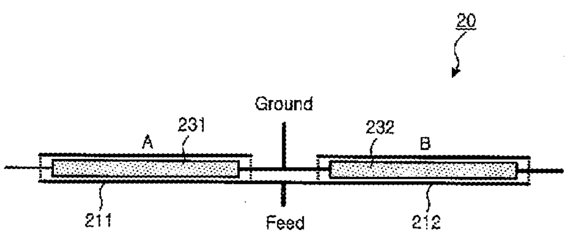

LTE 700
GSM/CDMA
최적화 과정
초기 디자인
100
90
80
70
60
50
40
30
20
10
0
704
737
824
960
700
720
740
760
780
800
820
840
860
880
900
920
940
960
980
1000

(b)

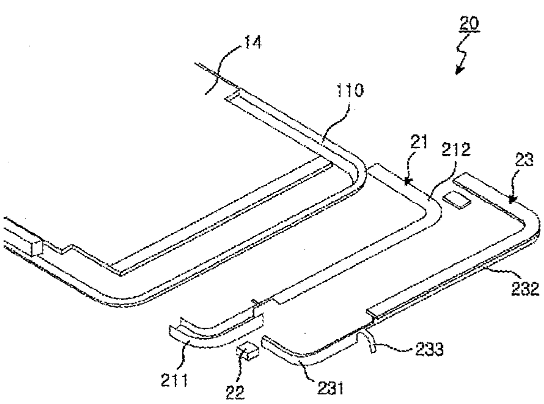
도면6


(a)
(b)
(c)

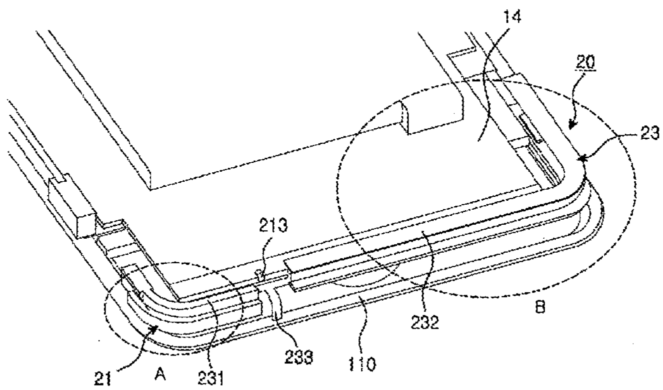
도면7


20
Ground
231
232
A
B
211
Feed
212

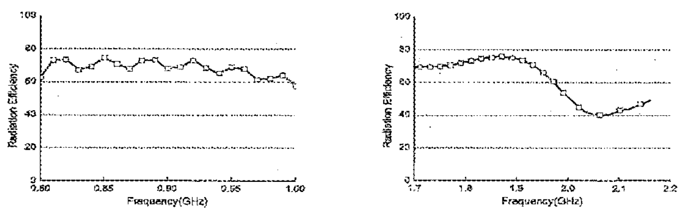
도면8


20
14
110
21
212
23
232
233
211
22
231

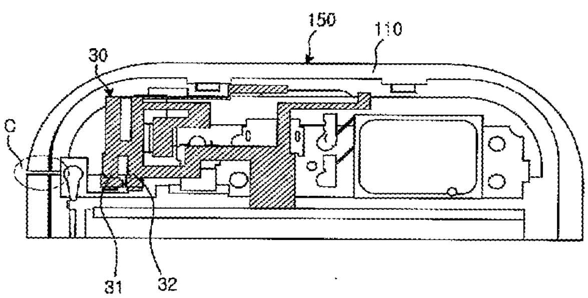
도면9



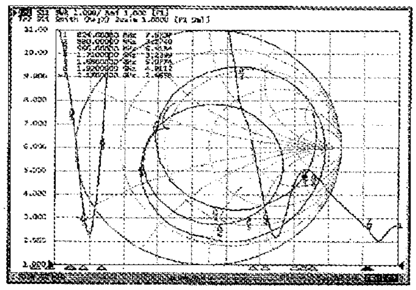
도면10



도면11



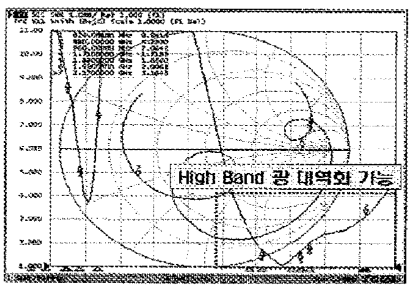
도면12



Frequency	Peak	Average	Effi. (%)
824	-6.9	-10.4	5%
837	-6.2	-9.7	11%
849	-4.8	-8.4	14%
869	-2.6	-6.2	24%
880	-2.1	-5.8	26%
915	-1.3	-5.3	29%
925	-1.9	-6.0	25%
960	-5.1	-9.5	11%
1710	-5.8	-9.6	11%
1785	-2.0	-6.7	22%
1805	-1.4	-6.9	20%
1850	-0.7	-7.2	19%
1880	-0.2	-7.1	19%
1920	0.9	-6.8	21%
1930	0.4	-6.7	22%
1980	1.2	-6.0	25%
1990	1.2	-5.6	26%
2110	2.0	-5.0	32%
2170	2.8	-4.5	35%

GSM 850	17
GSM 900	18
DCS	23
WCDMA	27

(a)

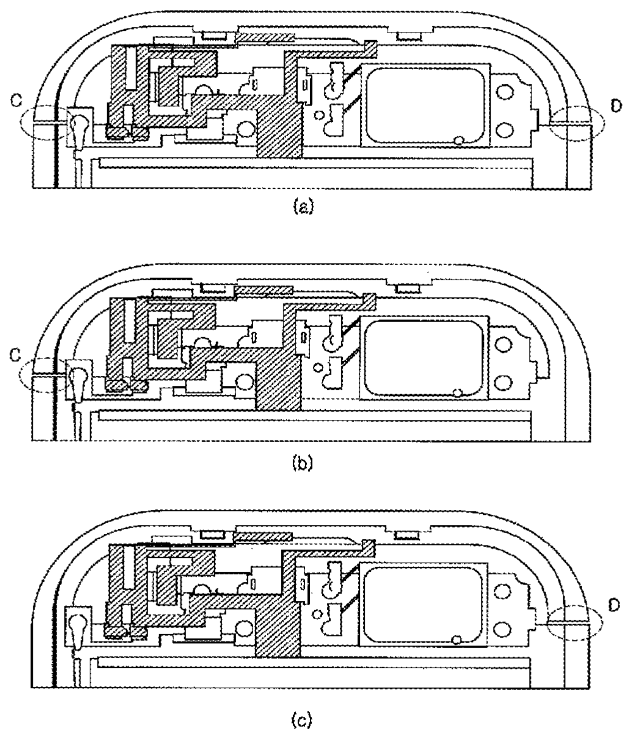


Frequency	Peak	Average	Effi. (%)
824	-4.7	-7.3	19%
837	-4.3	-6.5	20%
849	-3.4	-6.1	24%
869	-2.1	-4.9	33%
880	-2.0	-4.7	34%
915	-1.7	-4.6	35%
925	-2.4	-5.3	29%
960	-5.3	-8.4	14%
1710	1.1	-4.0	40%
1785	2.3	-2.9	51%
1805	2.5	-2.8	53%
1850	2.6	-2.3	58%
1880	2.4	-2.4	58%
1920	2.1	-2.7	54%
1930	1.8	-2.7	58%
1980	1.1	-3.1	49%
1990	0.9	-3.3	47%
2110	-1.1	-4.8	33%
2170	-1.5	-6.4	23%

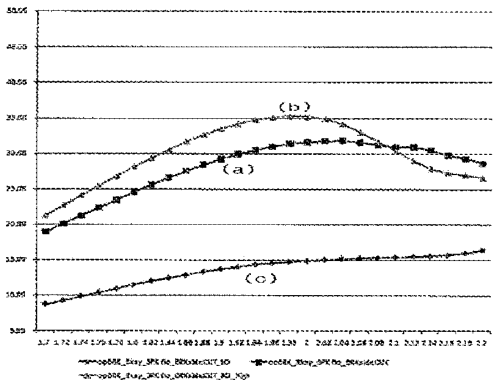
GSM 850	26
GSM 900	28
DCS	52
WCDMA	43

(b)

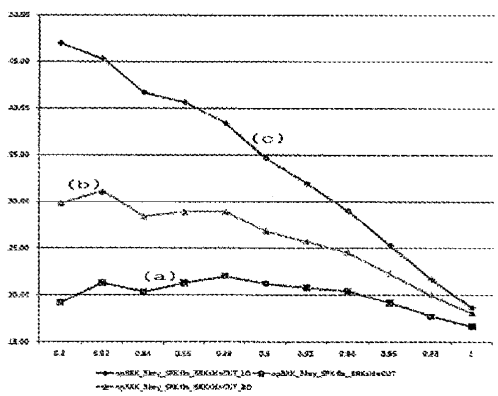
도면13



도면14

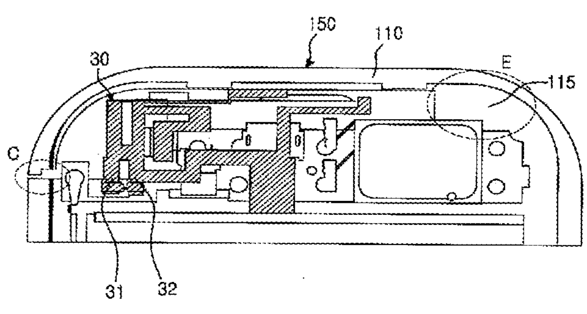


(A) <Lowband Efficiency: 75% Impedance Matching>

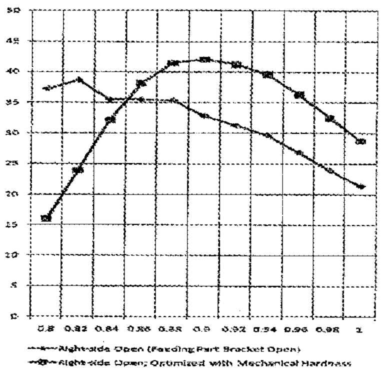


(B) <Highband Efficiency: 75% Impedance Matching>

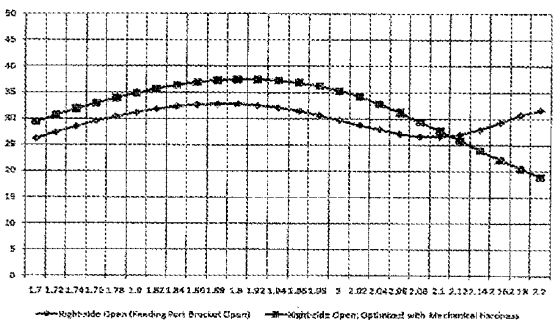
도면15



도면16



(A) Low-band Efficiency; 75% Impedance Matching



(B) High-band Efficiency; 75% Impedance Matching >

—◆—◆— 기계적강성 보강전
—■—■— 기계적강성 보강후

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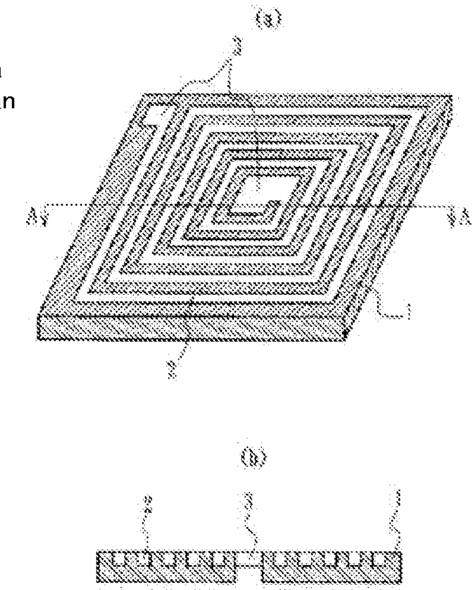
H01F 17/00
H02J 17/00

(21)Application number : 2001-102738
(22)Date of filing : 02.04.2001

(71)Applicant : KAWASAKI STEEL CORP
(72)Inventor : FUKUDA YASUTAKA

(54) **PLANAR MAGNETIC ELEMENT FOR NONCONTACT CHARGER**

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a planar magnetic element, for a noncontact charger, by which a small shape and a thin shape are satisfied and which can obtain satisfactory charging efficiency.
SOLUTION: A planar coil is embedded on one face of a ferrite magnetic layer whose magnetic-substance volume density is 25% or more, in such a way that its surface is exposed.



(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開2002－299138

（P2002－299138A）

(43)公開日　平成14年10月11日(2002.10.11)

(51)Int.Cl.⁷	識別記号	F I	テーマコード（参考）
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17/00		H02J 17/00	B
H02J 17/00		H01F 23/00	B

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(71)出願人　000001258
川崎製鉄株式会社
兵庫県神戸市中央区北本町通1丁目1番28号

(72)発明者　福田　泰隆
千葉県千葉市中央区川崎町1番地　川崎製鉄株式会社技術研究所内

(74)代理人　100072051
弁理士　杉村　興作　（外1名）

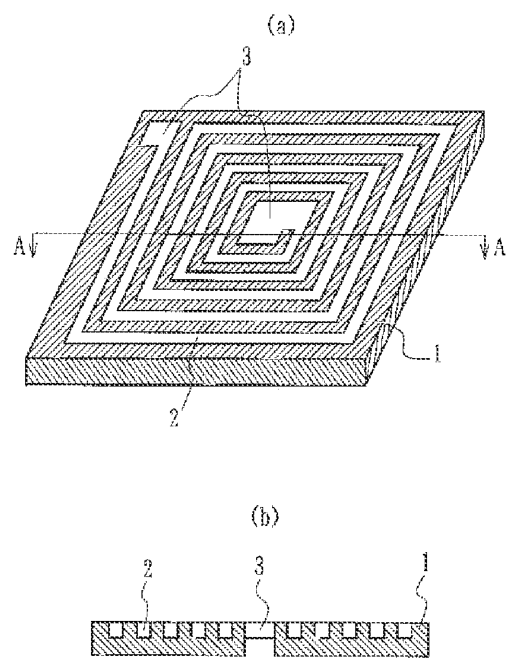
Ｆターム(参考)　5E070 AA01 AB01 BB01 CB03 CB15

(54)【発明の名称】　非接触充電器用平面磁気素子

(57)【要約】

【課題】　小型・薄型化を満足しつつ、良好な充電効率が得られる、非接触充電器用平面磁気素子を提供する。

【解決手段】　磁性体体積密度が25%以上のフェライト磁性層の片面に、平面コイルを、その上面を露出させて埋設する。



【特許請求の範囲】

【請求項1】　磁性層の片面に、上面を露出させて平面コイルを埋設した構造になる平面磁気素子であって、該磁性層が磁性体体積密度：25%以上のフェライト磁性層からなることを特徴とする非接触充電器用平面磁気素子。

【請求項2】　請求項1において、平面コイルのコイル線の幅および厚みをそれぞれ、次式で示される表皮厚みδの0.5倍以上、8倍以下としたことを特徴とする非接触充電器用平面磁気素子。

$\delta = \{2/(\mu \cdot \sigma \cdot \omega)\}^{1/2}$

ここで、μ：透磁率

σ：電気伝導率（S）

ω：角振動数（$=2\pi f$）

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、非接触充電器に搭載される薄型の平面磁気素子に関し、特にその充電効率の有利な向上を図ったものである。

【0002】

【従来の技術】近年、電子情報端末の小型化・計量化に伴い、Liイオン電池のような2次電池で駆動する携帯機器が多用されている。このような分野では、機器寸法の面での制約などから、主に接点を用いた充電システムが用いられている。しかしながら、携帯機器は人体の近くに常備されることが多く、接点形では信頼性に問題の生じるおそれがあるため、非接触形の充電システムが要望されている。

【0003】非接触充電システムは、シェーバーや電動ハブラシなどの水廻りの機器には従来から用いられてきた（例えば、特開平2000-78763 号公報）。一方、携帯情報機器関連では、カード型非接触充電の例がある（Kanai et al：IEEE APEC Record, pp.1157 -1162 (2000) や金井ら：電気学会マグネティクス研究会 MAG-00-150 など）。かかる非接触充電システムにおけるコイルは、フェライト板やアモルファス薄帯上に銅線を巻き回した構造になっている。

【0004】しかしながら、かかる構造のコイルには、次に述べるような問題があった。

(1) コイル厚さが1mm程度でかつ寸法が数cm角と大きいため、占有体積が大きく、機器の小型・薄型化が阻害される。

(2) 磁性コア間を渡る磁束がコイルを横切るため、コイルでの渦電流の発生が大きく、損失が大きい。

【0005】ところで、極薄型のコイルとしては、印刷法やシート法で形成したフェライト磁性膜を用いた平面型の磁気素子が知られている（特開平11-26239 号公報）。この平面磁気素子は、フェライト粉にバインダを混ぜた磁性ペーストをSi基板上に印刷、焼成することによって高抵抗のフェライト磁性膜を形成し、この膜上にコイルパターンをめっき法などで形成したのち、さらにその上に磁性膜を形成して磁気素子とするものである。

【0006】この構造の磁気素子だと、薄型化は勿論、コイルの損失を効果的に抑制することができるが、コイルの両側に磁性体を配置しているため磁束の外部への取り出しが十分とはいえず、受送電コイル間の磁束がお互いのコイルを横切らないため、非接触充電器用としては十分な能力を発揮できない。従って、本発明が対象としているような非接触充電器用コイルとしては、適用することができなかった。

【0007】

【発明が解決しようとする課題】本発明は、上記の現状に鑑み開発されたもので、非接触充電器の特に受電側について、その小型・薄型化を満足しつつ、さらに良好な充電効率が得られる、新規な構造になる非接触充電器用平面磁気素子を提案することを目的とする。

【0008】

【課題を解決するための手段】さて、発明者らは、上記の目的を達成すべく鋭意研究を重ねたところ、フェライト磁性層の片面に、平面コイルを、その上面を露出させて埋設し、さらに好ましくは平面コイルのコイル線の厚みおよび幅をそれぞれ適正な範囲に調整することによって、所期した目的が有利に達成されることの知見を得た。本発明は、上記の知見に立脚するものである。

