		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.				
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-$ 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 16:04
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.	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2015/08/12 16:04

		B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S145) AND S144	EPO; JPO; DERWENT; IBM_TDB			
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 (connector|connect$3|terminal)))) AND @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:11
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	JPO	ADJ J	ON	2015/08/13 11:35

		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)				
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 (coil$1 or winding$1 or resonator or secondary or inductor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:10
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-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:33
S167	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 19:34
S168	30	S167 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:34
S169	49	(US-20130249302-$ 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-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:35

		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-$).did.				
S170	5	S169 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:35
S171	21496	713/3??.ccls.	US-PGPUB; USPAT	OR	ON	2015/08/13 19:52
S172	10	S171 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:53
S173	49	(US-20130249302-$ 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
S174	21	S173 and flexible	US-PGPUB;	OR	ON	2015/08/17

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			08:34
S175	21	S173 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 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))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 09:46
S176	1	S173 and "modular power transmitting system"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:02
S177	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
S178	5890	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/17 11:18

S179	380	S178 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
S180	180	S178 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
S181	94	S178 AND (coil|winding) SAME (groove$1|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:22
S182	3191265	(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	2015/10/13 09:14
S183	1498071	(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	2015/10/13 09:14
S184	3523990	(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	2015/10/13 09:14
S185	2858589	(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	2015/10/13 09:14
S186	7009	S182 AND S183 AND S184 and S185 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:14
S187	2229	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT·, USOC R; F RS; EPO; JPO;	OR	ON	2015/10/13 09: 19

			DERWENT; IBM_TDB			
S188	437	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:21
S189	171977	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. H01F38/14.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.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S190	15	S188 AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S191	17651	S182 AND S183 AND S184 and S185 and (radial (helically or helix) Near3 (flat planar))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:37
S192	681	S191 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:38
S193	6	S192 AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:39
S194	25	(coil WITH overlap$4 NEAR4 connect$3) AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:44
S195	49	(US-20130249302-$ 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-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/10/13 13:43

		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.				
S196	15	S195 and overlap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 13:43
S197	1	"20120248981"	US-PGPUB	OR	ON	2015/10/13 13:44
S198	1657391	(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$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 10:30
S202	51	(US-20130249302-$ 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-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ 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-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/16 10:52

		$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S207	546319	S198 AND (((receiv$3 or accept$3 or receipt or retriev$3 or acquir$3 or acquisition or fit$4 or accommodat$3) near3 (spac$3 or hole or opening or slot$3 or gap or notch$2 or port or area or shaped or cut-out or configured or size or shape or dimension or design or pattern or cutout or "cut out" or configuration or layout)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:03
S208	1657391	(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)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:11
S209	1657391	(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)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S210	1130997	S209 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")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S211	723742	(coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:28
S212	32986	S211 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:36
S213	7222	S212 AND S210	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:38
S214	723868	(coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed	US-PGPUB; USPAT; USOCR;	OR	ON	2016/01/19 09:22

		layer pattern)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S215	32995	S214 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S216	51	(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-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ 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-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ 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	2016/01/19 09:22
S217	6	S215 AND S216	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S218	1658038	(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)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/19 09:55
S219	287249	S218 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	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	ON	2016/01/19 09:55

		configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base))	IBM_TDB			
S220	3911	S215 AND S219	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:08
S221	253	S220 AND (third ADJ2 (terminal electrode end terminus "connecting land" end contact pin)) AND (fourth ADJ2 (terminal electrode end terminus "connecting land" end contact pin))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:15
S222	167	S221 and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:23
S223	33	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 13:51
S224	62	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 14:23
S225	6	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across)) NEAR3 (space gap)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:13
S226	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4)) NEAR3 (space gap)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:18
S227	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (top)) NEAR3 (substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:29

1/ 19/ 2016 4:47:58 PM
C:\ Users\ jevans2\ Documents\ EAST\ Workspaces\ 13663012.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	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
Re-searched all symbols above	1/19/2016	JPE

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
307	104	1/29/2015	JPE
713	300	8/13/2015	JPE
Re-searched all above		1/19/2016	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
Searched amended claims	1/19/2016	JPE

/JAMES P EVANS/
Examiner.Art Unit 2836

SEARCH NOTES

Search Notes	Date	Examiner
Consulted Primary Ken Wells	1/19/2016	JPE

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04B	5/0037	1/19/2016	JPE

/JAMES P EVANS/ Examiner.Art Unit 2836	

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.	Applicant(s)/Patent Under Reexamination
13663012	AN ET AL.
Examiner	**Art Unit**
JAMES P EVANS	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

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

U.S. Patent and Trademark Office

Part of Paper No. 20160115

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

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

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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 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

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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:

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
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Serial No.	:	13/663,012
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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)

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

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
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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
Filing Date:	29-OCT-2012
Time Stamp:	16:01:15
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		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.

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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
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PO Box 142950
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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 <u>31, the</u> conductive line of the conductive pattern crosses over the receiving space."

Should be:

"The wireless power receiver of claim <u>1, wherein the</u> 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-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/20 15:01
S15	22	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 15:01
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S17	6	"39593692".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/20 17:15
S18	2	"20120044114"	US-PGPUB; USPAT	OR	ON	2015/01/20 17:26
S19	3	(("Jeong Wook") near2 (AN)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:52
S20	2	(("Jeong Wook") near2 (AN)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:54
S21	8	(("Jung Oh") near2 (LEE)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:55
S22	1	(("Jung Oh") near2 (LEE)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:57
S23	3	(("Sung Hyun") near2 (LEEM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:58
S24	0	(("Sung Hyun") near2 (LEEM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:04
S25	7	(("Yang Hyun") near2 (KIM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 09:05
S26	3	(("Yang Hyun") near2 (KIM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:19
S27	5	"47598569".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/23 11:34
S28	24	(US-20130249302-$ 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 oradio$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-PGP UB; 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.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	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	✓	✓							
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	19	✓	✓							
	20	-	-							
	21	✓	✓							
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	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.

AMENDMENT UNDER 37 C.F.R. §1.111
Examining Group 2836
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

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:

J:\SUN\LGI\420\Amd-Resp\Response1.doc/kh/lcf

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.

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,

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JL/kh/lcf

Attachment: Replacement Abstract

J:\SUN\LGI\420\Amd-Resp\Response1.doc/kh/lcf

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
Receipt Date:	11-MAY-2015
Filing Date:	29-OCT-2012
Time Stamp:	14:19:23
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		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
	Claims	3	6
	Applicant Arguments/Remarks Made in an Amendment	7	9
	Abstract	10	10

Warnings:

Information:

Total Files Size (in bytes):	424354

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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-			
	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	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	✓								
	10	-								
	11	✓								
	12	✓								
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	14	-								
	15	-								
	16	-								
	17	-								
	18	-								
	19	✓								
	20	-								
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	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 R	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)

Sheet 1 of 2

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

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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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E.

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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
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

*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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PTO/SB/08A

Substitute for form 1449A/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	**Application Number**	13/663,012
	Filing Date	October 29, 2012
	First Named Inventor	Jeong Wook An
(use as many sheets as necessary)	**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 Code2 (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 Code5 (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	T6
	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.	T2
	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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PTO/SB/08A (08-03)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet	1	of	2

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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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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E.

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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	/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] 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E.

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

BIB DATA SHEET

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 ☐ Met after Allowance Verified and Acknowledged /JAMES P EVANS/ Examiner's Signature ____ 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	FEES	
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

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	

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		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.

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

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, 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	

*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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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 a9e4da973684e463ded5cd1ac92980115604 50404	no	12
Warnings:					
Information:					
3	Foreign Reference	F2.pdf	6377316 a3dea408e8d013bc79b3aebd4fd1d230db 8a3df1	no	11
Warnings:					
Information:					
4	Foreign Reference	F3.pdf	3670337 f09b71fda539c20578a66a52018459b7c1f4 8e5f	no	14
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	R1.pdf	2929254 75fbe1ffee3103e28228efa0de965e085be2 8263	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	19522449		

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.

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. 04-511l 5, 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

J:\SUN\LGI\420\IDS-Refs\12-29-14\SIDS(2).doc/bdt 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.

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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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.

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Electronic Acknowledgement Receipt

EFS ID:	19586316
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/SARAH M ALLEN
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	15-JUL-2014
Filing Date:	29-OCT-2012
Time Stamp:	16:15:43
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		SIDS-AF.pdf	286510 32d2c087703a75d109b6c33ce9fdd1153ee31055	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-PT1.pdf	11457189 52f71ceefac7e6abf8b6e1f27b06255cb2b5a7bd	no	20
Warnings:					
Information:					
3	Foreign Reference	F1-PT2.pdf	8387304 e14fba49cab9922180378b9ac8ea616b1b2374ff	no	13
Warnings:					
Information:					
4	Foreign Reference	F2-PT1.pdf	7604738 f9f7bb2a17142e84b04e11f6704331411a5f35c4	no	14
Warnings:					
Information:					
5	Foreign Reference	F2-PT2.pdf	6877647 87590c87deec6acfaa44dbbdfd9ced57402b02a4	no	10
Warnings:					
Information:					
6	Foreign Reference	F3-PT1.pdf	8632857 f13baae6bf2be40921900760fd2bdda2d9a70b54	no	14
Warnings:					
Information:					
7	Foreign Reference	F3-PT2.pdf	7957516 08cb6f192a95dcfd2f5fc7699c96063e29831343	no	11
Warnings:					
Information:					
8	Other Reference-Patent/App/Search documents	R1.pdf	6167665 f478570ca4d34e63d38a400e005eb38d867fe49a	no	9
Warnings:					
Information:					
		Total Files Size (in bytes):	57371426		

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.

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 : 10-2012-0079004
Application Number

출 원 년 월 일 : 2012년 07월 19일
Filing Date JUL. 19, 2012

출 원 인 : 엘지이노텍 주식회사
Applicant(s) LG INNOTEK CO., LTD.

2014년 06월 19일

특 허 청
COMMISSIONER

【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

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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 0.43mm이고, 코일부(200)의 두께는 0.1mm이고, 이를 합한 두께는 0.53mm일 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 전체 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 후술할 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, 레이저는 UV 레이저, CO2 레이저 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 0.1mm, 자성 기판(100)의 두께는 0.43mm일 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 제조방법은 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.

【요약서】

【요약】

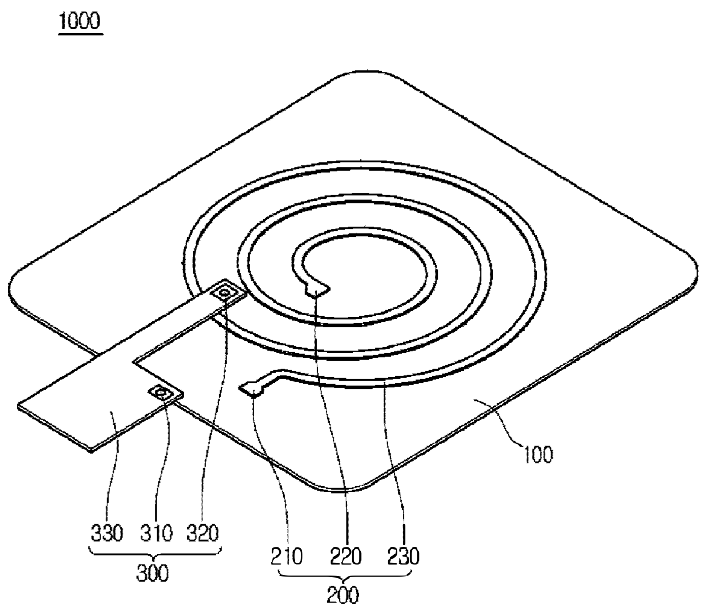
본 발명의 일 실시 예에 따른 무선전력 수신장치는 자성 기판 및 상기 자성 기판의 내부에 배치되어 무선으로 전력을 수신하는 코일부를 포함하는 것을 특징으로 한다.

【대표도】

도 16

【도면】

【도 1】



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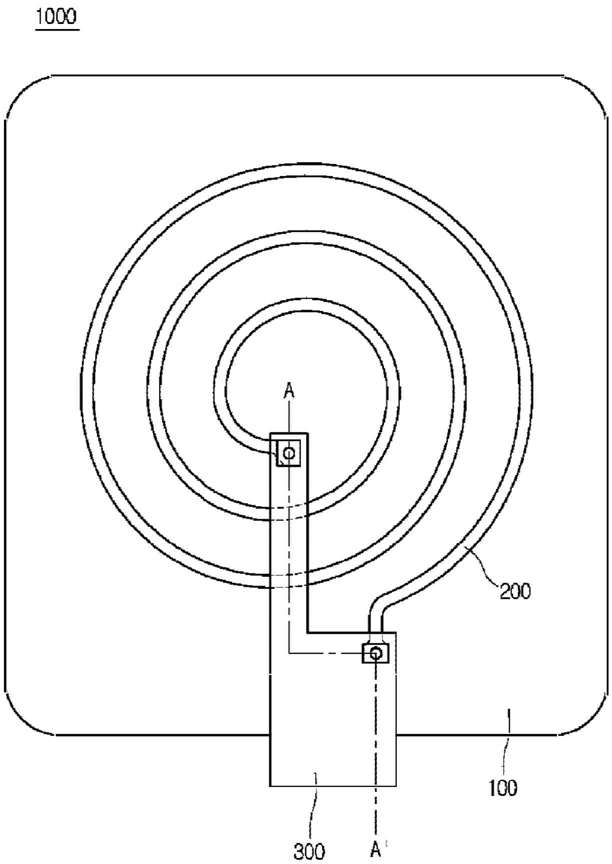

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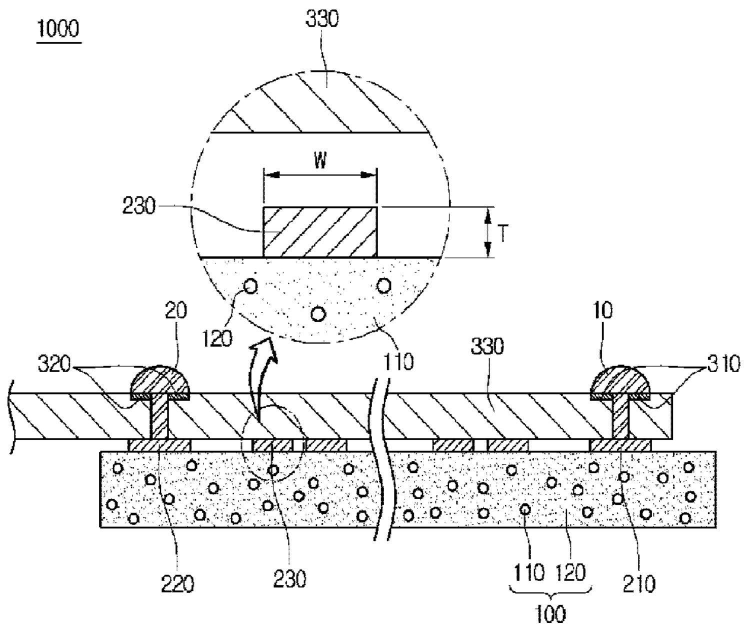
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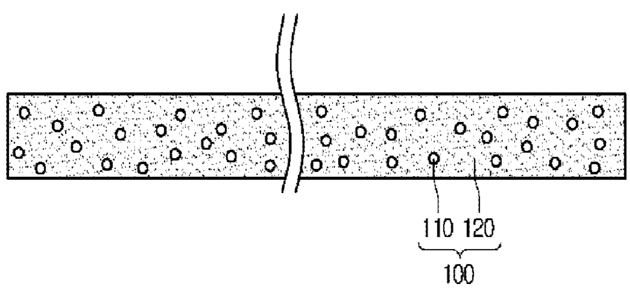
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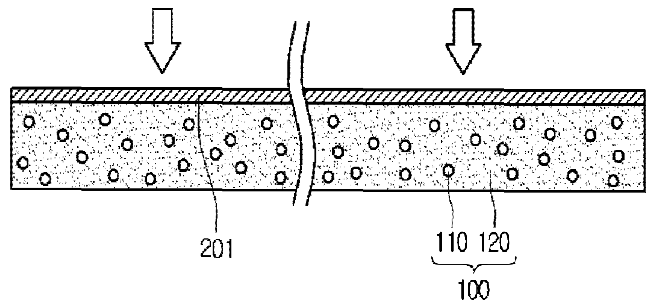

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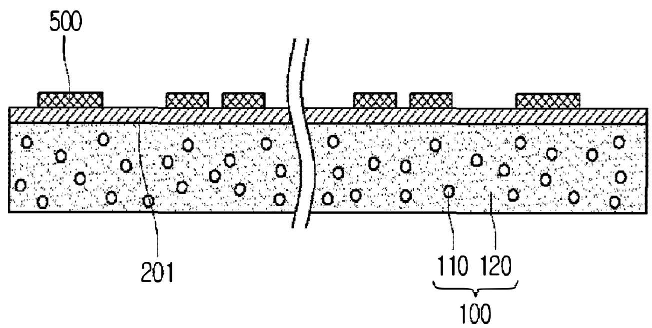