【0009】すなわち、本発明の要旨構成は次のとおりである。

1．磁性層の片面に、上面を露出させて平面コイルを埋設した構造になる平面磁気素子であって、該磁性層が磁性体体積密度：25%以上のフェライト磁性層からなることを特徴とする非接触充電器用平面磁気素子。

【0010】上記1の発明では、平面コイルの上面が磁性層から露出しているので、充電器側の送電コイルと機器本体側の受電コイルとのギャップを小さくすることができ、ひいては受送電コイル間の磁束をお互いのコイルに十分に横切らせることができるので、充電効率を格段に向上させることができる。

【0011】図1に、本発明に従う代表的な平面磁気素子（コイル形状はスパイラル型）を模式で示す。図1(a)は平面図、同図(b)はそのA-A断面図であり、図中番号1はフェライト磁性層、2は平面コイル、そして3が端子である。上記のフェライト磁性層において、磁性体の体積密度を 25vol%以上としたのは、これ未満では、充電器側の送電コイルと機器本体側の受電コイル間の磁気的結合（次式に示す結合係数kで表される）が小さくなって十分の充電特性が得られないからである。

$k = M/(L_1 \times L_2)^{1/2}$

ここで、M：相互インダクタンス

L_1，L_2：コイル1，2の自己インダクタンス（例えば、L_1が送電側コイルのインダクタンス、L_2が受電側のインダクタンスとなる）

なお、本発明を受電コイルとして利用する場合、500kHz以上、 20MHz以下の周波数で受電する方式の非接触充電システムに搭載すると特に有利である。

【0012】また、本発明において、フェライト磁性層の厚みは5～500 μm 程度とすることが好ましい。というのは、この厚みが5μm に満たないと結合係数が小さく、一方 500μm を超えると磁気素子の厚みが厚くなるからである。さらに、コイルの厚みは5～200 μm 程度とすることが好ましい。というのは、この厚みが5μm に満たないとコイル直流抵抗が大きくなり、一方 200μm を超えるとレジスト露出やコイル線間をフェライトで埋めることが困難となるからである。

【0013】2．上記1において、平面コイルのコイル線の幅および厚みをそれぞれ、次式で示される表皮厚みδの 0.5倍以上、8倍以下としたことを特徴とする非接触充電器用平面磁気素子。

$\delta = \{2/(\mu \cdot \sigma \cdot \omega)\}^{1/2}$

ここで、μ：透磁率

σ：電気伝導率（S）

ω：角振動数（＝2πf）

なお、透磁率および電気伝統率は、平面コイルの透磁率および電気伝統率である。

【0014】上記2の発明では、コイル線の厚みおよび幅をそれぞれ、好適範囲に規定したものである。コイル線の厚みや幅が表皮厚み以上のコイルに高周波電流を流すとコイル表面にしか電流が流れず、交流抵抗が大きくなる。しかしながら、これらの値を表皮厚みに揃えると、コイル断面積が小さくなり、直流抵抗が大きくなって、その結果損失が大きくなる。これを避けるために、コイル線の幅を表皮厚み程度に分割したコイルが用いられることが多い。しかしながら、この場合、コイル線間のスペースが大きくなるため、素子の小型化が損なわれる。

【0015】そこで、交流抵抗による損失と直流抵抗による損失の和が最小となる組み合わせについて種々検討を重ねたところ、図2に示すコイル線の厚みaおよび幅bをそれぞれ、次式で示される表皮厚みδの 0.5倍以上、8倍以下とすることが有効であることが分かった。

$\delta = \{2/(\mu \cdot \sigma \cdot \omega)\}^{1/2}$

なお、コイル線の厚みおよび幅が表皮厚みδの 0.5倍に満たないと、コイル直流抵抗が大きくなり、コイルが発熱する。一方、8倍を超えると、直流抵抗は小さくなるものの、表皮効果による交流抵抗が大きくなって、全体としての損失の増大を招いたり、磁気素子の寸法が大きくなる。より好適には2倍以上、4倍以下である。

【0016】ここで、コイル形状につしては、スパイラル型およびミアンダー型のいずれでも良く、また、スパイラル型は1つあるいは2つ以上の組み合わせでもいい。また、本発明の平面磁気素子は、そのまま使用しても何ら問題ないが、表面を保護するために、図2に示したように、コイルの露出している面に、エポキシ樹脂、ポリイミド樹脂などの樹脂やガラス等の非磁性でかつ電気的絶縁体からなる保護被膜4を被覆することが有利である。

【0017】また、本発明におけるフェライトとしては、絶縁体であるNiZn系フェライト、中でも焼成温度を低くしたNiCuZn系フェライトが好適である。その組成については特に限定されることはないが、代表組成を示すと次のとおりである。なお、この組成は、磁気素子全体おいて、必ずしも同一組成とする必要はなく、下部フェライト、上部フェライトおよびコイル線間に充填するフェライトなど、場所に応じて適宜組成を変更することができる。

【0018】Fe_2O_3 ：40～50 mol％

Fe_2O_3 が50 mol％を超えると、Fe^{2+}イオンの存在により電気抵抗値が急激に低下する。電気抵抗の低下は高周波領域で使用するとき渦電流の発生でフェライトコアでの損失を急増させてしまう。また、40 mol％未満になるとフェライトの透磁率低下にともなうインダクタンスの劣化が大きいため、Fe_2O_3 は40～50 mol％程度とすることが好ましい。

【0019】ZnO：15～35mol ％

ZnOは、インダクタンスとキュリー温度に大きな影響を与える。キュリー温度は磁気素子の耐熱性を決める重要なパラメータである。15 mol％未満ではキュリー温度は高いもののインダクタンスが低下する。一方、35 mol％を超えるとインダクタンスは高いものの、キュリー温度が低下する。従って、ZnOは15～35 mol％程度とすることが好ましい。

【0020】CuO：20 mol％以下

CuOは、焼成温度を下げるために加える。しかしながら、20 mol％を超えると焼成温度は低下するがインダクタンスが劣化するので、CuOは 20mol％以下程度とすることが好ましい。

【0021】Bi_2O_3 ：10 mol％以下

Bi_2O_3 は、CuOと同じく、焼成温度を低下する効果がある。しかしながら、10mol ％を超えると焼成温度は低下するものの、インダクタンスが劣化するため、Bi_2O_3 は 10mol％以下程度とすることが好ましい。残部はNiOである。

【0022】以上、好適フェライトとして、NiZn系フェライトについて主に説明したが、これ以外のフェライトであってもNiZn系フェライトと同等の特性を持つものであれば、いずれもが使用できるのはいうまでもない。

【0023】次に、本発明の平面磁気素子の好適製造方法について説明する。まず初めに、Si基板上にポリイミド樹脂をスピンコートにより塗布したのち、熱硬化させて、保護被膜とする。この保護被膜の好適厚みは10μm程度である。ついで、この上に、この上にコイル形成の下地層として無電解めっきによりCu膜を 0.5μm 厚程度

に成膜する。ついで、この下地めっき層の上にフォトレジストを塗布したのち、フォトエッチングにより所望のコイル形状のレジストフレームを形成する。引き続き、電気めっきにより、レジストフレーム内にCuを析出させたのち、レジストを剥離し、ついで化学エッチングによりコイル線間の下地めっき層を除去して、平面コイルを保護被膜上に形成する。この時、コイル端子も併せて形成することが好ましい。

【0024】その後、コイル線間を含めて平面コイルの上に、エポキシ樹脂やポリイミド樹脂などの樹脂とフェライト粉末を混ぜた樹脂ペーストを印刷法にて塗布した後、熱硬化処理を施して、上部フェライト磁性層を形成する。この上部フェライト磁性層の形成に際し、樹脂ペーストの硬化処理温度は 150～400 ℃程度とすることが好ましい。なお、場合によっては基板を付けたまま、あるいは裏面研磨を施してもよく、また基板の種類はSi以外にもアルミナやセラミックスなどでもよい。

【0025】

【実施例】実施例1

Si基板上に、ポリイミド樹脂をスピンコートにより塗布したのち、熱硬化させて、厚み：10μm の保護被膜を形成した。ついで、下地めっき層として 0.5μm厚のCu膜を無電解めっき法で成膜した。ついで、この上にフォトレジストを塗布したのち、フォトエッチングにより所望のコイル形状のレジストフレームを形成した。その後、電気めっきにより、レジストフレーム内にCuを析出させたのち、レジストを剥離し、ついで化学エッチングでコイル線間の下地めっきを除去して、平面コイルとした。かくして、コイル線の厚みａ：100 μm 、幅ｂ：100 μm 、間隔ｃ：30μm でターン数が14のスパイラル型の平面コイルを作製した。

【0026】その後、Fe_2O_3 ：49 mol％、ZnO ：23 mol％、CuO ：12 mol％、NiO ：16 mol％の組成になるフェライト磁粉を、硬化後のフェライト体積が表１に示す割合になるように調合したエポキシ樹脂ペーストをを、スクリーン印刷法にてその上部に塗布し、150 ℃で熱硬化させて、コイルトップからの膜厚：100 μm のフェライト磁性層を形成した。ついで、基板と保護被膜間を剥がして約 200μm の薄型受電コイルを作製した。送電コイルは、ドラム型のNiZnフェライトで作製し、これを３MHz の周波数で駆動したものに、受電側平面磁気素子を0.5 mmのスペースで接触させて、そのときの結合係数ｋと発生電圧を測定した。得られた結果を表１に併記する。

【0027】

【表１】

No.	磁性体体積密度 (vol%)	結合係数 k	発生電圧 (V)	備　考
1	70	0.85	4.5	発明例 1
2	50	0.80	4.2	〃　2
3	35	0.75	4.1	〃　3
4	27	0.70	4.0	〃　4
5	60	0.82	4.3	〃　5
6	20	0.62	2.7	比較例 1
7	15	0.50	2.1	〃　2

【0028】同表から明らかなように、結合係数ｋおよび発生電圧の両者が共に大きく、薄型化に寄与するのは言うまでもなく、非接触充電に適していることが分かる。

【0029】実施例２

コイル線の厚みａおよび幅ｂを表２に示すように種々に変化させること以外は、実施例１のNo.2と同じ製造条件で、保護被膜、平面コイルおよびフェライト磁性層を形成して薄型受電コイルを製造した。かくして得られた薄型受電コイルの結合係数ｋと発生電圧について調べた結果を、表２に併記する。

【0030】

【表２】

No.	コイル線 厚みａ (μm)	コイル線 幅ｂ (μm)	コイル線間の間隔 c (μm)	表皮厚み δ (μm)	結合係数 k	発生電圧 (V)	備　考
1	70	70	30	40	0.80	4.2	発明例 6
2	400	100	30	40	0.80	4.2	〃　7
3	120	100	30	40	0.80	4.2	〃　8
4	10	20	30	40	0.80	4.2	〃　9
5	100	100	30	40	0.80	4.2	〃　10

【0031】同表から明らかなように、本発明に従い、コイル線の厚みａおよび幅ｂを表皮厚みδの 0.5倍以上、８倍以下の範囲に調整したものは、結合係数ｋはいずれも0.80、また発生電圧はいずれも 4.2Ｖであり、従来よりも優れた結合係数ｋおよび発生電圧が得られている。

【0032】

【発明の効果】かくして、本発明によれば、薄型化は勿

論のこと、充電効率に優れた非接触充電器用平面磁気素子を得ることができる。

【図面の簡単な説明】

【図１】　コイル形状としてスパイラル型を採用した場合の、本発明に従う代表的な平面磁気素子の平面図(a)およびA－A断面図(b) である。

【図２】　コイル線の断面形状を示した図である。

【符号の説明】

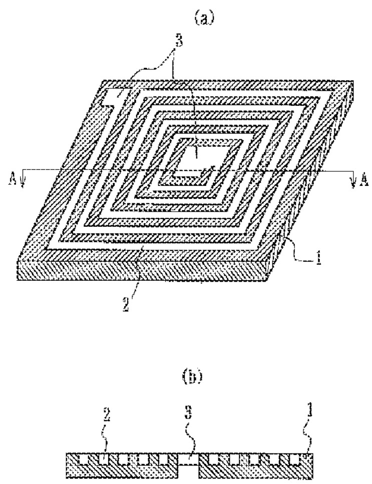
1　フェライト磁性層

2　平面コイル

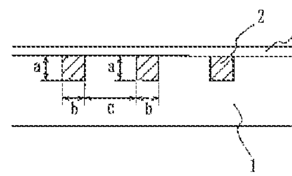
3　端子

4　保護被膜

【図１】



【図２】



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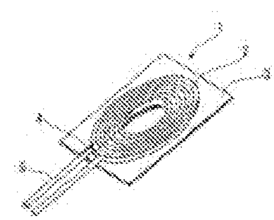
(71)Applicant : YONEZAWA DENSEN KK
ASUKA ELECTRON KK
(72)Inventor : UEKI KOJI
SAEGUSA SEIICHIRO
TAMADA TERUO
AZUMA SADAJI
FUJIMI TAKASHI
TAKAISHI YOSHI

(54) COIL HAVING MAGNETIC SHIELD SHEET

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a coil having a magnetic shield sheet that can be thinned and is suitable for a power receiving coil in a portable telephone for charging by non-contact type power transmission.
SOLUTION: In the coil having a magnetic shield sheet where the coil is joined to the magnetic shield sheet, the magnetic shield sheet has a slit for storing a terminal projecting in the thickness direction of the coil, and the coil is joined to the magnetic shield sheet while the terminal projecting in the thickness direction is made to coincide with the slit of the magnetic shield sheet.



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(21)出願番号　特願2007-43976(P2007-43976)	(71)出願人　592053952 米沢電線株式会社 山形県米沢市東１丁目１０番５３号
(22)出願日　平成19年2月23日(2007.2.23)	(71)出願人　504312830 明日香エレクトロン株式会社 大阪府大阪市淀川区宮原５丁目１番３号
	(74)代理人　100064908 弁理士　志賀　正武
	(74)代理人　100108578 弁理士　高橋　詔男
	(74)代理人　100089037 弁理士　渡邊　隆
	(74)代理人　100101465 弁理士　青山　正和

最終頁に続く

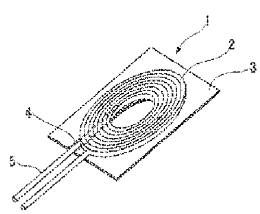
(54)【発明の名称】防磁シート付きコイル

(57)【要約】

【課題】無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄化を達成可能な防磁シート付きコイルの提供。

【解決手段】防磁シートにコイルが接合された防磁シート付きコイルであって、前記防磁シートは、前記コイルの厚み方向に突出した端子が収容されるスリットを有し、前記コイルは、厚み方向に突出した端子を防磁シートのスリットに合致させた状態で防磁シートに接合されたことを特徴とする防磁シート付きコイル。

【選択図】図２



【特許請求の範囲】
【請求項1】
防磁シートにコイルが接合された防磁シート付きコイルであって、
前記防磁シートは、前記コイルの厚み方向に突出した端子が収容されるスリットを有し、前記コイルは、厚み方向に突出した端子を防磁シートのスリットに合致させた状態で防磁シートに接合されたことを特徴とする防磁シート付きコイル。
【請求項2】
前記コイルが、１列～３列多層巻きのコイルであることを特徴とする請求項１に記載の防磁シート付きコイル。
【請求項3】
前記防磁シートとコイルとが、両面テープ又は接着剤を介して接合されたことを特徴とする請求項１又は２に記載の防磁シート付きコイル。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、例えば、電磁誘導方式による無接点方式電力伝送システムにおいて受電コイルとして好適な薄型の防磁シート付きコイルに関する。
【背景技術】
【0002】
近年、携帯電話、電気剃刀機、卓上掃除機、リモートコントローラなど、コードレスにした機器（コードレス機器）に内蔵したバッテリーを充電する充電器として、充電器に内蔵した一次コイルと機器に内蔵した二次コイルとを磁気結合した無接点充電式機器が知られている。また、腕時計、電卓等、従来、電池の起電力が低下した場合に電池交換することが一般的であった機器についても、近年では、内蔵バッテリーを無接点方式によって充電する方式のものが出現してきている。この種の無接点充電式機器では、充電器と機器を電気的に接続する接点を設けることなく、一次コイルから二次コイルへの電磁誘導により、充電器から機器に電力を供給することができる（例えば、特許文献１～４参照。）。
【特許文献1】特開平５－２５８９４１号公報
【特許文献2】特開平６－３０２２２１号公報
【特許文献3】特開２００５－１３６３４２号公報
【特許文献4】特開２００５－１３７１７３号公報
【発明の開示】
【発明が解決しようとする課題】
【0003】
携帯電話等の機器において、無接点方式電力伝送による充電が検討されている。携帯電話は、薄型化のニーズが特に強く、このニーズに答えつつ、無接点方式電力伝送による充電可能な構造を実現するには、携帯電話に内蔵される受電側コイルを極薄のものとする必要がある。また、受電側コイルには、他の部品に対し電磁波の影響を防止するために、防磁シートを貼り合わせて使用されるが、一般のコイルは巻始め端子が厚み方向に突出しているため、平坦なシート上にコイルを貼り合わせた場合、コイルの巻始め端子の突出分が余分な厚みとなって、防磁シート付きコイルを薄型化する上での障害となっている。
【0004】
本発明は、前記事情に鑑みてなされ、無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄化を達成可能な防磁シート付きコイルの提供を目的とする。
【課題を解決するための手段】
【0005】
前記目的を達成するため、本発明は、防磁シートにコイルが接合された防磁シート付きコイルであって、前記防磁シートは、前記コイルの厚み方向に突出した端子が収容されるスリットを有し、前記コイルは、厚み方向に突出した端子を防磁シートのスリットに合致

させた状態で防磁シートに接合されたことを特徴とする防磁シート付きコイルを提供する。

【0006】

本発明の防磁シート付きコイルにおいて、前記コイルが、１列～３列多層巻きのコイルであることが好ましい。

【0007】

本発明の防磁シート付きコイルにおいて、前記防磁シートとコイルとが、両面テープ又は接着剤を介して接合されたことが好ましい。

【発明の効果】

【0008】

本発明の防磁シート付きコイルは、コイルの厚み方向に突出した端子が収容されるスリットを有する防磁シートを用い、コイルの厚み方向に突出した端子を防磁シートのスリットに合致させた状態で防磁シートにコイルを接合した構成としたので、無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄化を達成可能な防磁シート付きコイルを提供することができる。

【発明を実施するための最良の形態】

【0009】

以下、本発明の実施形態について、図面を参照して説明する。

図１及び図２は、本発明の防磁シート付きコイルの第１実施形態を示し、図１は本実施形態の防磁シート付きコイル１の組立斜視図、図２は防磁シート付きコイル１の斜視図である。これらの図中、符号１は防磁シート付きコイル、２はコイル、３は防磁シート、４はスリット、５は巻始め端子、６は両面テープ（両面粘着フィルム）、７は外枠である。

【0010】

本実施形態の防磁シート付きコイル１は、防磁シート３にコイル２が接合されてなり、防磁シート３は、コイル２の厚み方向に突出した巻始め端子５が収容されるスリット４を有し、またコイル２は、厚み方向に突出した巻始め端子５を防磁シート３のスリット４に合致させた状態で両面テープ６（両面粘着フィルム）を介して防磁シート３に接合されている。

【0011】

このコイル２は、無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄の１列～３列多層巻きコイルである。

図３～図５はコイル２の一例を示し、図３はコイル２の斜視図、図４は平面図、図５は側面図である。本例示において、コイル２はドーナツ状をなし、図５に示すようにコイルの厚み方向において、巻始め端子５がコイル本体から突出している。従って、このコイル２を平坦な防磁シート上に接合した場合には、巻始め端子５の厚さ分だけ、防磁シート付きコイルの厚みが厚くなってしまう問題を生じる。本発明では、この巻始め端子５を防磁シート３のスリット４に入れることで、防磁シート付きコイル１を薄くすることができ、無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄化を達成する。

【0012】

前記防磁シート３は、軟磁性材料からなる微粒子を合成樹脂製フィルムで挟み込んだ薄い防磁シートを用いることが好ましい。これらの防磁シートは、容易に切断や穴明け加工ができ、使用するコイル２の大きさや形状に合わせて、所望の大きさや形状のものを切断加工して用いることができる。図１及び図２の例示では、正方形又は長方形の防磁シート３を用いている。

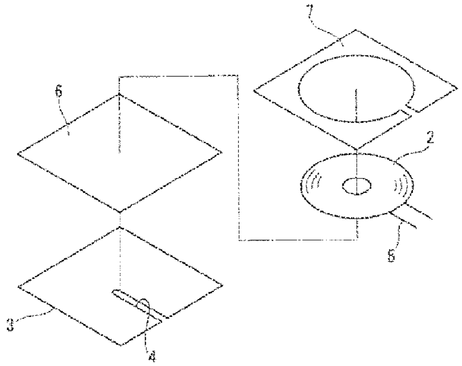
【0013】

この防磁シート３に設けるスリット４の形状や幅は、コイル２の巻始め端子５の形状に応じて適宜変更可能であり、図１及び図２に示すように細い直線上のスリット４以外に、例えば、Ｌ字状、Ｓ字状などの形状としても良い。薄い防磁シート３にスリット４を形成する方法としては、パンチング等の周知の加工法を用いて簡単に行うことができる。

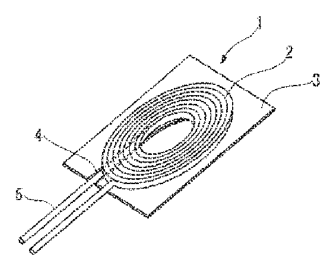
【0014】
本実施形態では、防磁シート３とコイル２とを接合する手段として、図１に示すように、両面テープ６（両面粘着シート）を用いている。この場合、コイル２の巻始め端子５が当接する部分は、両面テープ６が撓んで巻始め端子５を包みながらスリット４に収容されるので、特に加工を施す必要はないが、両面テープ６の巻始め端子５が当接する部分に切れ目やスリットを設けておいても良い。
【0015】
なお、防磁シート３とコイル２とを接合する手段は、本例示に限定されず、ホットメルト系接着剤、エポキシ系接着剤、シアノアクリレート系接着剤、ウレタン系接着剤などを用いて両者を接着しても良い。
【0016】
また、本実施形態では、図１に示すように、防磁シート３とコイル２とを両面テープ６を介して接合し、さらにコイル２の周囲に透明な合成樹脂製フィルムからなる外枠７を貼り付けているが、両面テープ６をコイル２の外寸法と合わせて用いる場合や前記接着剤を用いる場合には、外枠７を省いても良い。
【0017】
本実施形態の防磁シート付きコイル１は、コイル２の厚み方向に突出した巻始め端子５が収容されるスリット４を有する防磁シート３を用い、コイル２の巻始め端子５を防磁シート３のスリット４に合致させた状態で防磁シート３にコイル２を接合した構成としたので、無接点方式電力伝送による充電を行うための携帯電話の受電コイルとして好適な極薄化を達成可能な防磁シート付きコイル１を提供することができる。
【0018】
図６及び図７は、本発明の防磁シート付きコイルの第２実施形態を示し、図６は本実施形態の防磁シート付きコイル１１の組立斜視図、図７は防磁シート付きコイル１１の斜視図である。これらの図中、符号１１は防磁シート付きコイル、１２はコイル、１３は防磁シート、１４はスリット、１５は巻始め端子、１６は両面テープ（両面粘着フィルム）である。
【0019】
本実施形態の防磁シート付きコイル１１は、防磁シート１３に平面視略四角形のコイル１２が接合されてなり、防磁シート１３は、コイル１２の厚み方向に突出した巻始め端子１５が収容されるスリット１４を有し、またコイル１２は、厚み方向に突出した巻始め端子１５を防磁シート１３のスリット１４に合致させた状態で両面テープ１６（両面粘着フィルム）を介して防磁シート１３に接合されている。
【0020】
本実施形態の防磁シート付きコイル１１は、コイル１２の形状を平面視略四角形としていること以外は、前述した第１実施形態の防磁シート付きコイル１とほぼ同様に構成することができる。
そして、本実施形態の防磁シート付きコイル１１は、前述した第１実施形態の防磁シート付きコイル１と同様の効果を得ることができる。
【図面の簡単な説明】
【0021】
【図1】本発明の防磁シート付きコイルの第１実施形態を示す組立斜視図である。
【図2】本発明の防磁シート付きコイルの第１実施形態を示す斜視図である。
【図3】コイルの一例を示す斜視図である。
【図4】コイルの一例を示す平面図である。
【図5】コイルの一例を示す側面図である。
【図6】本発明の防磁シート付きコイルの第１実施形態を示す組立斜視図である。
【図7】本発明の防磁シート付きコイルの第１実施形態を示す斜視図である。
【符号の説明】
【0022】

１，１１…防磁シート付きコイル、２，１２…コイル、３，１３…防磁シート、４，１４…スリット、５，１５…巻始め端子、６，１６…両面テープ、７…外枠。

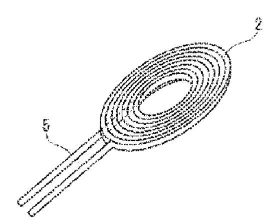
【図1】



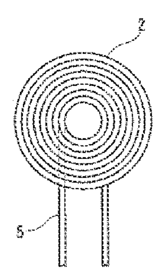
【図2】



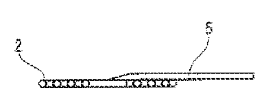
【図3】



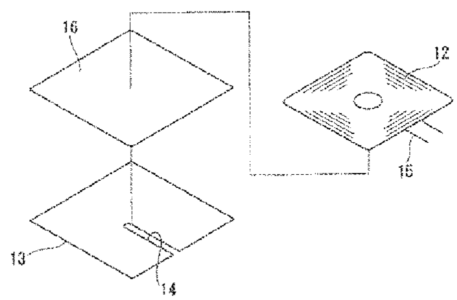
【図4】



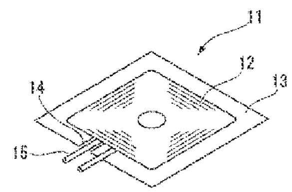
【図5】



【図6】



【図7】



(74)代理人　100094400
弁理士　鈴木　三義
(74)代理人　100107836
弁理士　西　和哉
(74)代理人　100108453
弁理士　村山　靖彦
(72)発明者　植木　孝司
山形県米沢市東１丁目１０番５３号　米沢電線株式会社内
(72)発明者　三枝　征一郎
山形県米沢市東１丁目１０番５３号　米沢電線株式会社内
(72)発明者　玉田　輝男
山形県米沢市東１丁目１０番５３号　米沢電線株式会社内
(72)発明者　我妻　貞治
山形県米沢市東１丁目１０番５３号　米沢電線株式会社内
(72)発明者　藤身　貴史
山形県米沢市東１丁目１０番５３号　米沢電線株式会社内
(72)発明者　高石　好
大阪府大阪市淀川区宮原５丁目１番３号　新大阪生島ビル４Ｆ　明日香エレクトロン株式会社内
Ｆターム(参考) 5E058 CC12

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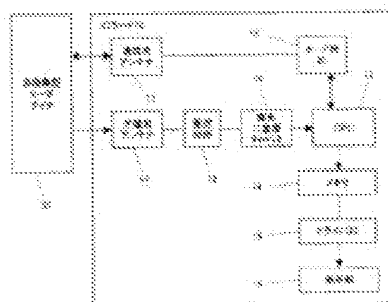
(71)Applicant : **DAINIPPON PRINTING CO LTD**
(72)Inventor : **OZAWA HIDETOSHI**

(54) **NONCONTACT IC CARD**

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a noncontact IC card charging power sufficient for driving an additional function in a short time.
SOLUTION: In the noncontact IC card 10 for transfering data between an IC 12 for card and a noncontact reader writer 30 by radio communication a charging antenna 17 for charging power for displaying data on a display section 16 is disposed as well as an antenna 11 for communication between the IC 12 for card and noncontact reader writer 30. A rectifying circuit 18 rectifies electromagnetic wave acquired from the charging antenna 17 to direct current voltage, and charges an electric double layer capacitor 19.



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H01Q	1/38	(2006.01)	G06K	19/00	J	5J046
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(71)出願人　000002897

大日本印刷株式会社

東京都新宿区市谷加賀町一丁目1番1号

(74)代理人　100111659

弁理士　金山　聡

(74)代理人　100135954

弁理士　深町　圭子

(74)代理人　100119057

弁理士　伊藤　英生

(74)代理人　100122529

弁理士　藤枡　裕実

(74)代理人　100131369

弁理士　後藤　直樹

最終頁に続く

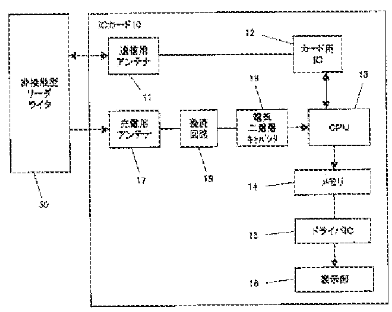
(54)【発明の名称】非接触ICカード

(57)【要約】

【課題】　付加機能を駆動するのに充分な電力を、短時間で充電することが可能な非接触ICカードを提供する。

【解決手段】　カード用IC１２と非接触リーダライタ３０とのデータの授受を無線通信により行う非接触ICカード１０において、カード用IC１２と非接触型リーダライタ３０との通信用のアンテナである通信用アンテナ１１とは別に、表示部１６にデータを表示させるための電力を充電するための充電用アンテナ１７を設け、充電用アンテナ１７から得られた電磁波を整流回路１８が直流電圧に整流し、電気二重層キャパシタ１９に充電する。

【選択図】　図1



【特許請求の範囲】
【請求項1】
　ＩＣと外部とのデータの授受を無線通信により行う非接触ＩＣカードであって、
　前記ＩＣと外部との通信用のアンテナである通信用アンテナと、
　前記データの授受以外の機能である付加機能を実行する付加機能実行手段と、
　前記付加機能実行手段の電力確保用のアンテナである充電用アンテナと、
　前記充電用アンテナから得られた電磁波を直流電圧に整流する整流回路と、
　前記整流回路により整流された直流電圧を充電する電気二重層キャパシタと、
　を有することを特徴とする非接触ＩＣカード。
【請求項2】
　前記通信用アンテナと充電用アンテナは、その共振周波数が、外部のＩＣリーダライタから出力される搬送周波数と等しくなるように調整されたものであることを特徴とする請求項１に記載の非接触ＩＣカード。
【請求項3】
　前記通信用アンテナと充電用アンテナは共にカード基材内部にコイル状に形成されたものであり、カードの平面方向において互いに重なり合わないように配置されていることを特徴とする請求項１または請求項２に記載の非接触ＩＣカード。

【発明の詳細な説明】
【技術分野】
【0001】
　本発明は、非接触ＩＣカードに関し、特に、表示機能等の付加機能のための電力を効率良く充電するための技術に関する。
【背景技術】
【0002】
　近年、無線通信により外部との情報の授受を行う非接触ＩＣカードの利用が飛躍的に増えてきており、様々な分野に利用されている。特に、最近では、情報の授受を行うだけでなく、表示デバイスを搭載し、ＩＣチップに記録されている情報を表示させる機能等の付加機能を持った非接触ＩＣカードが登場している。
【0003】
　このような付加機能を搭載する場合には、その駆動のための電力が必要になるため、従来に比べて多くの電力を必要とすることになる。このため、情報の授受等のためのアンテナとは別に、付加機能専用のアンテナを独立して設け、電力を確保する技術が提案されている（特許文献１参照）。
【特許文献1】特開２００４－２６５１７６号公報
【発明の開示】
【発明が解決しようとする課題】
【0004】
　しかしながら、上記特許文献１に記載の発明では、外部から電力供給を受けた場合にしか駆動できないため、任意のタイミングで付加機能を駆動することができないという問題がある。
【0005】
　そこで、本発明は、付加機能を駆動するのに充分な電力を、短時間で充電することが可能な非接触ＩＣカードを提供することを課題とする。
【課題を解決するための手段】
【0006】
　上記課題を解決するため、本発明では、ＩＣと外部とのデータの授受を無線通信により行う非接触ＩＣカードであって、前記ＩＣと外部との通信用のアンテナである通信用アンテナと、前記データの授受以外の機能である付加機能を実行する付加機能実行手段と、前

記付加機能実行手段の電力確保用のアンテナである充電用アンテナと、前記充電用アンテナから得られた電磁波を直流電圧に整流する整流回路と、前記整流回路により整流された直流電圧を充電する電気二重層キャパシタとを有する非接触ＩＣカードを提供する。
【発明の効果】
【0007】
本発明によれば、非接触ＩＣカードにおいて、ＩＣ駆動用のアンテナとは別に表示機能等の付加機能用のアンテナを設けるとともに、このアンテナから得られた電力を充電する電気二重層キャパシタを設けたため、付加機能を駆動するのに充分な電力を、短時間で充電することが可能となるという効果を奏する。
【発明を実施するための最良の形態】
【0008】
以下、本発明の好適な実施形態について、図面を参照して詳細に説明する。
（１．非接触ＩＣカードの構成）
まず、本発明に係る非接触ＩＣカードの構成について説明する。図１は、本発明に係る非接触ＩＣカードの機能ブロック図である。
【0009】
図１において、１０はＩＣカード、１１は通信用アンテナ、１２はカード用ＩＣ、１３はＣＰＵ、１４はメモリ、１５はドライバＩＣ、１６は表示部、１７は充電用アンテナ、１８は整流回路、１９は電気二重層キャパシタ、３０は非接触型リーダライタである。
【0010】
図１に示すように、本発明に係るＩＣカード１０は、通信用アンテナ１１、カード用ＩＣ１２、ＣＰＵ１３、メモリ１４、ドライバＩＣ１５、表示部１６、充電用アンテナ１７、整流回路１８、電気二重層キャパシタ１９を有しており、通信用アンテナ１１を介して、非接触型リーダライタ３０との通信を行うとともに、充電用アンテナ１７を介して表示用の電力を非接触型リーダライタ３０から得るようになっている。
【0011】
ＩＣカード１０において、通信用アンテナ１１、カード用ＩＣ１２は、通常のＩＣカードが有するものと同一であり、ＩＣカードの必須機能となるものである。ＣＰＵ１３、メモリ１４、ドライバＩＣ１５、表示部１６は上記必須機能に対して付加機能を実現するためのものであり、本実施形態では表示機能を実現している。
【0012】
図１中、通信用アンテナ１１は、カード用ＩＣ１２へ入出力するためのデータの送受信およびデータ入出力のための電力の供給を受けるためのものであり、ＩＣカード１０を構成する基材内部において、コイル状に巻かれたものとなっている。カード用ＩＣ１２は、データを記録するためのＩＣチップである。ＣＰＵ１３は、カード用ＩＣ１２に記録されたデータを処理するための演算処理装置である。本実施形態においては、表示部１６に対するデータの表示処理も行う。メモリ１４は、表示部１６に表示させるデータの記憶領域である。ドライバＩＣ１５は、表示部１６にデータを表示させるためのＩＣである。表示部１６は、データを表示するためのものであり、例えばＴＮ、ＳＴＮ等のネマチック液晶表示媒体、コレステリック液晶媒体、強誘電性液晶媒体、電子ペーパー、発光ダイオード等を用いることができる。
【0013】
充電用アンテナ１７は、付加機能用の電力の供給を受けるためのものであり、通信用アンテナ１１と同様、ＩＣカード１０を構成する基材内部において、コイル状に巻かれたものとなっている。整流回路１８は、非接触型リーダライタ３０から充電用アンテナ１７が受信した電磁波を整流して直流電圧に変換する機能を有している。電気二重層キャパシタ１９は、整流回路１８による整流により得られた直流電圧を電力として蓄積する機能を有している。
【0014】
上述のように、通信用アンテナ１１と充電用アンテナ１７は共に、コイル状に巻かれて

基材内部に形成されている。この２つのアンテナはＩＣカード１０内の平面方向に互いに重なり合わないように配置することが望ましい。平面方向に重なり合わないように配置した場合の例を図２（ａ）に示す。図２（ａ）の例では、通信用アンテナ１１を太線で、充電用アンテナ１７を細線で示している。図２（ａ）に示すように、平面方向に重なり合わないように配置する手法としては、非接触ＩＣカード１０のカード基材上において、一方の側（図中左側）に通信用アンテナ１１をコイル状に巻いて配置し、他方の側（図中右側）に充電用アンテナ１７をコイル状に巻いて配置する手法がある。