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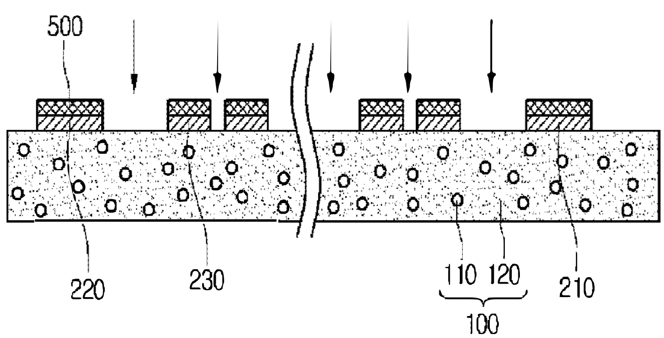

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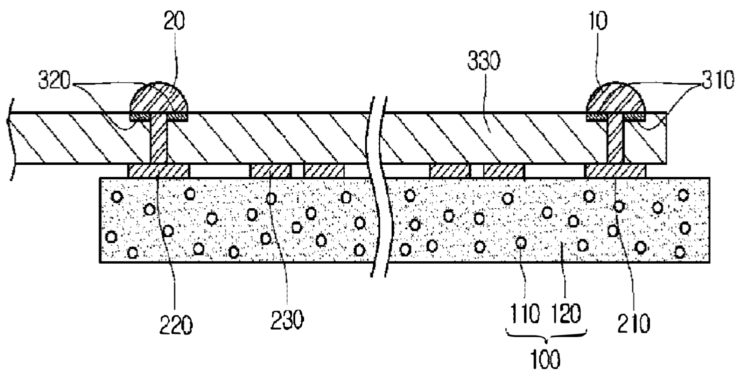
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【도 9】

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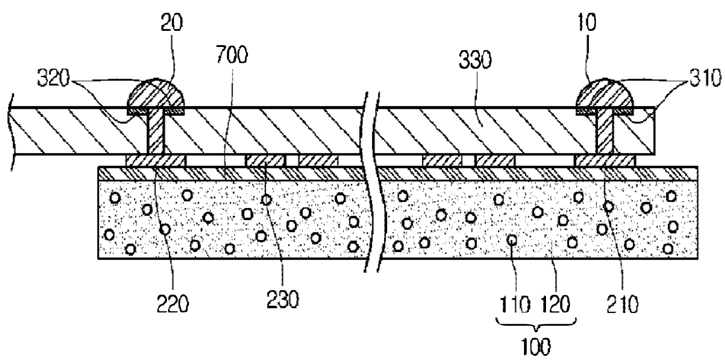
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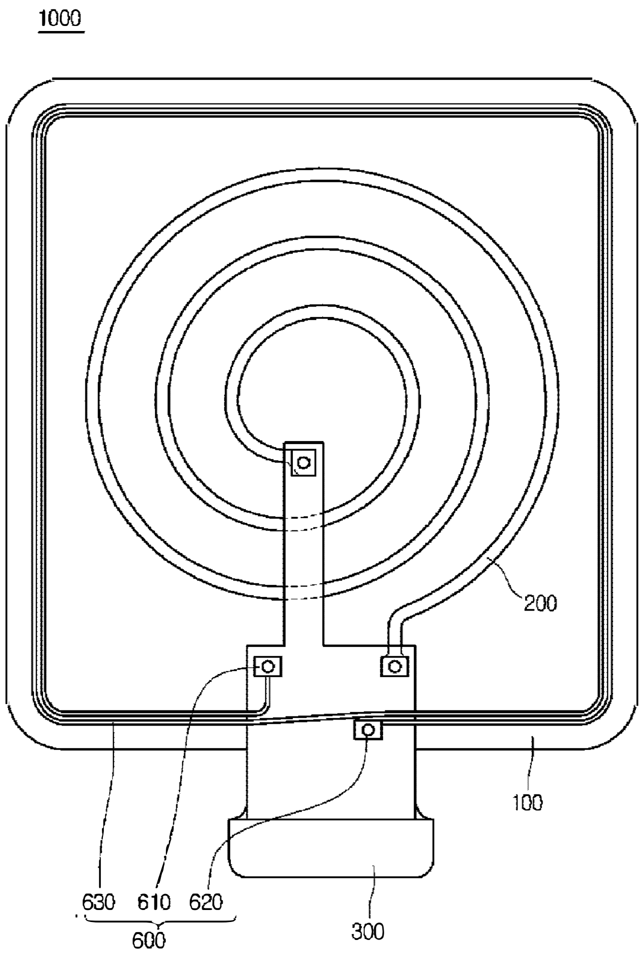
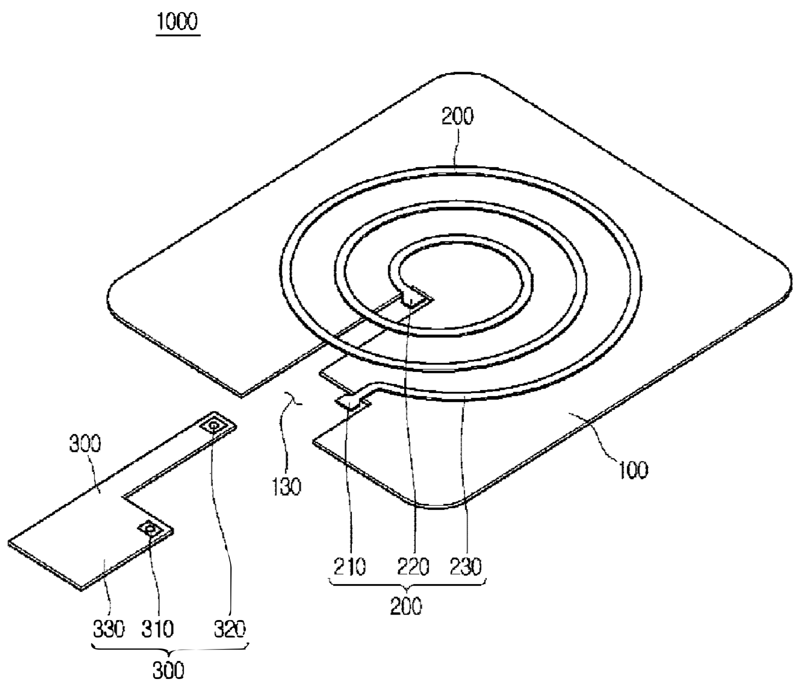


【도 11】



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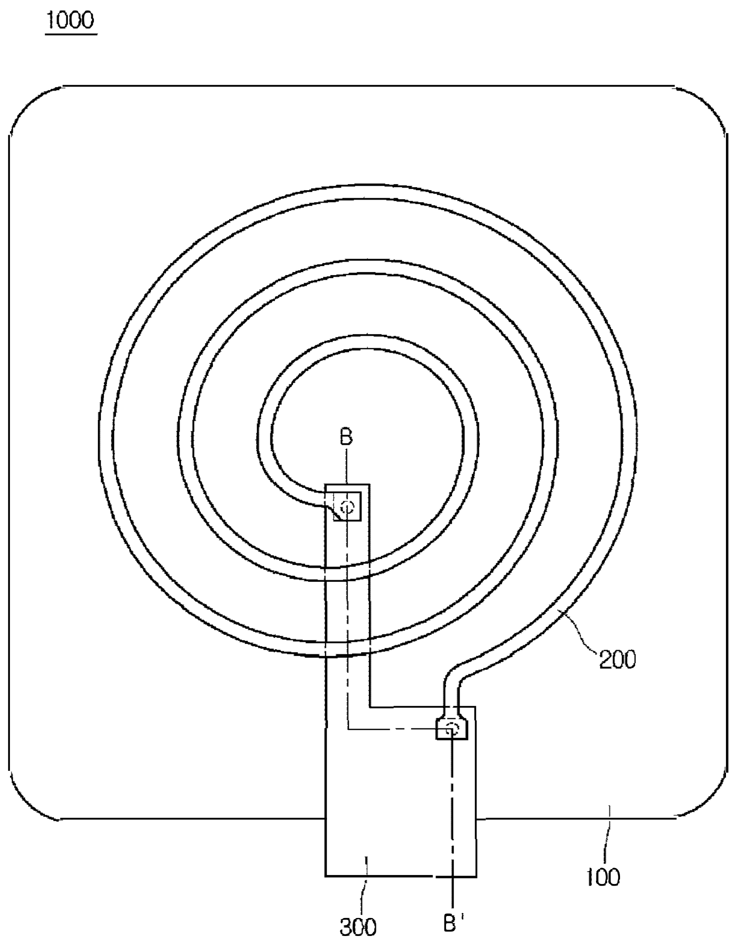
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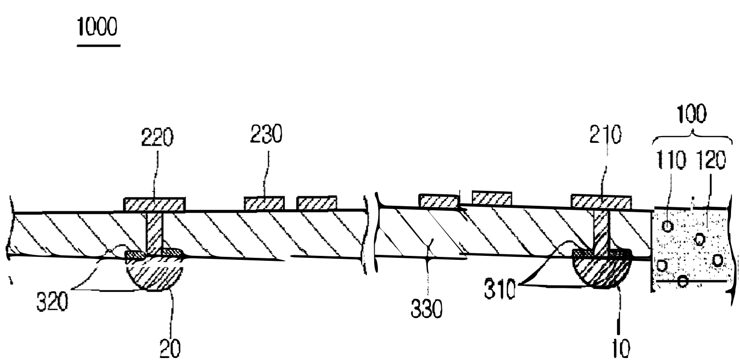
【도 13】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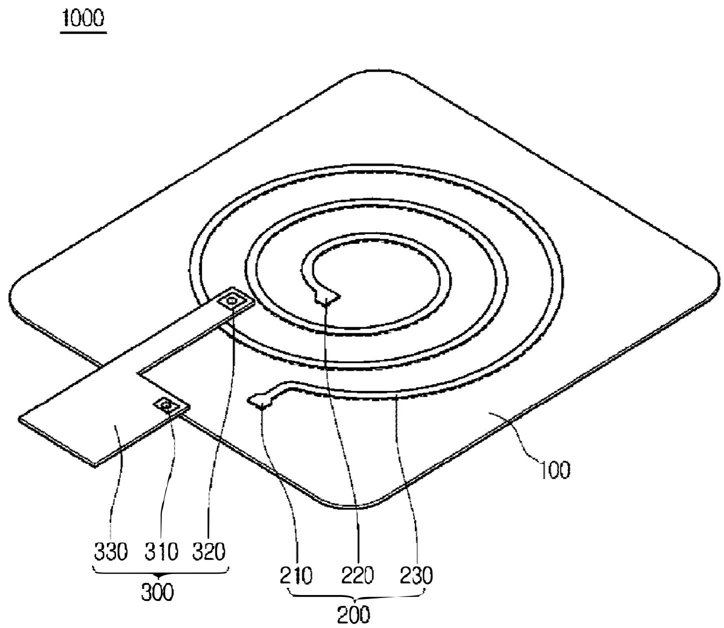
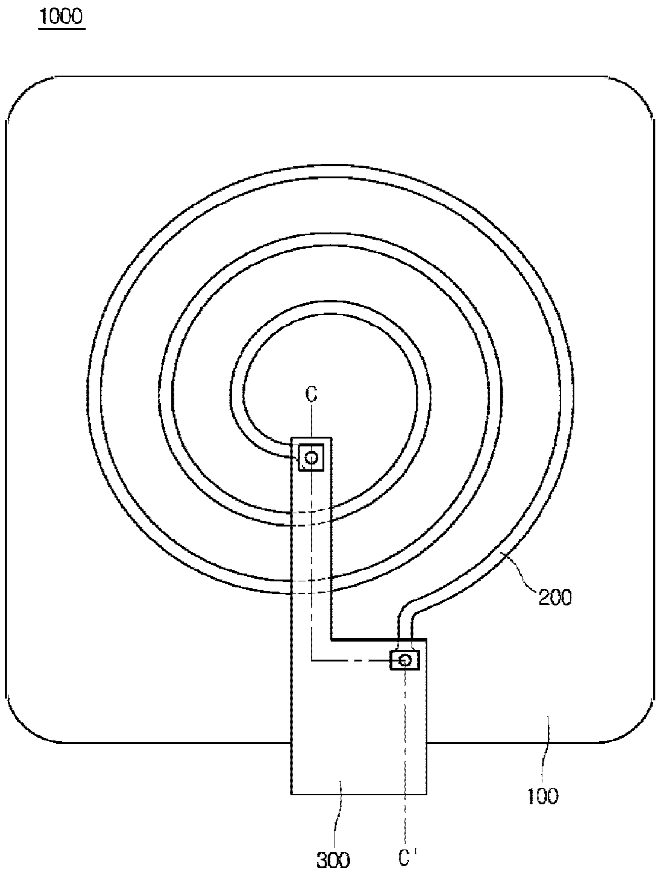
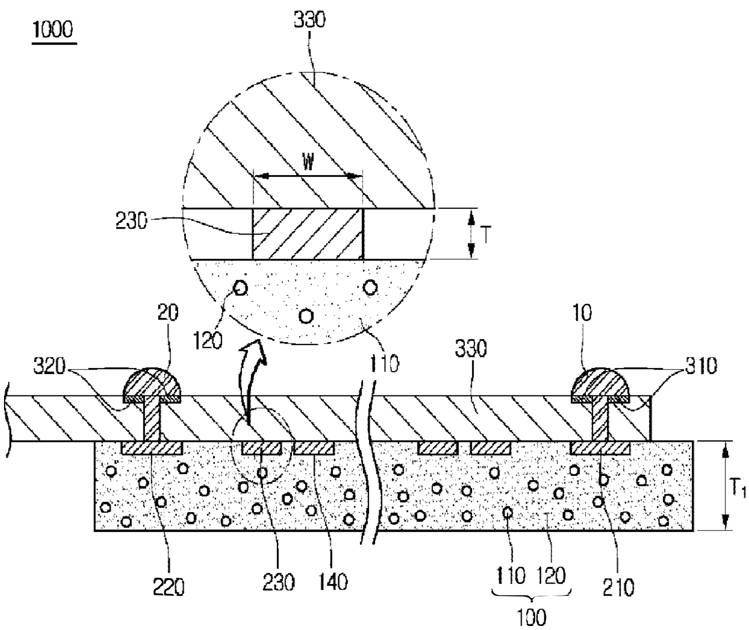
【도 14】



【도 15】



【도 16】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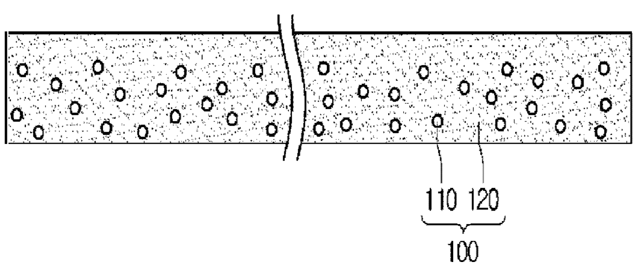
【도 17】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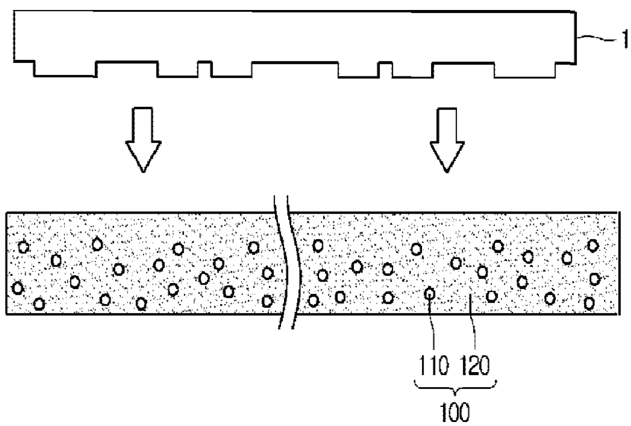
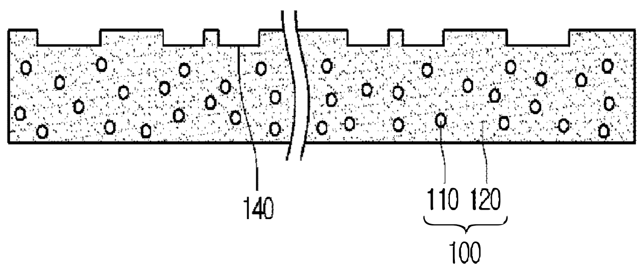


【도 19】



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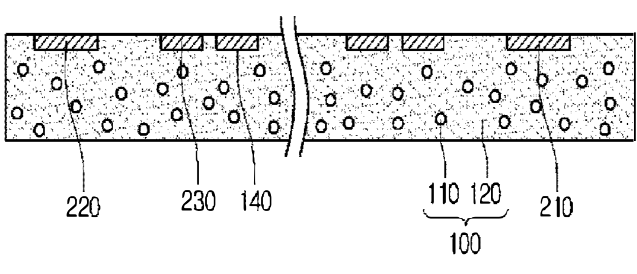