【0015】

また、重なり合ってしまう場合でも、平面方向において重なる部分ができるだけ少なくするようにすることが望ましい。平面方向において重なる部分をできるだけ少なくなるように配置した場合の例を図２（ｂ）に示す。図２（ｂ）の例でも、図２（ａ）と同様、通信用アンテナ１１を太線で、充電用アンテナ１７を細線で示している。図２（ｂ）に示すように、平面方向において重なる部分をできるだけ少なくなるように配置する手法としては、非接触ＩＣカード１０のカード基材上において、外周側に通信用アンテナ１１をコイル状に巻いて配置し、その内周側に充電用アンテナ１７をコイル状に巻いて配置する手法がある。

【0016】

上述のように、通信用アンテナ１１と充電用アンテナ１７を平面方向において重なる部分をできるだけ少なくしたとしても、アンテナが近隣に複数本存在する場合、それぞれが干渉して受信の効率が低下し、通信不良などの不具合が発生する場合がある。そこで、これらについては、通信阻害を発生させないように、その周波数特性を調整しておく。具体的には、通信用アンテナ１１と充電用アンテナ１７を重ねた状態での共振周波数が、非接触型リーダライタ３０の搬送周波数と等しくなるように調整する。規格により定められた非接触型リーダライタ３０の搬送周波数が１３．５６ＭＨｚであるので、２本のアンテナの共振周波数が１３．５６ＭＨｚとなるよう設定することになる。このように２本のアンテナの周波数特性を調整しておくと、通信阻害が発生せず、充電時間も短くなる。

【0017】

（２．処理動作）

続いて、図１に示したＩＣカード１０の処理動作について説明する。ＩＣカード１０を非接触型リーダライタ３０に近付けると、ＩＣカード１０は通信用アンテナ１１および充電用アンテナ１７の両方を介して通信を開始する。通信用アンテナ１１においては、双方向に情報のやりとりを行う。具体的には、カード用ＩＣ１２に記録された情報を非接触型リーダライタ３０に送信するとともに、非接触型リーダライタ３０から受信した情報をカード用ＩＣ１２に記録する処理等を行うことになる。この際、必要な駆動電力は、通信用アンテナ１１が非接触型リーダライタ３０から得ることになる。

【0018】

このように、カード用ＩＣ１２と非接触型リーダライタ３０の間において情報のやりとりが行われている際、並行して充電用アンテナ１７は、非接触型リーダライタ３０から電磁波を受信する。そして、整流回路１８が受信した電磁波を整流して直流電圧に変換する。さらに電気二重層キャパシタ１９が、変換された直流電圧を電力として蓄積していく。このようにして、通信用アンテナ１１側で情報のやりとりが行われている間、充電用アンテナ１７側では、付加機能用の電力を得るための充電が行われることになる。

【0019】

そして、カード用ＩＣ１２に記録されたデータを表示部１６に表示させる場合には、電気二重層キャパシタ１９に蓄積された電力を利用してＣＰＵ１３がカード用ＩＣ１２からデータを抽出してメモリ１４に渡し、ドライバＩＣ１５がメモリに保持されたデータを表示部１６に表示させる。

【0020】

非接触型リーダライタ３０とカード用ＩＣ１２の間のデータのやりとりについては、上述のように通信用アンテナ１１から得られる電力を利用するため、ＩＣカード１０が非接

触型リーダライタ３０から離れた場合には、電力供給がされず、実行することができない。一方、表示部１６へのデータの表示は、電気二重層キャパシタ１９に蓄積された電力を利用して行うため、ＩＣカード１０が非接触型リーダライタ３０から離れていても、表示を行うことが可能である。

【0021】

以上、本発明の好適な実施形態について説明したが、本発明は上記実施形態に限定されず、種々の変形が可能である。例えば、上記実施形態では、付加機能として表示機能を備えた場合について説明したが、付加機能として音声を発する発音機能等を備えるようにしても良い。

【図面の簡単な説明】

【0022】

【図1】本発明に係る非接触ＩＣカードの機能ブロック図である。

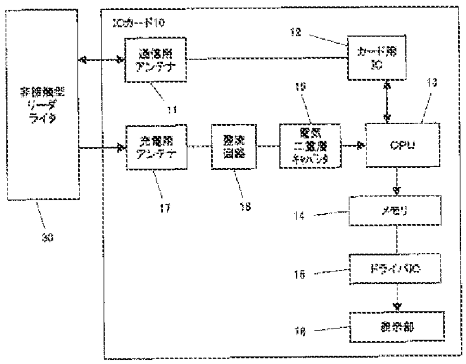
【図2】通信用アンテナ１１と充電用アンテナ１７の配置を示す平面図である。

【符号の説明】

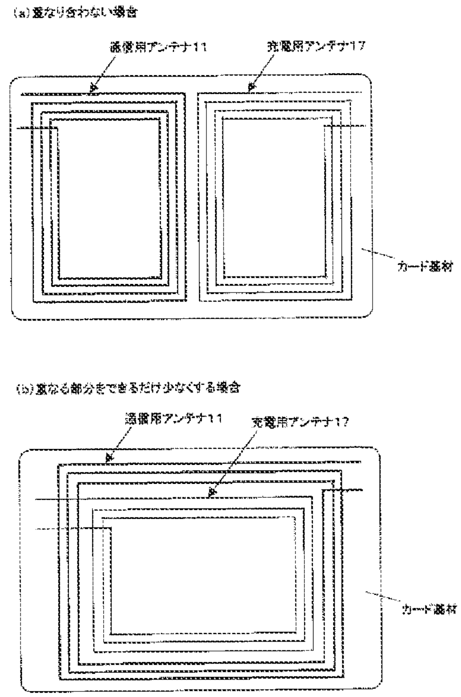
【0023】

１０・・・ＩＣカード
１１・・・通信用アンテナ
１２・・・カード用ＩＣ
１３・・・ＣＰＵ
１４・・・メモリ
１５・・・ドライバＩＣ
１６・・・表示部
１７・・・充電用アンテナ
１８・・・整流回路
１９・・・電気二重層キャパシタ
３０・・・非接触型リーダライタ

【図1】


非接触型
リーダ
ライタ
30
ICカード10
通信用
アンテナ
11
12
カード用
IC
13
充電用
アンテナ
17
整流
回路
18
19
電気
二重層
キャパシタ
CPU
14
メモリ
15
ドライバIC
16
表示部

【図2】


(a) 重なり合わない場合
通信用アンテナ11
充電用アンテナ17
カード基材
(b) 重なる部分をできるだけ少なくする場合
通信用アンテナ11
充電用アンテナ17
カード基材

(72)発明者　男澤　英敏
東京都新宿区市谷加賀町一丁目１番１号　大日本印刷株式会社内

Ｆターム(参考)　2C005 MA40 NA08 NA09 NA36 QC20
5B035 BB09 CA06 CA12 CA23 CA27
5J046 AA12 AB11 PA06

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(72) Inventor: Takasaka Tomoyoshi
c/o Fuji Denki Kagaku Kabushiki Kaisha, 36-11, Shinbashi 5-chome, Minato-ku, Tokyo, Japan
Inventor: Fukada Norihiro
c/o Fuji Denki Kagaku Kabushiki Kaisha, 36-11, Shinbashi 5-chome, Minato-ku, Tokyo, Japan
Inventor: Motoya Kunitsuku
c/o Fuji Denki Kagaku Kabushiki Kaisha, 36-11, Shinbashi 5-chome, Minato-ku, Tokyo, Japan
Inventor: Nawata Tadaaki
c/o Fuji Denki Kagaku Kabushiki Kaisha, 36-11, Shinbashi 5-chome, Minato-ku, Tokyo, Japan
(71) Applicant: Fuji Denki Kagaku Kabushiki Kaisha, 36-11, Shinbashi 5-chome, Minato-ku, Tokyo, Japan
(74) Representative: Patent Attorney Shigemi Jo

(57) Claim

A core for a rotary transformer having wiring grooves, which are formed on one surface of a disc-shaped core in the shape of concentric circles, and wiring which is buried in the wiring grooves, the wiring having one end connected to a flexible relay substrate so as to be able to be drawn out, wherein a notch unit for determining where on the relay substrate the core is to be attached is formed on the outer circumference of the disc-shaped core.

Description of the Drawings

FIG. 1 is a plan view illustrating a rotary transformer according to an embodiment, and FIG. 2 is a rear view illustrating the rotary transformer.

1: Core for Rotary Transformer

3: Wiring Grooves

5: Relay Substrate

8: Notch unit

⑲ 日本国特許庁（JP）　⑪実用新案出願公開

⑫ 公開実用新案公報（U）　昭61－69811

⑤Int.Cl.⁴　識別記号　庁内整理番号　㊸公開 昭和61年(1986) 5月13日

H 01 F 23/00　8525－5E
G 11 B 5/02　M－7736－5D

審査請求 未請求 （全1頁）

㊹考案の名称　回転トランス用コア

㉑実 願 昭59－153859
㉒出 願 昭59(1984)10月12日

⑫考案者 高坂 知義 東京都港区新橋5丁目36番11号 富士電気化学株式会社内
⑫考案者 深田 典宏 東京都港区新橋5丁目36番11号 富士電気化学株式会社内
⑫考案者 本谷 国次 東京都港区新橋5丁目36番11号 富士電気化学株式会社内
⑫考案者 縄田 忠明 東京都港区新橋5丁目36番11号 富士電気化学株式会社内
⑪出願人 富士電気化学株式会社 東京都港区新橋5丁目36番11号
⑭代理人 弁理士 茂見 穣

⑰実用新案登録請求の範囲

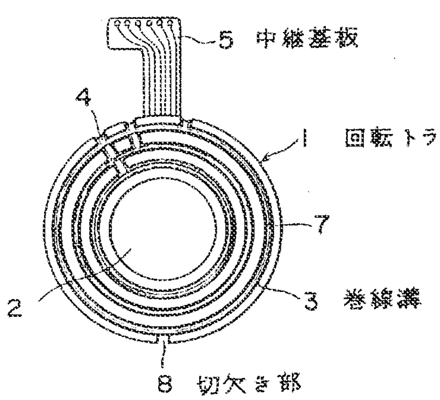
円板状コアの一方の面に同心円状の巻線溝が形成され、該溝内に埋設された巻線の端部が、他方の面に接着されたフレキシブル中継基板と接続されて外部に引き出される構造の回転トランスで用いられるコアであつて、円板状コアの外周に、該コアと中継基板との接着位置決め用の切欠き部を形成した回転トランス用コア。

図面の簡単な説明

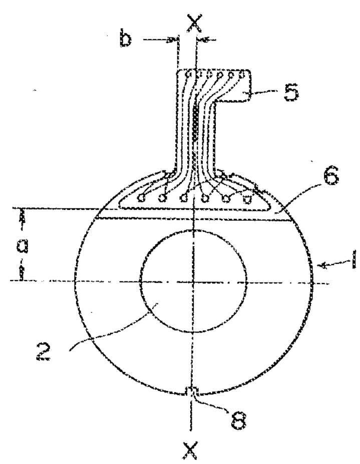
第1図は本考案を適用した回転トランスの一実施例を示す平面図、第2図はその背面図である。

1…回転トランス用コア、3…巻線溝、5…中継基板、8…切欠き部。

第1図



第2図



PATENT ABSTRACTS OF JAPAN

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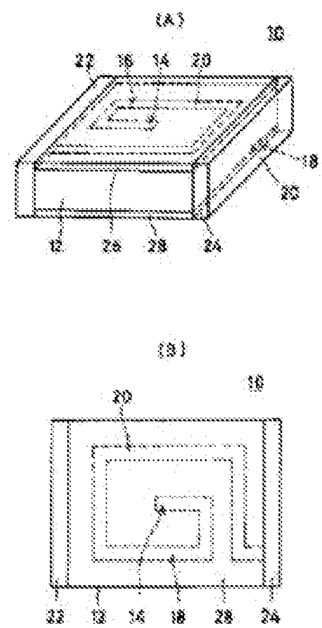
(71)Applicant : **MURATA MFG CO LTD**

(72)Inventor : **MAEDA HIDEKAZU**
SUZUKI JUNICHI
NISHII MOTOI
NISHINAGA YOSHIHIRO

(54) NOISE ELIMINATING ELEMENT

(57)Abstract:



PURPOSE: To provide a noise eliminating element that is manufactured at low cost using a surface mounting step, and easy to modify its design in accordance with an amount of current.

CONSTITUTION: A noise eliminating element 10 includes a core 12. The core 12 is formed in the shape of a rectangular parallelepiped and has a through hole 14 vertically to the upper and lower faces at an almost central part thereof. A spiral groove 16 is formed in the upper face of the core 12 with an end thereof joined to an opening of the through hole 14, while the other end is opened at the other end face of the core 12. Likewise, a spiral groove 18 is formed in the lower face of the core 12, and a conductor 20 is formed in the through hole 14 and in the grooves 16 and 18. An end-face electrode 22 to be connected with the conductor 20 in the groove 16 is formed at a left end-face of the core 12. An end-face electrode 24 to be connected with the conductor 20 in the groove 18 is formed at a right end-face of the core 12. Moreover, exterior materials 26 and 28 are formed on the upper and lower faces of the core 12.

(19)日本国特許庁（ＪＰ）　　(12) **公開特許公報**（Ａ）　　(11)特許出願公開番号

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(21)出願番号　特願平5－76173	(71)出願人　000006231 株式会社村田製作所 京都府長岡京市天神二丁目26番10号
(22)出願日　平成５年(1993)３月９日	(72)発明者　前田　英一 京都府長岡京市天神２丁目26番10号　株式会社村田製作所内
	(72)発明者　鈴木　淳一 京都府長岡京市天神２丁目26番10号　株式会社村田製作所内
	(72)発明者　西井　基 京都府長岡京市天神２丁目26番10号　株式会社村田製作所内
	(74)代理人　弁理士　岡田　全啓

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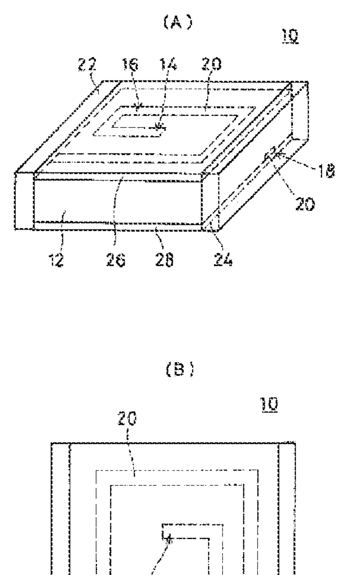
(54)【発明の名称】　ノイズ除去部品

(57)【要約】

【目的】　製造コストを低減することができ、電流容量に対応して容易に設計変更でき、面実装することが可能な、ノイズ除去部品を得る。

【構成】　ノイズ除去部品１０はコア１２を含む。コア１２は、直方体状に形成される。コア１２のほぼ中央部には、上面および下面に垂直に、貫通孔１４が形成される。コア１２の上面には、渦巻状の溝１６が、その一端を貫通孔１４の開口部に連なるようにし、他端をコア１２の一方端面に開口するようにして形成される。同様に、コア１２の下面には、渦巻状の溝１８が形成される。そして、貫通孔１４、溝１６および溝１８内には、導体２０が形成される。コア１２の左端面には、溝１６内の導体２０と接続するように端面電極２２が形成され、右端面には、溝１８内の導体２０と接続するように端面電極２４が形成される。さらに、コア１２の上面および下面には、外装材２６および外装材２８が形成される。



【特許請求の範囲】
【請求項1】　上下面に渦巻状の溝と、前記渦巻状の溝を接続する貫通孔とが形成された直方体状のコア、
前記コアの溝および貫通孔内に形成される導体、および前記導体に接続されるように前記コアの端部に形成される端面電極を含む、ノイズ除去部品。
【発明の詳細な説明】
【0001】
【産業上の利用分野】この発明はノイズ除去部品に関し、特にたとえば、コアの周囲に巻線を形成したノイズ除去部品に関する。
【0002】
【従来の技術】図8は従来のノイズ除去部品を示す斜視図である。ノイズ除去部品1は、コア2を含む。コア2は、磁性体を用いてたとえば円柱状に形成される。そして、コア2の周囲に導線3を巻回することによって、ノイズ除去部品1が形成される。このノイズ除去部品1では、導線3に流す電流に応じて、導線3の径を調整したり、コア2の径を調整したりしていた。
【0003】
【発明が解決しようとする課題】しかしながら、このようなノイズ除去部品では、巻線を巻回する作業が大がかりとなり、製造コストが大きくなってしまう。また、電流容量を大きくするために巻線を太くすると、巻回工程においてコアを破損する恐れが大きくなる。また、このノイズ除去部品は、挿入部品であるため、面実装することが困難である。
【0004】それゆえに、この発明の主たる目的は、製造コストを低減することができ、電流容量に対応して容易に設計変更でき、面実装することが可能な、ノイズ除去部品を提供することである。
【0005】
【課題を解決するための手段】この発明は、上下面に渦巻状の溝およびそれらの溝を接続する貫通孔が形成された直方体状のコアと、コアの溝および貫通孔内に形成される導体と、導体に接続されるようにコアの端部に形成される端面電極とを含む、ノイズ除去部品である。
【0006】
【作用】コアは直方体状であるため、コアの上下面には平面が形成され、プリント基板などに安定に載置することができる。コアの上下面の渦巻状の導体は、溝内に、たとえば導電ペーストを充填して焼成することにより形成することができる。この渦巻状の導体は、貫通孔内に形成される導体によって互いに接続される。また、このコアの端部に形成された端面電極は、渦巻状の導体と接続される。
【0007】また、コアの上下面に外装材を形成することによって、コアと導体とが保護される。そして、この外装材内に磁性体材料を混入するか、あるいは、外装材を磁性体材料で形成することによって、外装材内に磁束が通過しやすくなる。
【0008】
【発明の効果】この発明によれば、導線を巻回することなく導体を渦巻状に形成することができるため、ノイズ除去部品の製造工程を簡略化することができる。そのため、ノイズ除去部品の製造コストを低減することができる。また、製造時に、溝の幅や深さおよび貫通孔の径などを変えることによって導体の断面積を変えることができる。したがって、所望の電流容量に対応したノイズ除去部品を得ることができる。また、コアの上下面は平面であるため、ノイズ除去部品をプリント基板などに安定して載置することができる。そのため、この状態で、プリント基板のパターン電極とノイズ除去部品の端面電極とをはんだ付けすることにより、面実装することができる。
【0009】また、磁性体材料を用いた外装材は、磁気シールドとしての効果を有するため、このノイズ除去部品からは、磁束が漏れにくくなり、ノイズ除去部品の近傍の素子に与える磁気の影響が少なくなる。
【0010】この発明の上述の目的，その他の目的，特徴および利点は、図面を参照して行う以下の実施例の詳細な説明から一層明らかとなろう。
【0011】
【実施例】図1（A）はこの発明の一実施例を示す斜視図であり、図1（B）はその底面図である。ノイズ除去部品10はコア12を含む。コア12は、たとえばフェライト材料などで直方体状に形成される。コア12のほぼ中央部には、上面および下面に垂直（厚み方向）に、貫通孔14が形成される。コア12の上面には、渦巻状の溝16が、その一端を貫通孔14の開口部に連なるようにし、他端をコア12の一方端面に開口するようにして形成される。さらに、コア12の下面には、渦巻状の溝18が、その一端を貫通孔14の開口部に連なるようにし、他端をコア12の他方端面に開口するようにして形成される。そして、貫通孔14、溝16および溝18内には、導体20が形成される。コア12の一方端面には、溝16内の導体20と接続するように端面電極22が形成され、他方端面には、溝18内の導体20と接続するように端面電極24が形成される。さらに、コア12の上面および下面には、外装材26および外装材28が形成される。
【0012】このようなノイズ除去部品10を製造するためには、たとえば図2に示すような直方体状の成形体30が準備される。成形体30は、たとえばNi－Zn系フェライト造粒粉末をプレス成形することによって形成される。この際、成形体30のほぼ中央部には、上面および下面に垂直に貫通孔14が形成される。また、成形体30の上面には、渦巻状の溝16が、その一端を貫通孔14の開口部に連なるようにし、他端を成形体30の一方端面に開口するようにして形成される。さらに、