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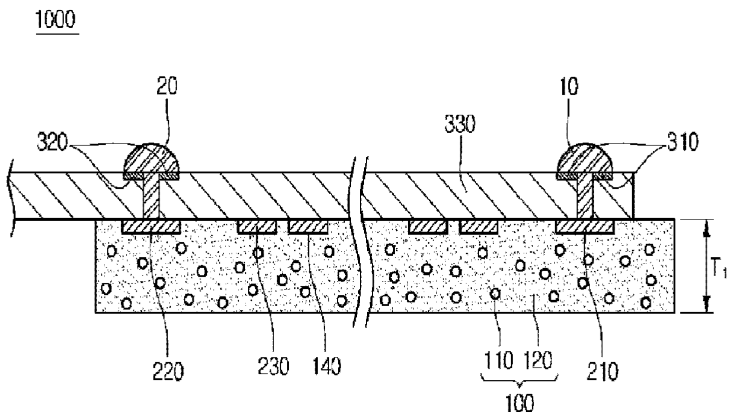

【도 22】

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
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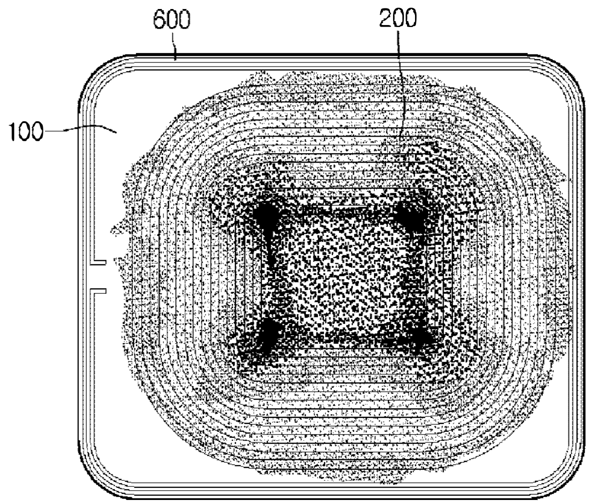
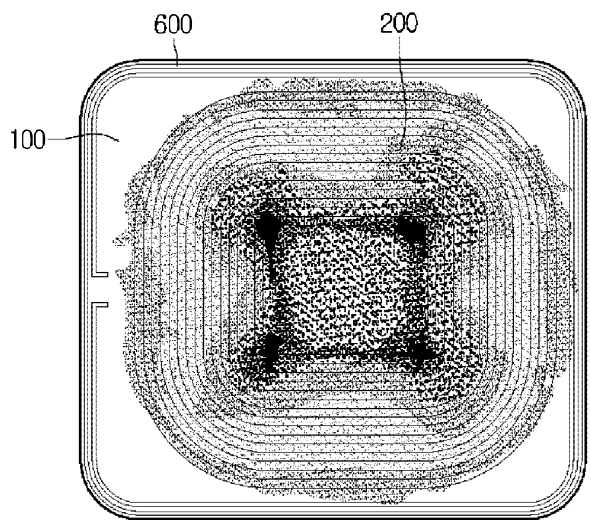
154.000000	10332.303299	0.872774	11.367050
155.000000	10330.550019	0.877706	11.374754
156.000000	10328.799305	0.882658	11.382099
157.000000	10327.050748	0.887629	11.389091
158.000000	10325.304351	0.892618	11.395741
159.000000	10323.560143	0.897626	11.402053
160.000000	10321.817935	0.902653	11.408035

【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.

PRELIMINARY AMENDMENT
Examining Group 2681
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

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:

J:\SUN\LGI\420\Amd-Resp\Response1.doc/sma

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

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
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	29-APR-2014
Filing Date:	29-OCT-2012
Time Stamp:	18:12:02
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		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

Warnings:	
Information:	
Total Files Size (in bytes):	188742

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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/

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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Electronic Acknowledgement Receipt

EFS ID:	17716868
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
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	19-DEC-2013
Filing Date:	29-OCT-2012
Time Stamp:	18:19:35
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		IDS-AF.pdf	235425 7edb4a881344039c45ca386d6e5e559406463116	yes	3

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	3	
Warnings:					
Information:					
2	Foreign Reference	F2.pdf	7467131 002d802b323c6e1f7573d393308d3ee818f8aaec	no	20
Warnings:					
Information:					
3	Foreign Reference	F3.pdf	6279336 5601702d68d5833f3cacdfe2fd5f170606282006	no	17
Warnings:					
Information:					
4	Foreign Reference	F8.pdf	5935037 1567c57a932e7c102b5fd21cfa2205a191c0646b	no	23
Warnings:					
Information:					
5	Foreign Reference	F9.pdf	5008679 70eae88836e564234749c4105c108ec11fe49752	no	21
Warnings:					
Information:					
6	Non Patent Literature	R1.pdf	89938 378023cdd67f20602339659080230c5db010a057	no	7
Warnings:					
Information:					
7	Non Patent Literature	R2.pdf	99517 1dd2e2b08b7da082ed1e3a57da9ff423cc130f99	no	3
Warnings:					
Information:					
8	Foreign Reference	F1.pdf	3914955 d22b33c437db98e9e3500389d01568390df97979	no	6
Warnings:					
Information:					

9	Foreign Reference	F4.pdf	3187502 07058599fec151cc85293eece802b36260ab2178	no	8
Warnings:					
Information:					
10	Foreign Reference	F5.pdf	3378390 437804e006b72170294a3eb91e9b19f20c90883a	no	8
Warnings:					
Information:					
11	Foreign Reference	F6.pdf	1341537 2c4543ad9866f4fc8973eeaf2ceea899a12727ec	no	2
Warnings:					
Information:					
12	Foreign Reference	F7.pdf	2988241 dcafd0269b3ad1a3c9d1df58676da1b1394f2ff3	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	39925688		

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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 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.

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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
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Gainesville, FL 32614-2950

JL/mv

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

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An attempt by the Office to electronically retrieve, under the Priority Document Exchange programs (PDX and DAS), 10-2012-0079004 to which priority is claimed has FAILED on 12/05/2013.

For further questions or assistance, please contact our EBC Customer Support Center at

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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	10-2012-0029987
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

【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 유도을 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 0.43mm이고, 코일부(200)의 두께는 0.1mm이고, 이를 합한 두께는 0.53mm일 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 도전체 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.

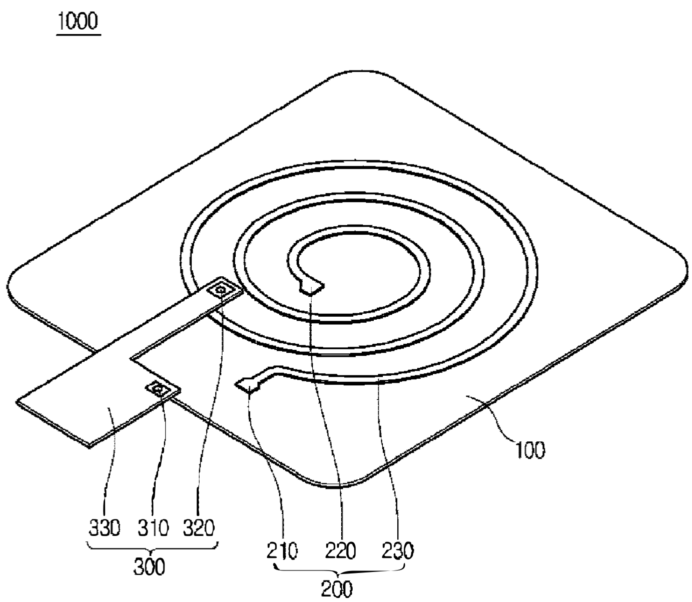
또한, 라미네이팅 및 에칭 과정만을 통해 자성 기판 상면에 코일부를 직접 배치시켜 무선전력 수신장치의 제조 공정을 단순화 시킨 방법의 제공을 목적으로 한다.

【대표도】

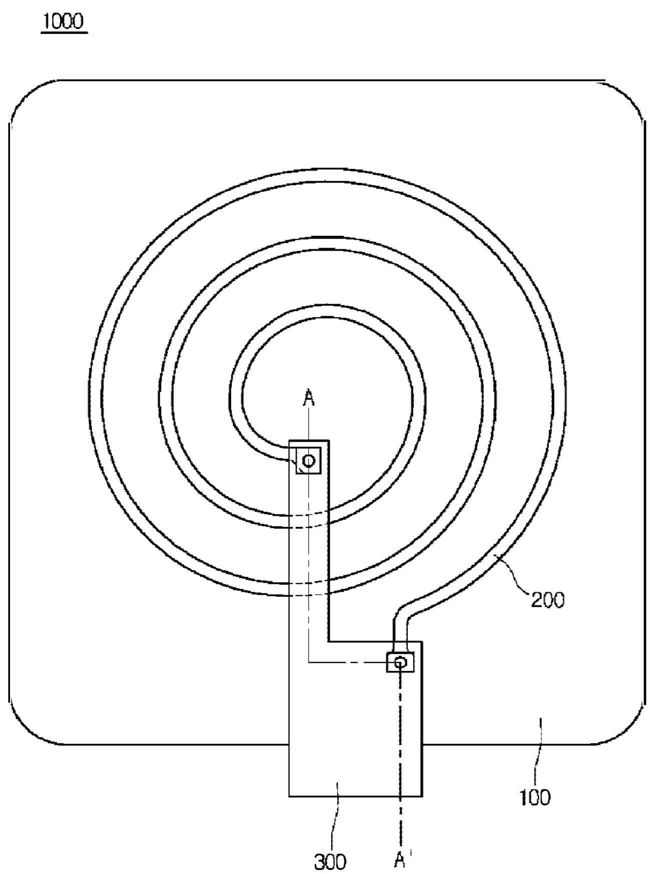
도 9

【도면】

【도 1】



【도 2】



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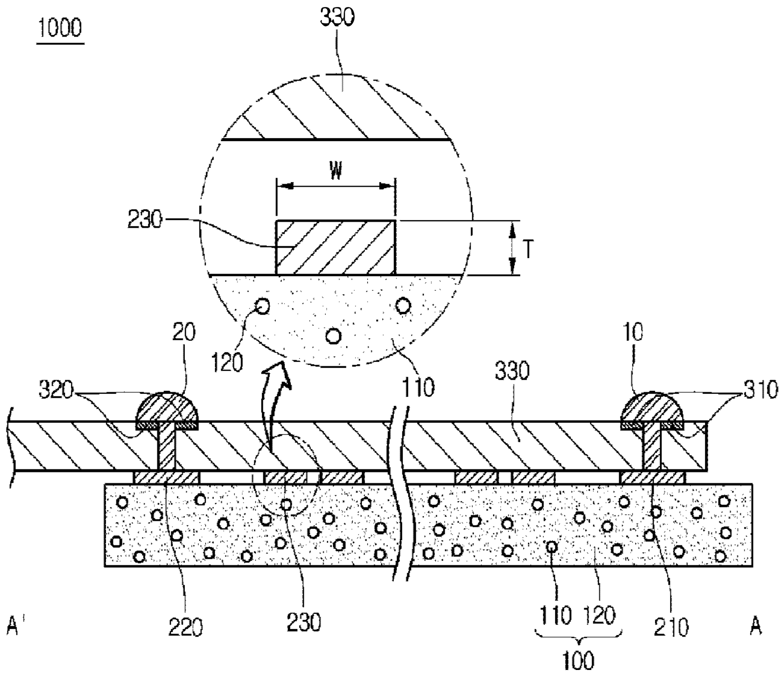
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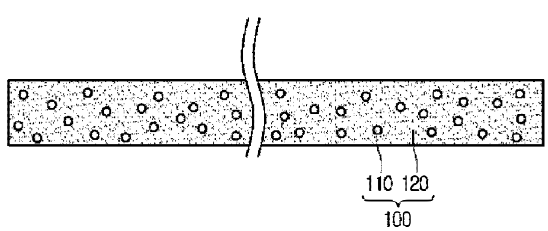
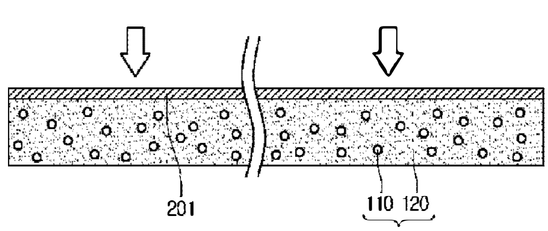
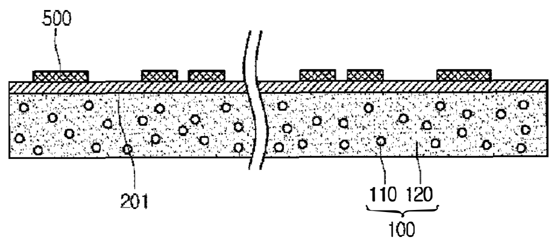
【도 4】


110 120
100

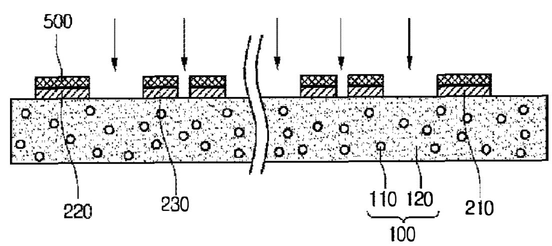
【도 5】


201
110 120
100

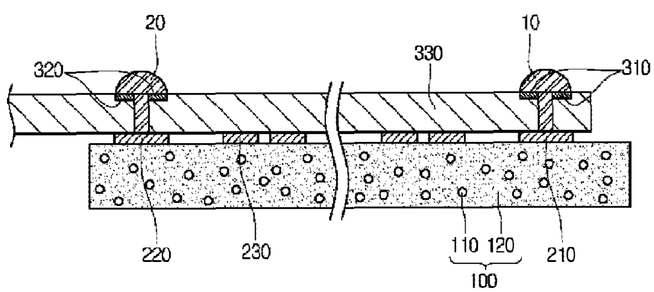
【도 6】


500
201
110 120
100

【도 7】


500
220
230
110 120
100
210

【도 8】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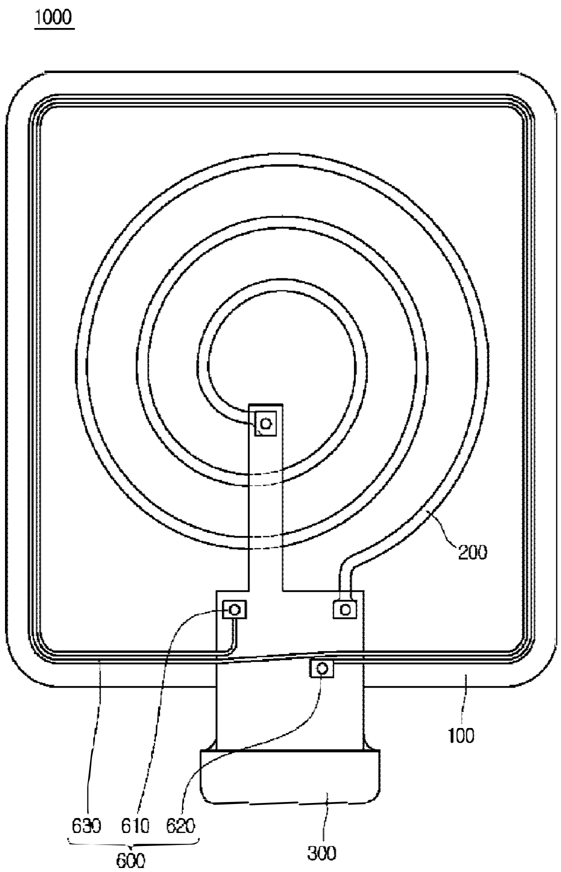
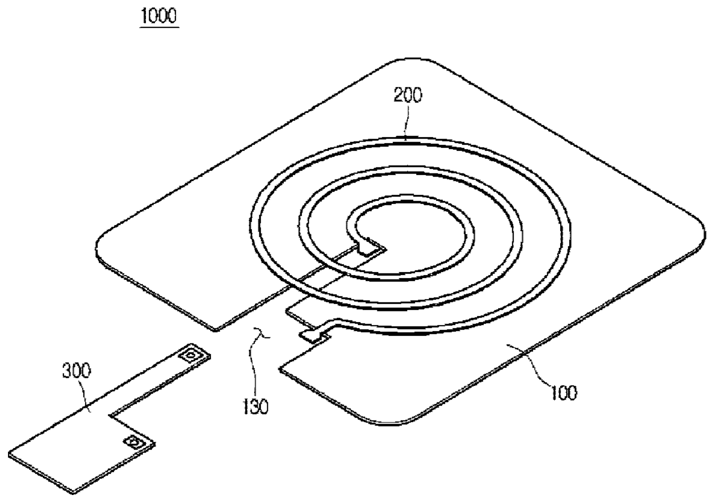
110 120
100
210