成形体３０の下面には、渦巻状の溝１８が、その一端を貫通孔１４の開口部に連なるようにし、他端を成形体３０の他方端面に開口するようにして形成される。

【００１３】次に、図3に示すように、貫通孔１４、溝１６および溝１８には、たとえばＡｇまたは、Ａｇ－Ｐｄ等を用いた導電ペースト３２が印刷等の方法により充填される。さらに、図4に示すように、成形体３０の上面および下面には、フェライトスラリーが厚膜塗布される。そして、全体が焼成されることにより、外装材２６と外装材２８とが形成されるとともに、成形体３０および導電ペースト３２が焼結して、コア１２と導体２０とが形成される。さらに、コア１２の一方端面と他方端面とには、たとえば、導電ペーストが厚膜塗布され焼き付けられて、端面電極２２および端面電極２４が形成される。ここで、端面電極２２および端面電極２４はスパッタにより形成してもよい。

【００１４】この発明によれば、ノイズ除去部品１０を製造する際に、導線を巻回する工程が不要となる。そのため、導線を巻回して巻線を形成する従来のノイズ除去部品に比べて製造コストを低減することができる。また、貫通孔１４の径や、溝１６，溝１８の幅および深さなどを調整することにより、導体２０の断面積を変えることができるため、実用電流に応じた電流容量のノイズ除去部品１０を得ることができる。また、コア１２が直方体状であるため、ノイズ除去部品１０を安定してプリント基板上に載置することができ、表面実装を行うことができる。

【００１５】また、外装材２６および外装材２８が形成されているため、コア１２と導体２０とが保護される。さらに、外装材２６および外装材２８が磁性体材料で形成されているため、ノイズ除去部品１０から磁束が漏れにくくなり、インピーダンスを大きくすることができる。また、もれ磁束が少ないため、ノイズ除去部品１０の近傍の素子に与える磁気の影響が少なくなる。したがって、ノイズ除去部品１０と他の素子との間隔を小さくすることができ、高密度実装が可能である。さらに、溝１４および溝１８の巻き数を調整することによって、ノイズ除去部品１０のインピーダンスを調整することができる。

【００１６】図5は、この発明の他のノイズ除去部品１０を示す斜視図である。このノイズ除去部品１０を製造するためには、たとえば、図6に示すように、コア１２が準備される。コア１２は、たとえばＮｉ－Ｚｎ系フェライト材料をインジェクション成形することによって、貫通孔１４と、貫通孔１４によって接続される渦巻状の溝１６および溝１８とを有する直方体状に形成した後、焼成されたものである。次に、貫通孔１４、溝１６および溝１８には、たとえばＡｇおよびＡｇ－Ｐｄ等を用いた導電ペーストが塗布され焼き付けられて、導体２０が形成される。さらに、図7に示すように、コア１２の両端面には、たとえばＡｇおよびＡｇ－Ｐｄ等を用いた導電ペーストが厚膜塗布され焼き付けられて、端面電極２２および端面電極２４が形成される。次に、導体２０が渦巻状に形成されたコア１２の上面および下面には、たとえばフェライト磁粉を混入したエポキシ樹脂がモールドされ、外装材２６と外装材２８とが形成される。こうして製造された図5に示す実施例でも、図１に示す実施例と同様の効果を有する。

【図面の簡単な説明】

【図１】（Ａ）はこの発明の一実施例を示す斜視図であり、（Ｂ）はその底面図である。

【図２】図１に示すノイズ除去部品を作製するために準備される成形体を示す斜視図である。

【図３】図２に示す成形体の溝および貫通孔に導電ペーストを充填した状態を示す斜視図である。

【図４】図３に示す成形体の上面および下面にフェライトスラリーを塗布した状態を示す斜視図である。

【図５】この発明の他の実施例を示す斜視図である。

【図６】図５に示すノイズ除去部品を作製するために準備されるコアを示す斜視図である。

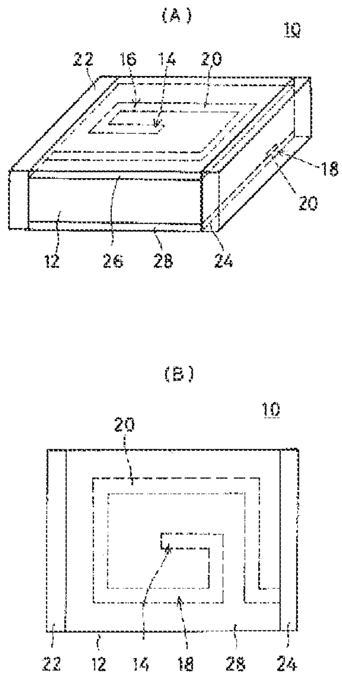
【図７】図６に示すコアの溝および貫通孔に導体を形成し、一方端面および他方端面に端面電極を形成した状態を示す斜視図である。

【図８】従来のノイズ除去部品を示す図解図である。

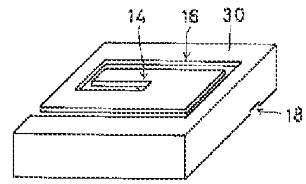
【符号の説明】

１０　ノイズ除去部品
１２　コア
１４　貫通孔
１６　溝
１８　溝
２０　導体
２２　端面電極
２４　端面電極
２６　外装材
２８　外装材

【図1】



【図2】



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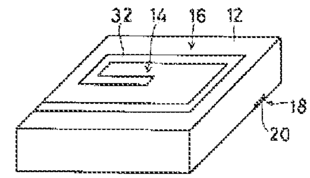
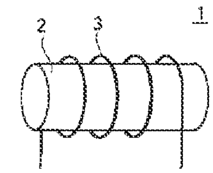
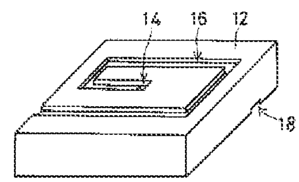


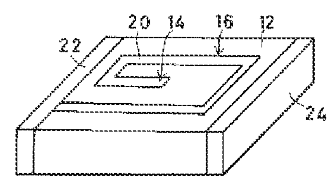
【図8】



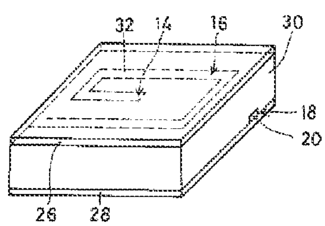
【図6】



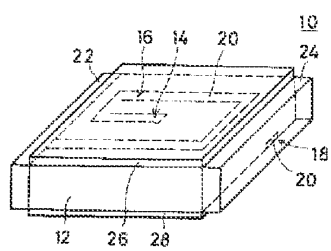
【図7】



【図4】



【図5】



フロントページの続き

(72)発明者　西　永　良　博
京都府長岡京市天神２丁目26番10号　株式
会社村田製作所内

Electronic Acknowledgement Receipt

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Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Jennifer R Ruppert
Filer Authorized By:	Jeff Lloyd
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I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on December 19, 2013.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	Rexford N. Barnie
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

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

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached. However, Applicants have not submitted copies of the published U.S. Patent Applications cited on attached Form PTO/SB/08 pursuant to 37 CFR 1.98(a)(2)(ii).

Applicants note that Japanese Publication Nos. 2002-299138, 2008-172872, 2008-205215, 2008-210861, 2008-27015, 61-69811, and 6-267746 (cited as F1 to F7, respectively) and Korean Publication Nos. 10-2008-0074640 and 10-2012-0016778 (cited as F8 and F9, respectively) on the attached form PTO/SB/08, were written in foreign languages; however, English language Abstracts are provided herewith. Applicants have also included U.S.

Publication No. 2008/0164840, cited as U1 on the attached form PTO/SB/08, which is a patent family member of JP 2008-172872 and is believed to be an English language equivalent thereof. Applicants have also included U.S. Publication No. 2012/0044114, cited as U2 on the attached form PTO/SB/08, which is a patent family member of KR 10-2012-0016778 and is believed to be an English language equivalent thereof. Applicants respectfully request that the references be made of record and considered in the examination of the subject application.

The undersigned hereby certifies that each item of information contained in this Information Disclosure Statement was first cited in communications from foreign patent offices in counterpart foreign applications not more than three months prior to the filing of this Information Disclosure Statement. Applicants are attaching copies of the Korean and Japanese Office Actions.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/mv

Attachments: Form PTO/SB/08; copies of references cited.

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This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

출 원 번 호 : Application Number	10-2012-0029987
출 원 년 월 일 : Filing Date	2012년 03월 23일 MAR. 23, 2012
출 원 인 : Applicant(s)	엘지이노텍 주식회사 LG INNOTEK CO., LTD.

2013년 10월 25일

특 허 청
COMMISSIONER

제출 일자 : 2012-03-23

【서지사항】

【서류명】 특허출원서

【참조번호】 0510

【출원구분】 특허출원

【출원인】

【명칭】 엘지이노텍 주식회사

【출원인코드】 1-1998-000285-5

【대리인】

【성명】 서교준

【대리인코드】 9-2004-000236-3

【포괄위임등록번호】 2009-020964-8

【발명의 국문명칭】 무선전력 수신장치 및 그의 제조 방법

【발명의 영문명칭】 APPARATUS FOR RECEIVING WIRELESS POWER AND METHOD FOR MANUFACTURING THEREOF

【발명자】

【성명】 안정욱

【성명의 영문표기】 AN, JEONG WOOK

【주민등록번호】 740501-1XXXXXX

【우편번호】 100-095

【주소】 서울특별시 중구 남대문로5가 541번지 서울스퀘어

【국적】 KR

【발명자】

【성명】 이정오

【성명의 영문표기】 LEE, JUNG OH

【주민등록번호】 770427-1XXXXXX

【우편번호】 100-095

【주소】	서울특별시 중구 남대문로5가 541번지 서울스퀘어
【국적】	KR

【발명자】

【성명】	임성현
【성명의 영문표기】	LEEM, SUNG HYUN
【주민등록번호】	771222-1XXXXXX
【우편번호】	100-095
【주소】	서울특별시 중구 남대문로5가 541번지 서울스퀘어
【국적】	KR

【심사청구】 청구

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 서교준 (서명 또는 인)

【수수료】

【출원료】	0	면	38,000	원
【가산출원료】	31	면	0	원
【우선권주장료】	0	건	0	원
【심사청구료】	15	항	730,000	원
【합계】	768,000 원			

【명세서】

【발명의 명칭】

무선전력 수신장치 및 그의 제조 방법{APPARATUS FOR RECEIVING WIRELESS POWER AND METHOD FOR MANUFACTURING THEREOF}

【기술분야】

<1> 본 발명은 무선전력 수신장치 및 그의 제조 방법에 관한 것이다. 보다 상세하게는, 무선전력 전송 또는 안테나에 적용되어 전체 두께를 감소시키고, 제조 공정을 단순화 시킨 무선전력 수신장치 및 그의 제조 방법에 관한 것이다.

【배경기술】

<2> 무선으로 전기 에너지를 원하는 기기로 전달하는 무선전력전송 기술(wireless power transmission 또는 wireless energy transfer)은 이미 1800년대에 전자기유도 원리를 이용한 전기 모터나 변압기가 사용되기 시작했고, 그 후로는 라디오파나 레이저와 같은 전자파를 방사해서 전기에너지를 전송하는 방법도 시도 되었다. 우리가 흔히 사용하는 전동칫솔이나 일부 무선면도기도 실상은 전자기유도 원리로 충전된다. 전자기 유도는 도체의 주변에서 자기장을 변화시켰을 때 전압이 유도되어 전류가 흐르는 현상을 말한다. 전자기 유도 방식은 소형 기기를 중심으로 상용화가 빠르게 진행되고 있으나, 전력의 전송 거리가 짧은 문제가 있다.

<3> 현재까지 무선 방식에 의한 에너지 전달 방식은 전자기 유도 이외에 자기 공진 및 단파장 무선 주파수를 이용한 원거리 송신 기술 등이 있다.

<4> 그러나, 일반적으로 단말기에 내장된 무선전력 수신장치의 두께가 두껍고, 제조 공정이 복잡한 문제가 있다.

【발명의 내용】

【해결하려는 과제】

<5> 본 발명은 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 두께를 크게 감소시킬 수 있는 방법의 제공을 목적으로 한다.

<6> 본 발명은 자성 기판 상면에 코일부 및 근거리 통신 안테나를 직접 배치시켜 높은 전력전송 효율을 유지시키며 외부 장치와 통신도 가능케 하는 방법의 제공을 목적으로 한다.

<7> 본 발명은 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 제조 공정을 단순화 시킨 방법의 제공을 목적으로 한다.

【과제의 해결 수단】

<8> 본 발명의 일 실시 예에 따른 무선전력 수신장치는 송신 측과 커플링 되는 자기장의 방향을 변경시키는 자성 기판; 및 상기 자성 기판에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 한다.

<9> 상기 코일부는 상기 자성 기판의 상면에 직접 배치되어 도전 패턴 또는 도전층 형성하는 것을 특징으로 한다.

<10> 상기 무선전력 수신장치는 상기 코일부의 상 측에 배치되고, 상기 코일부와 접속 가능한 연결부를 더 포함한다.

<11> 상기 자성 기판은 수용영역을 포함하고, 상기 수용영역에 상기 코일부와 접속 가능한 연결부가 더 배치되는 것을 특징으로 한다.

<12> 상기 수용영역의 형태와 상기 연결부의 형태는 일치하도록 제작될 수 있다.

<13> 상기 코일부와 상기 연결부는 솔더에 의해 접속되는 것을 특징으로 한다.

<14> 상기 무선전력 수신장치는 상기 자성 기판 상면에 직접 상기 코일부를 감싸는 형태로 배치된 근거리 통신 안테나를 더 포함하는 것을 특징으로 한다.

<15> 상기 근거리 통신 안테나의 두께와 상기 코일부의 두께는 동일한 것을 특징으로 한다.

<16> 상기 근거리 통신 안테나는 NFC(NEAR FIELD COMMUNICATION) 안테나인 것을 특징으로 한다.

<17> 상기 무선전력 수신장치는 상기 코일부를 통해 전자기 유도를 이용해 전력을 수신하는 것을 특징으로 한다.

<18> 상기 무선전력 수신장치는 상기 코일부를 통해 자기 공진을 이용해 전력을 수신하는 것을 특징으로 한다.

<19> 본 발명의 또 다른 실시 예에 따른 무선전력 수신장치의 제조 방법은 자성 기판의 상면에 직접 도전체를 적층하는 단계; 상기 적층된 도전체를 라미네이팅 하는 단계; 상기 라미네이팅된 도전체 상에 마스크를 적층하는 단계; 및 상기 마스크가 적층된 상태에서 에칭을 수행하여 도전 패턴을 형성하는 단계를 포함하는 것을 특징으로 한다.

<20> 상기 무선전력 수신장치의 제조 방법은 상기 자성 기판과 상기 도전체 사이에 접착층을 적층하는 단계를 더 포함하는 것을 특징으로 한다.

<21> 상기 무선전력 수신장치의 제조 방법은 상기 형성된 도전 패턴을 연결부와 솔더링하는 단계를 더 포함하는 것을 특징으로 한다.

<22> 상기 무선전력 수신장치는 단말기에 내장될 수 있다.

【발명의 효과】

<23> 본 발명의 실시 예에 따르면, 다음과 같은 효과가 있다.

<24> 첫째, 본 발명은 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 두께를 크게 감소시킬 수 있다.

<25> 둘째, 자성 기판 상면에 코일부 및 근거리 통신 안테나를 직접 배치시켜 높은 전력전송 효율을 유지시키며 동시에 외부 장치와 통신도 가능케 한다.

<26> 셋째, 라미네이팅 및 에칭 과정만을 통해 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 제조 공정을 단순화 시킨 방법의 제공을 목적으로 한다.

<27> 한편 그 외의 다양한 효과는 후술될 본 발명의 실시 예에 따른 상세한 설명에서 직접적 또는 암시적으로 개시될 것이다.

【도면의 간단한 설명】

<28> 도 1은 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

도 2는 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 3은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

도 4 내지 도 8는 본 발명의 일 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법에 설명하기 위한 도면이다.

도 9는 본 발명의 제2 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 10은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

도 11은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

도 12는 도 11의 연결부(300)에 도시된 점을 따라 B에서 B'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

도 13은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 본 발명의 제4 실시 예에 따른 무선전력 송신장치(1000)의 단면도이다.

【발명을 실시하기 위한 구체적인 내용】

<29> 이하에서는, 첨부된 도면을 참조하여 본 발명의 바람직한 실시예에 대하여 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있도

록 상세히 설명한다.