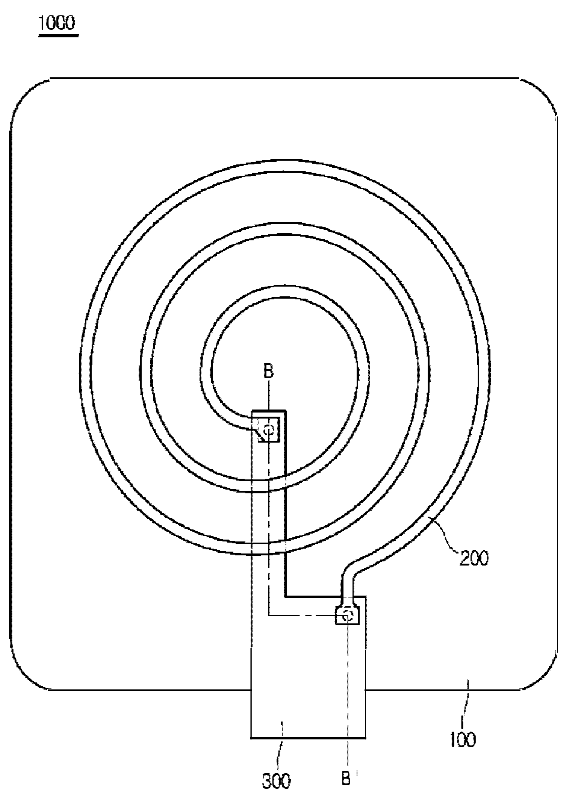
【도 9】



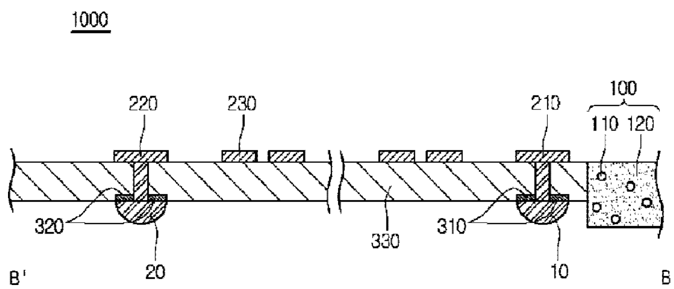
【도 10】



【도 11】



【도 12】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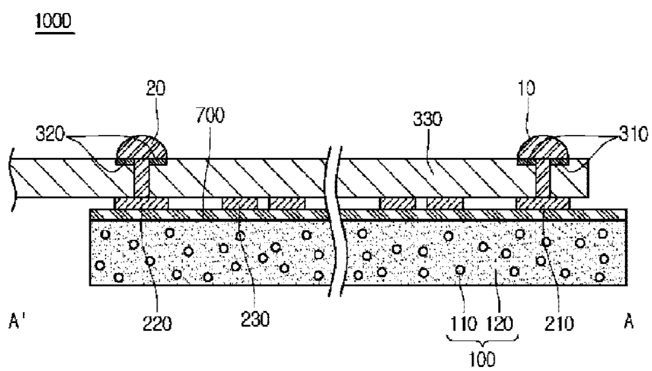
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420

CONFIRMATION NO. 3575

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

PUBLICATION NOTICE

OC000000064032882

Title:WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Publication No.US-2013-0249302-A1
Publication Date:09/26/2013

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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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
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1260

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($)	ADDITIONAL FEE($)	OR	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

OC000000058888751

23557
SALIWANCHIK, LLOYD & EISENSCHENK
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PO Box 142950
GAINESVILLE, FL 32614

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**

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Assignment For Published Patent Application

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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.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0029987 03/23/2012
REPUBLIC OF KOREA 10-2012-0079004 07/19/2012

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If Required, Foreign Filing License Granted: 11/16/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/663,012**

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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Title 37, Code of Federal Regulations, 5.11 & 5.15

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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
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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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STATEMENT UNDER 37 C.F.R. §1.125(b)
Examining Group 2681
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

Commissioner for Patents
P.O. Box 1450
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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,

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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.

First, referring to FIG. 14, the wireless power receiver **1000** according to the fifth embodiment may include a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using electromagnetic induction. In this case, the coil **230** of the coil unit **200** can wirelessly receive power through the electromagnetic induction with a coil of the transmission side.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using resonance.

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 leaked to the outside by changing the direction of the magnetic field received from the transmission side.

The magnetic substrate **100** can change the direction of the magnetic field received 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. 16, the magnetic substrate **100** may include a magnet **110** and a support **120**.

The magnet **110** may include a particle or a ceramic. According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

The magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

Referring again to FIG. 14, the coil unit **200** may include a first connection terminal **210**, a second connection terminal **220** and a coil **230**. The coil **230** may formed as a conductive layer or a conductive pattern.

The coil unit **200** may be disposed inside the magnetic substrate **100**. In detail, the coil unit **200** may be buried inside the magnetic substrate **100**. In more detail, the magnetic substrate **100** may include a pattern groove and the coil unit **200** may be disposed in the pattern groove. The pattern groove may be formed as a conductive pattern or a conductive layer similar to the coil unit **200**.

The coil unit **200** has a thickness smaller than that of the magnetic substrate **100** and an upper portion of the coil unit **200** may be exposed out of the magnetic substrate **100**.

A process for manufacturing the wireless power receiver **1000** by disposing the coil unit **200** and the connecting unit **300** in the magnetic substrate **100** will be described later with reference to FIGS. 17 to 21.

The first connection terminal **210** of the coil unit **200** is located at one end of the coil **230** and the second connection terminal **220** of the coil unit **200** is located at the other end of the coil **230**.

The first and second connection terminals **210** and **220** of the coil unit **200** are necessary for connection with the connecting unit **300**.

The coil **230** may be formed as a coil 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** may transfer the power wirelessly received from the transmission side to the connecting unit **300**. The coil unit **200** may transfer the power wirelessly received from the transmission side using the electromagnetic induction or resonance to the connecting unit **300**.

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 the wiring layer may include a wireless power receiving circuit, which will be described later.

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 receiver circuit. The wireless power receiver circuit may include a rectifier circuit (not shown) 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. 15 and 16 show the detailed structure of the wireless power receiver **1000** according to the fifth embodiment when the coil unit **200** is connected to the connecting unit **300**.

FIG. 15 shows the coil unit **200** and the connecting unit **300** interconnected with each other.

The coil unit **200** can be connected to the connecting unit **300** by a solder.

Referring to FIG. 16, 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 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**.

According to one embodiment, the via hole can be formed by using a laser. The laser may include a UV laser or a CO2 laser.

FIG. 16 is a sectional view of the wireless power receiver **1000** in which the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

That is, the first connection terminal **210**, the second connection terminal **220** and the coil **230** constituting the coil unit **200** may be disposed in a pattern groove **140** of the magnetic substrate **100**.

In addition, the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

The coil **230** may be designed to have a predetermined width **W** and a predetermined thickness **T** and the magnetic substrate **100** may be designed to have a predetermined thickness **T1**. According to one embodiment, the coil **230** has a thickness of 0.1mm and the magnetic substrate **100** has a thickness of 0.43 mm, but these numerical values are illustrative purposes only. According to one embodiment, the thickness **T** of the coil **230** may be smaller than the thickness **T1** of the magnetic substrate **100**.

In the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is directly disposed in the pattern groove **140** of the magnetic substrate **100**, so the overall thickness of an electronic appliance equipped with the wireless power receiver **1000** can be reduced as much as the thickness of the coil unit **200**. Thus, if the wireless power receiver **1000** according to the fifth embodiment is applied to the electronic device, such as the portable terminal, the overall thickness of the portable terminal can be reduced suitably for the current trend of slimness

In addition, in the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**. Thus, different from the electronic appliance in which a coil pattern is formed on an FPCB, the overall size of the electronic device equipped with the wireless power receiver **1000** can be reduced.

FIGS. 17 to 21 are views for explaining a method of manufacturing the wireless power receiver **1000** according to the fifth embodiment.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to the fifth embodiment will be described with reference to FIGS. 17 to 21 as well as FIGS. 14 to 16.

First, referring to FIG. 17, the magnetic substrate **100** is prepared. According to one embodiment, the magnetic substrate **100** may be produced by coating metal powder of sendust alloys, such as Al, Fe and SiO2, on polyethylene rubber and then forming an oxide layer on a surface of the polyethylene rubber.

Then, referring to FIG. 18, heat and pressure are applied using a mold **1** to form the pattern groove in the magnetic substrate **100** for receiving the coil unit **200**. The mold **1** may

have the shape corresponding to the shape of the coil unit **200**. According to one embodiment, the mold **1** can be manufactured by using an aluminum alloy, a copper alloy or a cast iron.

The mold **1** may be provided with a protrusion at a region corresponding to the coil unit **200** for wirelessly receiving the power.

When the heat is applied by using the mold **1**, the heat having the specific temperature is applied by taking the property of the metal powder of the sendust alloy constituting the magnetic substrate **100** into consideration. According to one embodiment, if the magnetic substrate **100** is produced by coating the metal powder of sendust alloy on the polyethylene rubber, when the heat and pressure are applied by using the mold **1**, high-pressure is applied at the temperature in the range of 100ºC to 180ºC, and then the mold **100** is cooled to the temperature of 100ºC or below. After that, the mold **1** is separated from the magnetic substrate **100**. If the mold **1** is separated just after the pressure has been applied to the magnetic substrate **100**, the desired pattern groove **140** may not be formed due to residual heat in the pattern groove **140**. For this reason, the mold **1** is separated from the magnetic substrate **100** after cooling the mold **100** to the temperature of 100ºC or below.