<30> 도 1은 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

<31> 도 1 내지 도 3을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300)를 포함할 수 있다.

<32> 무선전력 수신장치(1000)는 송신 측으로부터 무선으로 전력을 수신할 수 있다. 일 실시 예에서 무선전력 수신장치(1000)는 전자기 유도를 이용해 무선으로 전력을 수신 할 수 있다. 일 실시 예에서 무선전력 수신장치(1000)는 자기 공진을 이용해 무선으로 전력을 수신할 수 있다.

<33> 전자기 유도 및 자기 공진 모두 자기장을 이용하여 전력을 전송하는 방식이다.

<34> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시킬 수 있다.

<35> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과를 가질 수 있다.

<36> 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 측방으로 변경시켜 코일부(200)에 자기장이 더 집중적으로 전달될 수 있도록 한다.

<37> 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다.

<38> 자성체(110)는 입자 또는 세라믹의 형태를 포함할 수 있다.

<39> 지지체(120)는 열경화성 수지 또는 열가소성 수지를 포함할 수 있다.

<40> 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

<41> 코일부(200)는 제1 연결단자(210), 제2 연결단자(220), 코일(230)을 포함할 수 있다. 코일(230)은 도전층 또는 도전 패턴을 형성할 수 있다.

<42> 제1 연결단자(210)는 코일(230)의 일단에 제2 연결단자(220)는 코일(230)의 타단에 위치한다.

<43> 제1 연결단자(210) 및 제2 연결단자(220)는 연결부(300)와의 접속을 위해 필요한 단자이다.

<44> 코일(230)은 하나의 도선이 복수 번 권선된 코일 패턴을 형성할 수 있다. 일 실시 예에서 코일 패턴은 평면 나선 구조일 수 있으나, 이에 한정될 필요는 없고, 다양한 패턴을 형성할 수 있다.

<45> 코일부(200)는 자성 기판(100)의 상면에 직접 배치될 수 있다. 일 실시 예에서 코일부(200)와 자성 기판(100) 사이에는 접착층(미도시)이 더 배치될 수 있다.

<46> 코일부(200)는 도전체를 포함할 수 있다. 도전체는 금속 또는 합금이 이용될 수 있다. 일 실시 예에서 금속은 은 또는 구리가 사용될 수 있으나, 이에 한정될 필요는 없다.

<47> 코일부(200)는 송신 측으로부터 무선으로 수신한 전력을 연결부(300)에 전달할 수 있다. 코일부(200)는 송신 측으로부터 전자기 유도 또는 자기 공진을 이용하여 전력을 수신할 수 있다.

<48> 연결부(300)는 제3 연결단자(310), 제4 연결단자(320), 인쇄회로기판(330)을 포함할 수 있다.

<49> 제3 연결단자(310)는 제1 연결단자(210)와 접속될 수 있고, 제4 연결단자(320)는 제2 연결단자(220)와 접속될 수 있다.

<50> 인쇄회로기판(330)은 배선층을 포함할 수 있다.

<51> 연결부(300)는 수신회로(미도시)와 코일부(200) 사이를 연결하여 코일부(200)로부터 전달받은 전력을 수신회로(미도시)를 통해 부하(미도시)로 전달할 수 있다. 수신회로는 교류전력을 직류전력으로 변환하는 정류회로 및 변환된 직류전력에서 리플 성분을 제거하여 부하에 전달하는 평활회로를 포함할 수 있다.

<52> 다음으로 도 2 내지 도 3에서 코일부(200)와 연결부(300)가 연결된 상태인 경우, 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 상세한 구성을 설명한다.

<53> 도 2는 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

<54> 도 2는 코일부(200)와 연결부(300)가 서로 접속되어 있는 상태를 보여준다.

<55> 일 실시 예에서 코일부(200)와 연결부(300) 간의 접속은 솔더에 의해 이루어질 수 있다. 구체적으로 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연결단자는 제1 솔더(10)에 의해 연결될 수 있고, 코일부(200)의 제2 연결단자(220)와 연결부(300)의 제4 연결단자(320)는 제2 솔더(20)에 의해 연결될 수 있다. 구체적으로, 제1 연결단자(210)는 제1 솔더(10)의 비아홀을 통해 제3 연결단자(310)와 연결될 수 있고, 제2 연결단자(220)는 제2 솔더(20)의 비아홀을 통해 제4 연결단자(320)와 연결될 수 있다.

<56> 도 2에 도시된 무선전력 수신장치(1000)는 단말기 등과 같은 전자기기에 내장될 수 있다.

<57> 단말기는 셀룰러 폰, PCS(Personal Communication Servie) 폰, GSM 폰, CDMA-2000 폰, WCDMA 폰과 같은 통상적인 이동 전화기, PMP(Portable Multimedia Player), PDA(Personal Digital Assistants), 스마트폰, MBS(Mobile Broadcast System) 폰 일 수 있다.

<58> 도 2에서 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 단면에 대한 설명은 도 3에서 한다.

<59> 도 3은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A' 으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

<60> 도 3을 참고하면, 자성 기판(100) 상면에는 코일부(200)의 구성요소인 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 배치되어 있다.

<61> 본 발명의 제1 실시 예에 따른 무선전력 수신장치(1000)는 자성 기판(100)의 상면에 코일부(200)가 직접 배치되어 있어, 기존의 FPCB 상에 코일 패턴을 형성한 경우와 달리 전체적인 두께를 크게 감소시킬 수 있다.

<62> 바람직하게 자성 기판(100)의 두께는 0.43㎜이고, 코일부(200)의 두께는 0.1㎜이고, 이를 합한 두께는 0.53㎜일 수 있다. 그러나, 이 수치는 예시에 불과하다.

<63> 즉, 코일부(200)를 도전체, 도전 패턴, 박막과 같은 형태로 구성함으로써 무선전력 수신장치(1000)의 두께를 감소시킬 수 있다. 이는, 요즘 휴대용 단말기와 같이 슬림화를 요구하고 있는 전자기기에 적용한다면 휴대용 단말기의 전체 두께를 감소시키면서 송신 측으로부터 전력을 수신하는데 유용한 효과를 가져올 수 있다.

<64> 코일부(200)의 상 측에는 연결부(300)가 직접 배치되어 있다. 코일부(200)의 상 측에 연결부(300)가 직접 배치됨에 따라 코일부(200)와 연결부(300)가 쉽게 접속될 수 있다.

<65> 코일부(200)의 제1 연결단자(210)는 솔더(10)에 의해 연결부(300)의 제3 연결단자와 접속된다.

<66> 코일부(200)의 제2 연결단자(220)는 솔더(20)에 의해 연결부(300)의 제4 연결단자와 접속된다.

<67> 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 코일(230)과 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

<68> 도 4 내지 도 8는 본 발명의 일 실시 예에 따른 무선전력 수신장치(1000)의 제조 방법에 설명하기 위한 도면이다.

<69> 무선전력 수신장치(1000)의 구성은 도 1 내지 도 3에서 설명한 것과 본질적으로 결합될 수 있다.

<70> 먼저, 도 4를 참고하면, 자성 기판(100)이 형성된다.

<71> 다음으로 도 5를 참고하면, 자성 기판(100)의 상면에 직접 도전체(201)를 적층된다. 일 실시 예에서는 자성 기판(100)의 상면에 접착층이 적층된 후, 도전체(201)가 적층될 수도 있다.

<72> 일 실시 예에서 자성 기판(100)의 상면에 도전체(201)를 적층시키는 방법은 도전체(201)를 소정의 온도에서 가열하고, 그 후, 소정의 압력을 가하는 라미네이팅(laminating) 공정이 사용될 수 있다. 라미네이팅(laminating) 공정이란, 열과 압력을 이용하여 서로 다른 종류의 금속박, 종이 등을 접착시키는 공정을 의미한다.

<73> 다음으로 도 6을 참고하면, 도전체(201)의 상 면에 마스크(500)가 적층된다. 마스크(500)는 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 형성되어 있는 위치의 상 면에만 적층될 수 있다.

<74> 다음으로, 도 7을 참고하면, 도 6의 상태에서 에칭액에 담구면 마스크(500)가 위치하지 않은 홈 부분이 식각된다. 그러면, 도전체(201)는 일정한 도전 패턴을 형성하게 된다.

<75> 그 후, 마스크(500)를 제거하면, 무선전력 수신장치(1000)의 코일부(200)가 형성된다.

<76> 다음으로 도 8을 참고하면, 코일부(200)와 연결부(300)가 접속되도록 솔더링 작업을 거친다.

<77> 즉, 코일부(200)의 제1 연결단자(210)와 연결부(300)의 제3 연결단자(310)를 솔더(10)에 의해 접속시키고, 코일부(200)의 제2 연결단자(200)와 연결부(300)의 제4 연결단자(320)를 솔더(20)에 의해 접속시킨다.

<78> 상기와 같이 자성 기판(100) 상 면에 직접 코일부(200)를 배치시킴으로써, 무선전력 수신장치(300)의 전체 두께를 크게 감소시킬 수 있고, 라미네이팅과 에칭 과정만을 통해 무선전력 수신장치(1000)를 제조할 수 있어 공정이 단순화되는 효과가 있다.

<79> 도 9는 본 발명의 제2 실시 예에 따른 무선전력 수신장치(1000)의 평면도이다.

<80> 도 9를 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300), 근거리 통신 안테나(600)를 포함할 수 있다.

<81> 자성 기판(100), 코일부(200), 연결부(300)에 대한 설명은 도 1에서 설명한 것과 같다.

<82> 근거리 통신 안테나(600)는 제5 연결단자(610), 제6 연결단자(620), 외곽 코일(630)을 포함한다.

<83> 제5 연결단자(610) 및 제6 연결단자(620)는 연결부(300)에 접속된다.

<84> 근거리 통신 안테나(600)는 근거리 무선통신이 가능한 리더기와 통신을 수행할 수 있다. 근거리 통신 안테나(600)는 상기 리더기와 정보를 송수신하는 안테나의 역할을 수행한다.

<85> 일 실시 예에서 근거리 통신 안테나(600)는 코일부(200)의 외곽에 배치될 수 있다. 일 실시 예에서 코일부(200)가 자성 기판(100)의 중앙에 배치된 경우, 근거리 통신 안테나(600)는 코일부(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 근거리 통신 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

<86> 근거리 통신 안테나(600)는 코일부(200)처럼 도전 패턴, 도전층을 형성할 수 있다.

<87> 근거리 통신 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다. NFC(Near Field Communication)는 13.56MHz의 대역을 가지며, 가까운 거리의 무선통신을 하기 위한 기술이다.

<88> 근거리 통신 안테나(600)는 자성 기판(100)의 상면에 직접 배치될 수 있다.

<89> 근거리 통신 안테나(600)가 자성 기판(100)에 배치되는 방법은 상기 도 4에서 설명한 제조 방법과 동일할 수 있다.

<90> 다음으로 도 10 내지 도 12에서 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 상세한 구성을 설명한다.

<91> 도 10은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 사시도이다.

<92> 도 10을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300)를 포함한다.

<93> 코일부(200), 연결부(300)에 대한 설명은 도 1에서 설명한 것과 같다. 다만, 자성 기판(100)의 경우, 일부 구조가 다르므로 이를 중심으로 설명한다.

<94> 도 10을 참고하면, 자성 기판(100)은 연결부(300)의 구조와 동일한 구조를 갖는 수용영역을 형성하고 있다. 즉, 도 1의 경우, 자성 기판(100) 상면에 코일부(200)가 배치되고, 코일부(200) 위에 연결부(300)가 연결되는 구조이나, 도 10의 경우, 자성 기판(100) 자체에 연결부(300)의 구조와 동일한 구조에 해당하는 부분만큼 수용영역이 형성된다.

<95> 도 11은 본 발명의 제3 실시 예에 따른 무선전력 수신장치(1000)의 평면도이

다.

<96> 도 11은 코일부(200)와 연결부(300)가 서로 접속되어 있는 상태를 보여준다.

<97> 연결부(300)의 두께는 자성 기판(100)의 두께와 같거나 작을 수 있다.

<98> 연결부(300)는 자성 기판(100)의 수용영역(130)에 배치될 수 있다.

<99> 연결부(300)의 두께가 자성 기판(100)의 두께와 같거나 작다면, 도 3의 실시예와 달리, 연결부(300)의 두께만큼 무선전력 수신장치(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

<100> 도 12는 도 11의 연결부(300)에 도시된 점을 따라 B에서 B'으로 자른 경우, 무선전력 수신장치(1000)의 단면도이다.

<101> 연결부(300)의 두께는 자성 기판(100)의 두께보다 작은 경우를 가정하여 설명한다.

<102> 도 12를 참고하면, 연결부(300) 상면에는 코일부(200)의 구성요소인 제1 연결단자(210), 제2 연결단자(220), 코일(230)이 배치되어 있다.

<103> 코일부(200)의 하 측에는 연결부(300)가 배치되어 있다.

<104> 코일부(200)의 제1 연결단자(210)는 솔더(10)에 의해 연결부(300)의 제3 연결단자와 접속된다.

<105> 코일부(200)의 제2 연결단자(220)는 솔더(20)에 의해 연결부(300)의 제4 연

결단자와 접속된다.

<106> 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 코일(230)과 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

<107> 도 12를 참고하면, 연결부(300)의 두께가 자성 기판(100)의 두께보다 작으므로, 도 3의 실시 예와 달리, 연결부(300)의 두께만큼 무선전력 수신장치(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

<108> 도 13은 도 2의 연결부(300)에 도시된 점선을 따라 A에서 A'으로 자른 경우, 본 발명의 제4 실시 예에 따른 무선전력 송신장치(1000)의 단면도이다.

<109> 도 13을 참고하면, 무선전력 수신장치(1000)는 자성 기판(100), 코일부(200), 연결부(300), 접착층(700)을 포함할 수 있다.

<110> 자성 기판(100), 코일부(200), 연결부(300)는 도 1에서 설명한 것과 같다.

<111> 접착층(700)은 자성 기판(100)과 코일부(200) 사이에 배치되어 자성 기판(100)과 코일부(200)를 접착시킨다.

<112> 또한, 이상에서는 본 발명의 바람직한 실시 예에 대하여 도시하고 설명하였지만, 본 발명은 상술한 특정의 실시 예에 한정되지 아니하며, 청구범위에서 청구하는 본 발명의 요지를 벗어남이 없이 당해 발명이 속하는 기술분야에서 통상의 지

식을 가진 자에 의해 다양한 변형 실시가 가능한 것은 물론이고, 이러한 변형 실시들은 본 발명의 기술적 사상이나 전망으로부터 개별적으로 이해 되어서는 안될 것이다.

【부호의 설명】

<113> 10: 제1 솔더

20: 제2 솔더

100: 자성 기판

110: 자성체

120: 지지체

130: 수용영역

200: 코일부

201: 도전체

210: 제1 연결단자

220: 제2 연결단자

230: 코일

300: 연결부

310: 제3 연결단자

320: 제4 연결단자

330: 인쇄회로기판

500: 마스크

600: 근거리 통신 안테나

700: 접착층

【특허청구범위】

【청구항 1】

송신 측과 커플링 되는 자기장의 방향을 변경시키는 자성 기판; 및

상기 자성 기판의 상면에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 2】

제1항에 있어서,

상기 코일부는 상기 자성 기판의 상면에 직접 배치되어 도전 패턴 또는 도전층 형성하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 3】

제1항에 있어서,

상기 코일부의 상 측에 배치되고, 상기 코일부와 접속 가능한 연결부를 더 포함하는 무선전력 수신장치.

【청구항 4】

제1항에 있어서,

상기 자성 기판은 수용영역을 포함하고,

상기 수용영역에 상기 코일부와 접속 가능한 연결부가 더 배치되는 것을 특징으로 하는 무선전력 수신장치.

【청구항 5】

제4항에 있어서,

상기 수용영역의 형태와 상기 연결부의 형태는 일치하도록 제작된 무선전력 수신장치.

【청구항 6】

제3항 또는 제4항에 있어서,

상기 코일부와 상기 연결부는 솔더에 의해 접속되는 것을 특징으로 하는 무선전력 수신장치.

【청구항 7】

제1항에 있어서,

상기 자성 기판 상면에 직접 상기 코일부를 감싸는 형태로 배치된 근거리 통신 안테나를 더 포함하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 8】

제7항에 있어서,

상기 근거리 통신 안테나의 두께와 상기 코일부의 두께는 동일한 것을 특징으로 하는 무선전력 수신장치.

【청구항 9】

제7항에 있어서,

상기 근거리 통신 안테나는,

NFC(NEAR FIELD COMMUNICATION) 안테나인 것을 특징으로 하는 무선전력 수신

장치.

【청구항 10】

제1항에 있어서,

상기 무선전력 수신장치는,

상기 코일부를 통해 전자기 유도을 이용해 전력을 수신하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 11】

제1항에 있어서,

상기 무선전력 수신장치는,

상기 코일부를 통해 자기 공진을 이용해 전력을 수신하는 것을 특징으로 하는 무선전력 수신장치.

【청구항 12】

자성 기판의 상면에 직접 도전체를 적층하는 단계;

상기 적층된 도전체를 라미네이팅 하는 단계;

상기 라미네이팅된 도전체 상에 마스크를 적층하는 단계; 및

상기 마스크가 적층된 상태에서 에칭을 수행하여 도전 패턴을 형성하는 단계를 포함하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 13】

제12항에 있어서,

상기 자성 기판과 상기 도전제 사이에 접착층을 적층하는 단계를 더 포함하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 14】

제13항에 있어서,

상기 형성된 도전 패턴을 연결부와 솔더링하는 단계를 더 포함하는 것을 특징으로 하는 무선전력 수신장치의 제조 방법.

【청구항 15】

제1항의 무선전력 수신장치가 내장된 단말기.

【요약서】

【요약】

본 발명의 실시 예에 따른 무선전력 수신장치는 송신 측과 커플링 되는 자기장의 방향을 변경시키는 자성 기판 및 상기 자성 기판에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 한다.

본 발명의 다양한 실시 예에 따르면, 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 두께를 크게 감소시킬 수 있다.

또한, 자성 기판 상면에 코일부 및 근거리 통신 안테나를 직접 배치시켜 높은 전력전송 효율을 유지시키며 동시에 외부 장치와 통신도 가능케 한다.

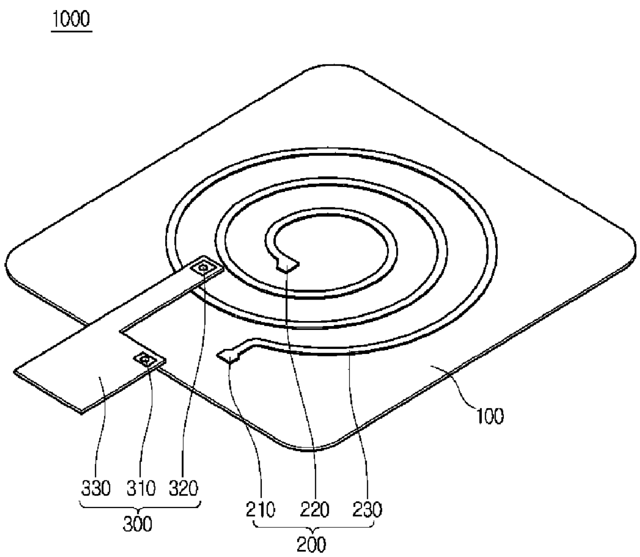
또한, 라미네이팅 및 에칭 과정만을 통해 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 제조 공정을 단순화 시킨 방법의 제공을 목적으로 한다.

【대표도】

도 9

【도면】

【도 1】



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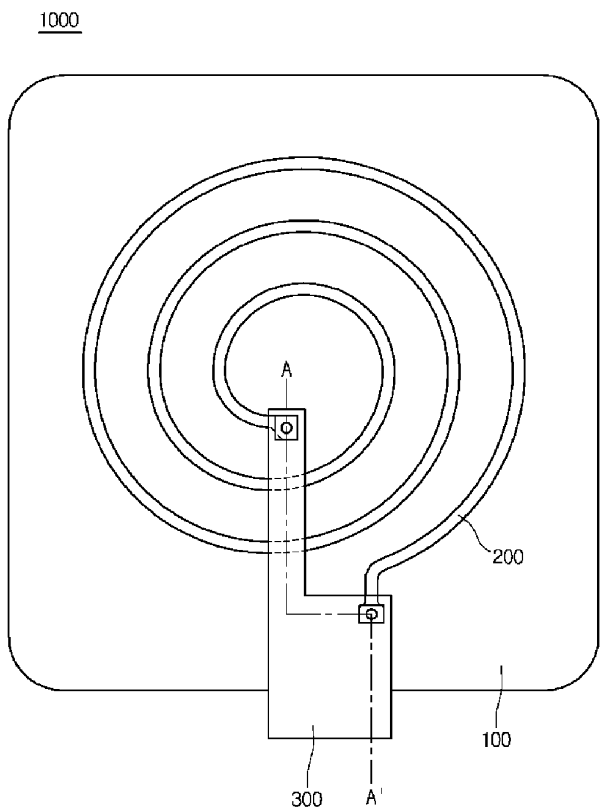

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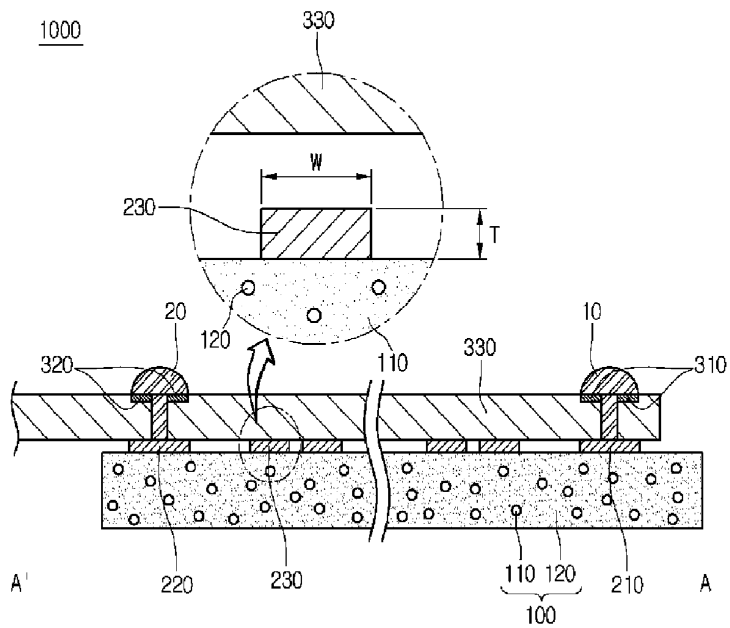
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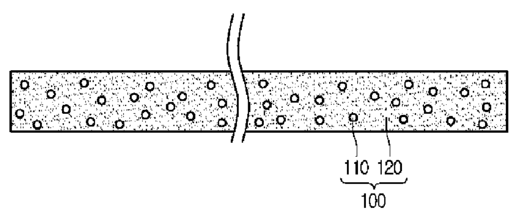
【도 4】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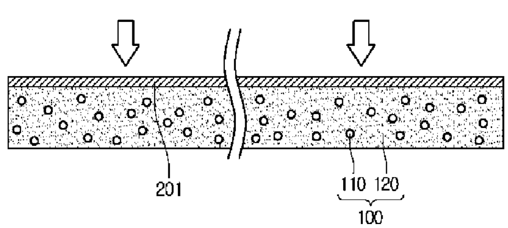
【도 5】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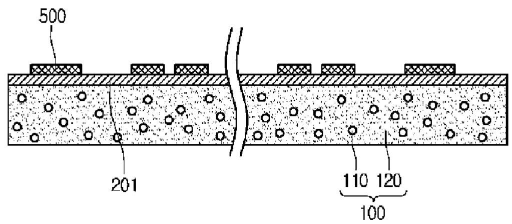
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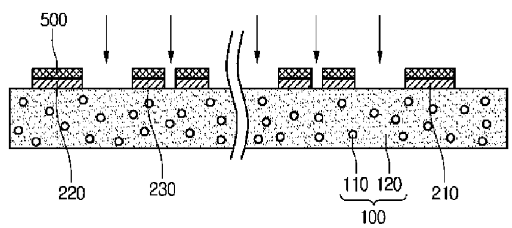
【도 7】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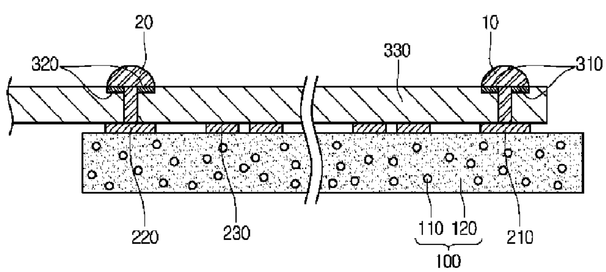
【도 8】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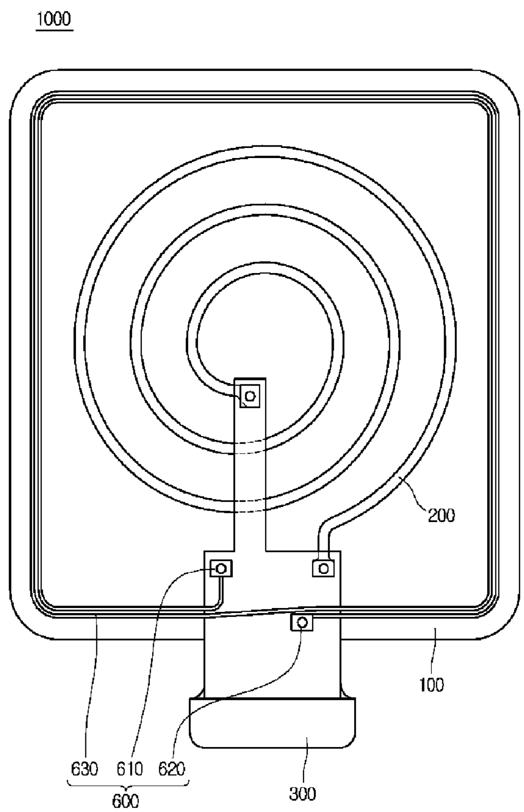
【도 9】



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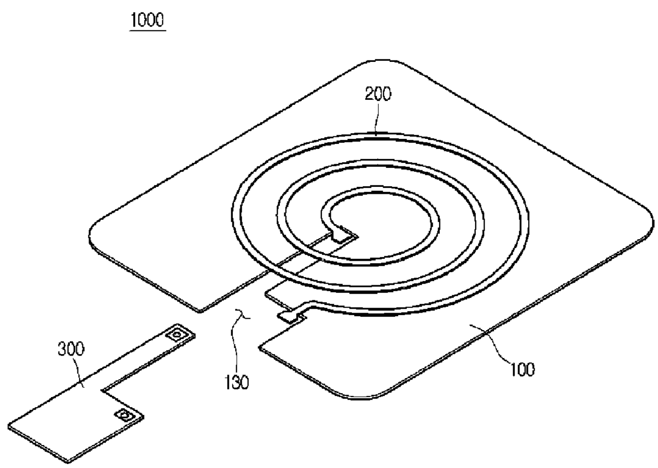
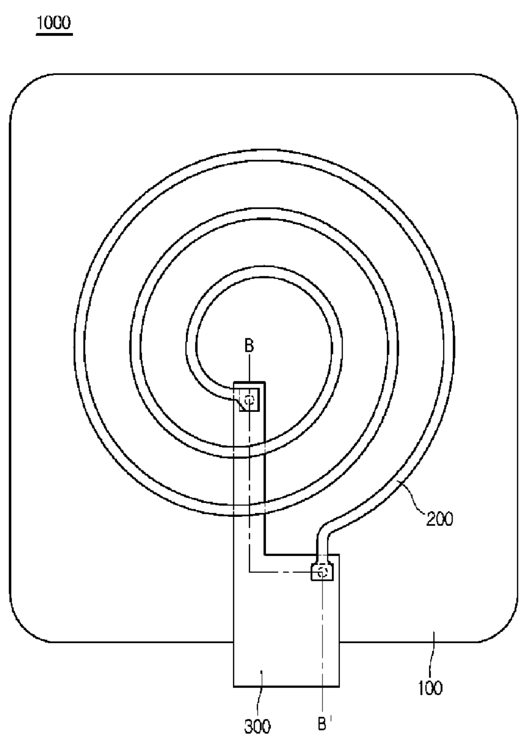


【도 11】



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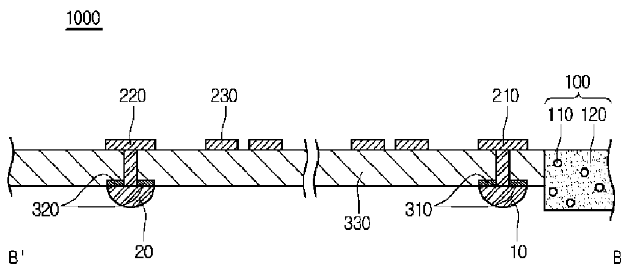
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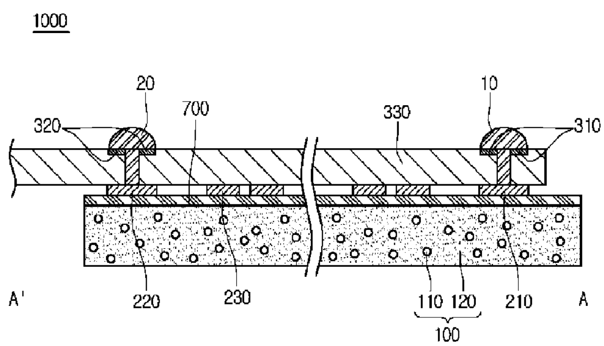
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420

CONFIRMATION NO. 3575

PUBLICATION NOTICE

OC000000064032882

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

Title:WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Publication No.US-2013-0249302-A1
Publication Date:09/26/2013

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/663,012

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	390
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 62 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1260

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/663,012	10/29/2012	2681	1260	SUN.LGI.420	20	3

CONFIRMATION NO. 3575

UPDATED FILING RECEIPT

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

OC000000058888751

Date Mailed: 01/31/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Jeong Wook AN, Seoul, KOREA, REPUBLIC OF;
Jung Oh LEE, Seoul, KOREA, REPUBLIC OF;
Sung Hyun LEEM, Seoul, KOREA, REPUBLIC OF;
Yang Hyun KIM, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

LG Innotek Co., LTD., Seoul, KOREA, REPUBLIC OF

Assignment For Published Patent Application

LG INNOTEK CO., LTD., Seoul, KOREA, REPUBLIC OF

Power of Attorney: The patent practitioners associated with Customer Number 23557

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

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Projected Publication Date: 09/26/2013

Non-Publication Request: No

Early Publication Request: No
Title

WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Preliminary Class

340

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MISSING PARTS
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop MISSING PARTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Sir:

The Notice of Omitted Items in a Nonprovisional Application dated November 21, 2012 indicates that Figure 37 described in the specification was omitted from the application. Applicants hereby select option III listed on the Notice of Omitted Items and respectfully request that the application as deposited be accepted. Transmitted herewith is a substitute specification that amends the specification to cancel any references to the omitted drawing and a Statement Under 37 C.F.R. §1.125(b).

J:\SUN\LGI\420\PTO-misc\Resp-Notice-Repl-Figs.doc/mhl

The Commissioner is hereby authorized to charge any fees which may be required to Deposit Account No. 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: P.O. Box 142950
Gainesville, FL 32614-2950

JL/mhl

Attachments: New Substitute Specification pages 1-32
Marked-up version of Substitute Specification
Statement Under 37 C.F.R. §1.125(b)

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Jeff Lloyd, Patent Attorney, Reg. No. 35,589

STATEMENT UNDER 37 C.F.R. §1.125(b)
Examining Group 2681
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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For	:	Wireless Power Receiver and Method of Manufacturing the Same

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

STATEMENT UNDER 37 C.F.R. §1.125(b)

Sir:

Attached herewith is a substitute specification, pages 1-32, excluding figures, in the subject application. The substitute specification includes no new matter. Also, attached herewith is a marked-up copy of the substitute specification showing the subject matter being deleted from the specification of record.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Saliwanchik
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/mhl

Attachments: New Substitute Specification pages 1-32
Marked-up version of Substitute Specification

J:\SUN\LGI\420\PTO-misc\Stmt-Sub-Spec.doc/DNB/mhl

DESCRIPTION

WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C §119 of Korean Patent Application Nos. 10-2012-0029987, filed March 23, 2012, and 10-2012-0079004, filed July 19, 2012, which are hereby incorporated by reference in their entirety.

BACKGROUND

The embodiment relates to a wireless power receiver and a method of manufacturing the same. In more particular, the embodiment relates to a wireless power receiver used for wireless power transmission or an antenna to reduce a thickness of the wireless power receiver and to simplify the manufacturing process thereof and a method of manufacturing the same.

A wireless power transmission or a wireless energy transfer refers to a technology of wirelessly transferring electric energy to desired devices. In the 1800's, an electric motor or a transformer employing the principle of electromagnetic induction has been extensively used and then a method of transmitting electrical energy by irradiating electromagnetic waves, such as radio waves or lasers, has been suggested. Actually, electrical toothbrushes or electrical razors, which are frequently used in daily life, are charged based on the principle of electromagnetic induction. The electromagnetic induction refers to the generation of an electric current through induction of a voltage when a magnetic field is changed around a conductor. The electromagnetic induction scheme has been successfully commercialized for electronic appliances having small sizes, but represents a problem in that the transmission distance of power is too short.

Besides the electromagnetic induction scheme, the long-distance transmission using the resonance and the short-wavelength radio frequency has been suggested as the wireless energy transfer scheme.

However, in general, a wireless power receiver disposed in a terminal has a thick thickness and the manufacturing process thereof is complicated.

BRIEF SUMMARY

An embodiment provides a method capable of remarkably reducing a thickness of a wireless power receiver by directly disposing a coil unit on a top surface of a magnetic substrate.

An embodiment provides a method capable of ensuring high power transmission efficiency and enabling communication with external devices by directly disposing a coil unit and a near field communication antenna on a top surface of a magnetic substrate.

An embodiment provides a method capable of simplifying the manufacturing process for a wireless power receiver by directly disposing a coil unit on a magnetic substrate.

An embodiment provides a method capable of remarkably reducing a thickness of a wireless power receiver by disposing a coil unit inside a magnetic substrate.

An embodiment provides a method capable of ensuring high power transmission efficiency and enabling communication with external devices by disposing a coil unit inside a magnetic substrate and a near field communication antenna on a magnetic substrate.

An embodiment provides a method capable of simplifying the manufacturing process for a wireless power receiver by disposing a coil unit inside a magnetic substrate.

A wireless power receiver according to one embodiment includes a magnetic substrate and a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer on the magnetic substrate.

A wireless power receiver according to one embodiment includes a magnetic substrate and a coil a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer at the magnetic substrate, wherein a part of the coil is disposed inside the magnetic substrate.

A method of manufacturing a wireless power receiver for wirelessly receiving power according to one embodiment includes forming a conductor on a protective film, forming a conductive pattern by etching the conductor, connecting a connecting unit to be connected to an external circuit to a connection terminal of the conductive pattern, obtaining a magnetic substrate having a receiving space of a predetermined shape corresponding to the connecting unit and disposing the magnetic substrate on the conductive pattern while positioning the connecting unit in the receiving space.

According to one embodiment, the thickness of the wireless power receiver can be remarkably reduced by directly disposing the coil unit on a top surface of the magnetic substrate. According to one embodiment, the high power transmission efficiency can be ensured and communication with external devices can be enabled by directly disposing the coil unit and the near field communication antenna on the top surface of the magnetic substrate.

According to one embodiment, the manufacturing process for the wireless power receiver can be simplified by directly disposing the coil unit on the magnetic substrate only through laminating and etching processes.

According to one embodiment, the thickness of the wireless power receiver can be remarkably reduced by forming the conductive pattern inside the magnetic substrate.

According to one embodiment, the high power transmission efficiency can be ensured by forming the conductive pattern inside the magnetic substrate and the communication with external devices can be enabled by using the near field communication antenna.

According to one embodiment, the connecting unit is disposed in the receiving space of the magnetic substrate so that the thickness of the wireless power receiver can be remarkably reduced as much as the thickness of the connecting unit.

According to one embodiment, a tape substrate is used as the connecting unit so that the overall size of the wireless power receiver can be reduced.

According to one embodiment, a lead frame is used as the connecting unit, so the wiring layer included in the connecting unit can be protected from the heat, external moisture or impact and the mass production can be realized.

According to one embodiment, the magnetic field directed to the outside can be changed into the coil unit due to the conductive pattern formed in the magnetic substrate, so the power transmission efficiency can be improved, at the same time, the amount of the magnetic field leaked to the outside can be reduced so that the bad influence of the magnetic field exerted to the human body can be diminished.

According to one embodiment, the wireless power receiver can be manufactured only through the processes of forming the pattern groove and inserting the coil unit, so that the manufacturing process can be simplified.

Other various effects of the embodiments will be disclosed directly or indirectly in the detailed description of the embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating a wireless power receiver **1000** according to the first embodiment;

FIG. 2 is a plan view illustrating a wireless power receiver **1000** according to the first embodiment;

FIG. 3 is a sectional view taken along line A-A’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 2;

FIGS. 4 to 8 are views for explaining a method of manufacturing a wireless power receiver **1000** according to one embodiment;

FIG. 9 is a sectional view taken along line A-A’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 2 according to the second embodiment;

FIG. 10 is a plan view illustrating a wireless power receiver **1000** according to the third embodiment;

FIG. 11 is a perspective view illustrating a wireless power receiver **1000** according to the fourth embodiment;

FIG. 12 is a plan view illustrating a wireless power receiver **1000** according to the fourth embodiment;

FIG. 13 is a sectional view taken along line B-B’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 12 according to the fourth embodiment;

FIG. 14 is a perspective view illustrating a wireless power receiver **1000** according to the fifth embodiment;

FIG. 15 is a plan view illustrating a wireless power receiver **1000** according to the fourth embodiment;

FIG. 16 is a sectional view taken along line C-C’ of a wireless power receiver **1000** according to the fifth embodiment;

FIGS. 17 to 21 are views for explaining a method of manufacturing a wireless power receiver **1000** according to the fifth embodiment;

FIG. 22 is a view for explaining variation of inductance, resistance and **Q** values of a coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed on a top surface of a magnetic substrate according to the first embodiment;

FIG. 23 is a view for explaining variation of inductance, resistance and **Q** values of a coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed in a pattern groove formed in a magnetic substrate according to the fifth embodiment;

FIG. 24 is an H-field for illustrating a radiation pattern of a magnetic field when a coil unit is disposed on a top surface of a magnetic substrate according to the first embodiment;

FIG. 25 is an H-field for illustrating a radiation pattern of a magnetic field when a coil unit is disposed in a pattern groove formed in a magnetic substrate according to the fifth embodiment;

FIG. 26 is an exploded perspective view of a wireless power receiver **1000** according to still another embodiment;

FIG. 27 is a perspective view of a wireless power receiver **1000** according to still another embodiment;

FIG. 28 is a sectional view of a wireless power receiver **1000** according to still another embodiment; and

FIGS. 29 to ~~37~~36 are views for explaining a method of manufacturing a wireless power receiver according to still another embodiment.

DETAILED DESCRIPTION

Hereinafter, exemplary embodiments will be described in detail with reference to accompanying drawings so that those skilled in the art can easily work with the embodiments.

Hereinafter, “conductive pattern” refers to the shape of a conductive layer and may be used to refer to a structure formed by a patterning process. “conductive layer” may be used interchangeably with “conductive pattern” and refers to a structure formed by methods including patterning, etching, deposing, selective plating, and the like.

FIG. 1 is a perspective view illustrating a wireless power receiver **1000** according to the first embodiment, FIG. 2 is a plan view illustrating the wireless power receiver **1000** according to the first embodiment and FIG. 3 is a sectional view taken along line A-A' of a connecting unit **300** of the wireless power receiver **1000** shown in FIG. 2.

Referring to FIGS. 1 to 3, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

The wireless power receiver **1000** may wirelessly receive power from a transmission side. According to one embodiment, the wireless power receiver **1000** may wirelessly receive the power using electromagnetic induction. According to one embodiment, the wireless power receiver **1000** may wirelessly receive the power using resonance.

The electromagnetic induction and resonance may be used when transmitting the power using the magnetic field.

The magnetic substrate **100** may change the direction of the magnetic field received from the transmission side.

The magnetic substrate **100** can reduce the amount of the magnetic field to be leaked to the outside by changing the direction of the magnetic field received from the transmission side.

In detail, the magnetic substrate **100** changes the direction of the magnetic field transferred from the transmission side in the lateral direction such that the magnetic field can be more concentrated onto the coil unit **200**.

The magnetic substrate **100** can absorb some of the magnetic field received from the transmission side and leaked to the outside to dissipate the magnetic field as heat. If the amount of the magnetic field leaked to the outside is reduced, the bad influence of the magnetic field exerted on the human body can be reduced.

Referring to FIG. 3, the magnetic substrate **100** may include a magnet **110** and a support **120**.

The magnet **110** may include a particle or a ceramic.

The support **120** may include thermosetting resin or thermoplastic resin.

The magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

Referring again to FIG. 1, the coil unit **200** may include a first connection terminal **210**, a second connection terminal **220** and a coil **230**. The coil **230** may be formed as a conductive layer or a conductive pattern.

The first connection terminal **210** is located at one end of the coil **230** and the second connection terminal **220** is provided at the other end of the coil **230**.

The first and second connection terminals **210** and **220** are necessary for connection with the connecting unit **300**.

The coil **230** may be formed as a conductive pattern which is obtained by winding a conductive line several times. According to one embodiment, when viewed from the top, the coil pattern may have a spiral shape. However, the embodiment is not limited thereto, and various patterns may be formed.

The coil unit **200** can be directly disposed on the top surface of the magnetic substrate **100**. According to one embodiment, an adhesive layer (not shown) may be disposed between the coil unit **200** and the magnetic substrate **100**.

The coil unit **200** may include a conductor. The conductor may include a metal or an alloy. According to one embodiment, the metal may include silver or copper, but the embodiment is not limited thereto.

The coil unit **200** may transfer the power, which is wirelessly received from the transmission side, to the connecting unit **300**. The coil unit **200** can receive the power from the transmission side using the electromagnetic induction or resonance.

The connecting unit **300** may include a first connection terminal **310**, a second connection terminal **320** and a printed circuit board **330**.

The first connection terminal **310** of the connecting unit **300** may be connected to the first connection terminal **210** of the coil unit **200** and the second connection terminal **320** of the connecting unit **300** may be connected to the second connection terminal **220** of the coil unit **200**.

The printed circuit board **330** may include a wiring layer and a receiver circuit, which will be described later, may be disposed on the wiring layer.

The connecting unit **300** connects the wireless power receiving circuit (not shown) with the coil unit **200** to transfer the power received from the coil unit **200** to a load (not shown) through the wireless power receiving circuit. The wireless power receiving circuit may include a rectifier circuit for converting AC power into DC power and a smoothing circuit for transferring the DC power to the load after removing ripple components from the DC power.

FIGS. 2 and 3 are views for explaining the structure of the wireless power receiver **1000** according to the first embodiment in detail when the coil unit **200** is connected with the connecting unit **300**.

FIG. 2 is a plan view illustrating the wireless power receiver **1000** according to the first embodiment.

FIG. 2 shows the coil unit **200** connected with the connecting unit **300**.

According to one embodiment, the connection between the coil unit **200** and the connecting unit **300** may be achieved by a solder. In detail, the first connection terminal **210** of the coil unit **200** may be connected to the first connection terminal **310** of the connecting unit **300** through a first solder **10** and the second connection terminal **220** of the coil unit **200** may be connected to the second connection terminal **320** of the connecting **unit 300** through a second solder **20**. In more detail, the first connection terminal **210** of the coil unit **200** may be connected to the first connection terminal **310** of the connecting unit **300** through a via hole of the first solder **10** and the second connection terminal **220** of the coil unit **200** may be connected to the second connection terminal **320** of the connecting unit **300** through a via hole of the second solder **20**.

The wireless power receiver **1000** shown in FIG. 2 may be equipped in an electronic appliance, such as a terminal.

The terminal may include a typical mobile phone, such as a cellular phone, a PCS (personal communication service) phone, a GSM phone, a CDMA-2000 phone, or a WCDMA phone, a PMP (portable multimedia player), a PDA (personal digital assistant), a smart phone, or an MBS (mobile broadcast system) phone, but the embodiment is not limited thereto. Various devices can be used as the terminal if they can wirelessly receive the power.

A section taken along line A-A' of the connecting unit **300** shown in FIG. 2 will be explained with reference to FIG. 3.

FIG. 3 is a sectional view taken along line A-A' of the connecting unit **300** of the wireless power receiver **1000** shown in FIG. 2.

Referring to FIG. 3, the first connection terminal **210**, the second connection terminal **220** and the coil **230** constituting the coil unit **200** are disposed on the top surface of the magnetic substrate **100**.

In the wireless power receiver **1000** according to the first embodiment, the coil unit **200** is directly disposed on the top surface of the magnetic substrate **100**, so the overall thickness can be remarkably reduced when comparing with the case in which the coil pattern is formed on an FPCB.

Preferably, the magnetic substrate **100** has a thickness of 0.43 mm and the coil unit **200** has a thickness of 0.1 mm, so the overall thickness is 0.53 mm. However, this numerical value is illustrative purpose only.

That is, the thickness of the wireless power receiver **1000** can be reduced by preparing the coil unit **200** in the form of a conductor, a conductive pattern or a thin film. Since the current trend has tended toward the slimness, if the wireless power receiver **1000** is applied to the electronic device, such as the portable terminal, the overall thickness of the portable terminal can be reduced and the power can be effectively received from the transmission side.

The connecting unit **300** is directly disposed on the coil unit **200**. Since the connecting unit **300** is directly disposed on the coil unit **200**, the coil unit **200** can be readily connected with the connecting unit **300**.

The first connection terminal **210** of the coil unit **200** is connected to the first connection terminal **310** of the connecting unit **300** through the solder **10**.

The second connection terminal **220** of the coil unit **200** is connected to the second connection terminal **320** of the connecting unit **300** through the solder **20**.

The coil **230** may be designed to have a predetermined width **W** and a predetermined thickness **T**. In addition, the coil **230** can be designed to have a predetermined winding interval.

FIGS. 4 to 8 are views for explaining a method of manufacturing the wireless power receiver **1000** according to one embodiment.

The structure of the wireless power receiver **1000** may be essentially identical to the structure of the wireless power receiver **1000** described with reference to FIGS. 1 to 3.

First, referring to FIG. 4, the magnetic substrate **100** is prepared.

Then, referring to FIG. 5, a conductor **201** is directly laminated on the top surface of the magnetic substrate **100**. According to one embodiment, the conductor **201** may be laminated after the adhesive layer has been laminated on the top surface of the magnetic substrate **100**.

According to one embodiment, a laminating process can be used to form the conductor **201** on the top surface of the magnetic substrate **100**. According to the laminating process, the conductor **201** is heated at the predetermined temperature and then predetermined pressure is applied to the conductor **201**. The laminating process refers to a process of forming heterogeneous materials, such as a metal foil and a paper, by using heat and pressure.

Then, referring to FIG. 6, a mask **500** is laminated on the top surface of the conductor **201**. The mask **500** may be selectively formed on the top surface of the conductor **201** corresponding to positions of the first connection terminal **210**, the second connection terminal **220** and the coil **230** of the coil unit **200**.

After that, referring to FIG. 7, the structure shown in FIG. 6 is immersed in an etchant so that portions of the conductor **201** where the mask **500** is not positioned may be etched. Thus, the conductor **201** may have a predetermined conductive pattern.

Then, the coil unit **200** of the wireless power receiver **1000** is formed by removing the mask **500**.

Thereafter, referring to FIG. 8, the soldering work is performed to connect the coil unit **200** with the connecting unit **300**.

That is, the first connection terminal **210** of the coil unit **200** may be connected to the first connection terminal **310** of the connecting unit **300** through the first solder **10** and the second connection terminal **220** of the coil unit **200** may be connected to the second connection terminal **320** of the connecting unit **300** through the second solder **20**.

As described above, since the coil unit **200** is directly disposed on the top surface of the magnetic substrate **100**, the overall thickness of the wireless power receiver **1000** can be remarkably reduced. In addition, since the wireless power receiver **1000** can be manufactured only through the laminating and etching processes, the manufacturing process may be simplified.

FIG. 9 is a sectional view taken along line A-A' of the connecting unit **300** of the wireless power receiver **1000** shown in FIG. 2 according to the second embodiment.

Referring to FIG. 9, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200,** a connecting unit **300** and an adhesive layer **700**.

The magnetic substrate **100**, the coil unit **200**, and the connecting unit **300** are identical to those described with reference to FIG. 1.

The adhesive layer **700** is interposed between the magnetic substrate **100** and the coil unit **200** to bond the magnetic substrate **100** to the coil unit **200**.

FIG. 10 is a plan view illustrating a wireless power receiver **1000** according to the third embodiment.

Referring to FIG. 10, the wireless power receiver **1000** may include a magnetic substrate **100,** a coil unit **200**, a connecting unit **300** and a short-range communication antenna **600**.

The magnetic substrate **100**, the coil unit **200** and the connecting unit **300** are identical to those described with reference to FIGS. 1 to 3.

The short-range communication antenna **600** includes a first connection terminal **610**, a second connection terminal **620** and an outer peripheral coil **630**.

The first connection terminal **610** and the second connection terminal **620** of the short-range communication antenna **600** are connected to the connecting unit **300**.

The short-range communication antenna **600** can make near field communication with a reader. The short-range communication antenna **600** may serve as an antenna that transceives information in cooperation with the reader.

According to one embodiment, the short-range communication antenna **600** may be arranged at an outer peripheral portion of the coil unit **200**. According to one embodiment, when the coil unit **200** is disposed at the center of the magnetic substrate **100**, the short-range communication antenna **600** may be arranged along the outer peripheral portion of the magnetic substrate **100** to surround the coil unit **200**. The short-range communication antenna **600** may have a rectangular configuration by winding one conductive line several times, but the embodiment is not limited thereto.

Similar to the coil unit **200**, the short-range communication antenna **600** may be formed as a conductive pattern or a conductive layer.

Various short-range communication technologies can be applied to the short-range communication antenna **600**, and the NFC technology is preferable. The NFC technology has the band of 12.56 MHz and is used for wireless communication in a short distance.

The short-range communication antenna **600** can be directly disposed on the top surface of the magnetic substrate **100**.

The method of forming the short-range communication antenna **600** on the magnetic substrate **100** may be identical to the method described with reference to FIG. 4.

Hereinafter, a wireless power receiver **1000** according to the fourth embodiment will be described with reference to FIGS. 11 to 13.

FIG. 11 is a perspective view illustrating the wireless power receiver **1000** according to the fourth embodiment.

Referring to FIG. 11, the wireless power receiver **1000** includes a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

The magnetic substrate **100** and the coil unit **200** are identical to those described with reference to FIG. 1. However, the magnetic substrate **100** is slightly different from the magnetic substrate **100** described with reference to FIG. 1, so the following description will be made while focusing the difference of the magnetic substrate **100**.

Referring to FIG. 11, the magnet substrate **100** is formed with a receiving space **130** having a structure the same as that of the connecting unit **300**. That is, referring to FIG. 1, the coil unit **200** is disposed on the top surface of the magnetic substrate **100** and the connecting unit **300** is disposed on the coil unit **200**. However, referring to FIG. 11, the receiving space **130** having the structure the same as that of the connecting unit **300** is formed in the magnetic substrate **100**, so that the connecting unit **300** may be disposed under the coil unit **200**.

FIG. 12 is a plan view illustrating a wireless power receiver **1000** according to the fourth embodiment.

FIG. 12 shows the state in which the coil unit **200** and the connecting unit **300** are interconnected with each other.

The connecting unit **300** has a thickness equal to or smaller than a thickness of the magnetic substrate **100**. The connecting unit **300** may be implemented as a flexible printed circuit board (FPCB).

The connecting unit **300** may be disposed in the receiving space **130** of the magnetic substrate **100**.

If the thickness of the connecting unit **300** is equal to or smaller than the thickness of the magnetic substrate **100**, different from the embodiment shown in FIG. 3, the overall thickness of the wireless power receiver **1000** can be reduced as much as the thickness of the connecting unit

300. In addition, since the usage of the magnet **110** and the support **120** can be reduced due to the receiving space **130**, it is advantageous in terms of cost effectiveness.

FIG. 13 is a sectional view taken along line B-B’ of the connecting unit **300** of the wireless power receiver **1000** shown in FIG. 12 according to the fourth embodiment.

The following description will be made on the assumption that the connecting unit **300** has a thickness smaller than that of the magnetic substrate **100**.

Referring to FIG. 13, the first connection terminal **210**, the second connection terminal **220** and the coil **230** constituting the coil unit **200** are disposed on the top surface of the connecting unit **300**.

The connecting unit **300** is disposed under the coil unit **200**.

The first connection terminal **210** of the coil unit **200** is connected to the first connection terminal **310** of the connecting unit **300** by the solder **10**.

The second connection terminal **220** of the coil unit **200** is connected to the second connection terminal **320** of the connecting unit **300** by the solder **20**.

The coil **230** may be designed to have a predetermined width **W** and a predetermined thickness **T**. In addition, the coil **230** can be designed to have a predetermined winding interval.

Referring to FIG. 12, different from the embodiment shown in FIG. 3, the thickness of the connecting unit **300** is smaller than the thickness of the magnetic substrate **100**, so the overall thickness of the wireless power receiver **1000** can be reduced as much as the thickness of the connecting unit **300**. In addition, since the usage of the magnet **110** and the support **120** can be reduced due to the receiving space **130**, it is advantageous in terms of cost effectiveness.

Hereinafter, a wireless power receiver **1000** according to the fifth embodiment will be described in detail with reference to FIGS. 14 to 20.

FIG. 14 is a perspective view illustrating the wireless power receiver **1000** according to the fifth embodiment, FIG. 15 is a plan view illustrating the wireless power receiver **1000** according to the fourth embodiment, FIG. 16 is a sectional view taken along line C-C’ of the wireless power receiver **1000** according to the fifth embodiment, and FIGS. 17 to 21 are views for explaining a method of manufacturing the wireless power receiver **1000** according to the fifth embodiment.