If the magnetic substrate **100** is prepared by using the metal powder of sendust alloy, the heat temperature and pressure may vary depending on the distribution and concentration of the metal powder. That is, if the distribution of the metal powder is not uniform, the higher temperature and pressure may be applied. In contrast, if the distribution of the metal powder is uniform, the lower temperature and pressure may be applied. In addition, if the concentration of the metal powder is low, the lower temperature and pressure may be applied as compared with the case in which the concentration of the metal powder is high. Further, the heat temperature and pressure may vary depending on the composition of the metal powder, that is, depending on the alloy constituting the metal powder.

In this manner, the temperature applied to the mold **1** may vary depending on the distribution, concentration and composition of the powder.

According to one embodiment, laser may be irradiated, instead of applying heat and pressure using the mold **1**, to form the pattern groove in the magnetic substrate **100** to receive the coil unit **200**. In this case, the pattern groove can be formed by using an excimer laser that irradiates the laser beam having a wavelength band of ultraviolet ray. The excimer laser may

include a KrF excimer laser (central wavelength 248 nm) or an ArF excimer laser (central wavelength 193 nm).

Next, referring to FIG. 19, the mold **1** is separated from the magnetic substrate **100** so that the magnetic substrate **100** is formed with the pattern groove **140**.

Then, referring to FIG. 20, the coil unit **200** is inserted into the pattern groove **140** formed in the magnetic substrate **100**. As the coil unit **200** is inserted into the pattern groove **140**, a predetermined conductive pattern is formed in the pattern groove **140** of the magnetic substrate **100**.

According to one embodiment, a process for forming the coil unit **200** in the pattern groove **140** of the magnetic substrate **100** may include a plating process or a process for inserting a metal which has been etched to have the conductive pattern formed by the coil unit **200**.

In detail, according to the plating process, the metallic material is filled in the pattern groove **140** to form the coil unit **200**. At this time, the metallic material may include one selected from Cu, Ag, Sn, Au, Ni and Pd and the filling of the metallic metal can be performed through one of electroless plating, screen printing, sputtering, evaporation, ink-jetting and dispensing or a combination thereof.

Then, referring to FIG. 21, the soldering process 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** is connected to the first connection terminal **310** of the connecting unit **300** through the solder **10** and 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**.

As described above, according to the method of manufacturing the wireless power receiver **1000** of the fifth embodiment, the pattern groove is formed in the magnetic substrate **100** and the coil unit **200** is disposed in the pattern groove, so that the overall thickness of the wireless power receiver **1000** can be reduced. In addition, the wireless power receiver **1000** can be manufactured by simply forming the pattern groove and then inserting the coil unit into the pattern groove, so that the manufacturing process can be simplified.

FIG. 22 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed on a top

surface of the magnetic substrate according to the first embodiment, and FIG. 23 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

The inductance, resistance and Q values of the coil unit **200** can be expressed as following equation 1.

[Equation 1]

$$Q=W*L/R$$

In equation 1, w is a frequency used when transmitting power, L is inductance of the coil unit **200** and R is resistance of the coil unit **200**.

As can be understood from equation 1, the Q value becomes high as the inductance of the coil unit **200** is increased. If the Q value is increased, the power transmission efficiency can be improved. The resistance of the coil unit **200** is a numerical value of power loss occurring in the coil unit **200** and the Q value becomes high as the resistance value is decreased.

Referring to FIGS. 22 and 23, when comparing the fifth embodiment, in which the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**, with the first embodiment, in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**, when the usable frequency is 150 kHz, the inductance of the coil unit **200** is increased by 352.42 um from about 9986.92 um to about 10339.34 um and the resistance of the coil unit **200** is reduced by 0.057 Ω from 0.910 Ω to 0.853 Ω. That is, the Q value is increased corresponding to the increment of the inductance and the reduction of the resistance.

Therefore, the wireless power receiver **1000** according to the fifth embodiment can increase the Q value by disposing the coil unit **200** in the pattern groove of the magnetic substrate **100**.

FIG. 24 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed on a top surface of the magnetic substrate according to the first embodiment, and FIG. 25 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

Referring to FIGS. 24 and 25, a greater amount of magnetic fields is radiated from the outer peripheral portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

In addition, a greater amount of magnetic fields is radiated at the inner portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is also because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

Referring to FIGS. 24 and 25, the wireless power receiver **1000** may further include a short-range communication antenna **600**.

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.

Hereinafter, a wireless power receiver according to another embodiment will be described with reference to FIGS. 26 to ~~37~~36.

FIG. 26 is an exploded perspective view of the wireless power receiver **1000** according to still another embodiment, FIG. 27 is a perspective view of the wireless power receiver **1000** according to still another embodiment, and FIG. 28 is a sectional view of the wireless power receiver **1000** according to still another embodiment.

Meanwhile, FIG. 27 is a perspective view showing the assembled state of the elements of the wireless power receiver **1000** shown in FIG. 26, in which some elements are omitted.

The wireless power receiver **1000** according to still another embodiment may be disposed in an electronic device, such as a portable terminal.

Referring to FIGS. 26 to 28, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200**, a connecting unit **300**, a short-range communication antenna **600**, an adhesive layer **700**, a first dual-side adhesive layer **710**, a second dual-side adhesive layer **720**, a protective film **800** and a release paper layer **730**.

Referring to FIG. 26, the magnetic substrate **100** can change the direction of the magnetic field transferred from the transmission side.

The magnetic substrate **100** changes the direction of the magnetic field transferred to the coil unit **200** from the transmission side to reduce the amount of the magnetic field leaked to the outside. Thus, the magnetic substrate **100** may have the electromagnetic wave shielding effect.

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 transferred to the coil unit **200** 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. 28, the magnetic substrate **100** may include a magnet **110** and a support **120**.

According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

Referring again to FIG. 26, the magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

A receiving space **130** is formed at a predetermined area of the magnet substrate **100**. The receiving space **130** has a structure the same as that of the connecting unit **300**. The connecting unit **300** is disposed in the receiving space **130** and connected to the coil unit **200**.

The coil unit **200** can receive the power from the transmission side using the electromagnetic induction or resonance. Similar to the coil unit **200** illustrated in 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 connecting unit **300** connects a receiver 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 receiver circuit.

The connecting unit **300** may include a wiring layer and the wiring layer may include the wireless power receiving circuit. The wireless power receiving circuit may include a rectifier circuit for rectifying the power received from the coil unit **200**, a smoothing circuit for removing noise signals, and a main IC chip for performing the operation to wirelessly receive the power.

In addition, the receiver circuit can transfer the signal received from the short-range communication antenna **600** to a short-range communication signal processing unit (not shown).

The connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100** and connected to the coil unit **200**. FIG. 27 shows the connecting unit **300** disposed in the receiving space **130** of the magnetic substrate **100**.

The connecting unit **300** may include a first connection terminal **310**, a second connection terminal **320**, a third connection terminal **340** and a fourth connection terminal **350**. The first connection terminal **310** of the connecting unit **300** is connected to the first connection terminal **210** of the coil unit **200**, the second connection terminal **320** of the connecting unit **300** is connected to the second connection terminal **220** of the coil unit **200**, the third connection terminal **340** of the connecting unit **300** is connected to a first connection terminal **610** of the short-range communication antenna **600** and the fourth connection terminal **350** of the connecting unit **300** is connected to a second connection terminal **620** of the short-range communication antenna **600**.

The connecting unit **300** may have the shape corresponding to the shape of the receiving space **130** and may be disposed in the receiving space **130**. Since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

According to one embodiment, the connecting unit **300** may include a flexible printed circuit board (FPCB), a tape substrate (TS) or a lead frame (LF). If the tape substrate is used as the connecting unit **300**, the thickness of the connecting unit **300** can be reduced, so that the overall size of the wireless power receiver **1000** can be reduced.

If the lead frame is used as the connecting unit **300**, the wiring layer included in the connecting unit **300** can be protected from the heat, external moisture or impact and the mass production can be realized.

Referring again to FIG. 26, 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 NFC signal processing unit (not shown) can process the signal transferred to the short-range communication antenna **600** through the connecting unit **300**.

Various short-range communication technologies can be applied to the short-range communication antenna **600** and the NFC technology is preferable.

According to one embodiment, the short-range communication antenna **600** may be arranged at an outer peripheral portion of the coil unit **200**. Referring to FIG. 27, when the coil unit **200** is disposed at 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.

Referring again to FIG. 26, the adhesive layer (not shown) may be disposed under the protective film **800** to form the protective film **800** on the coil unit **200** and the short-range communication antenna **600**, which will be described later in detail.

The first dual-side adhesive layer **710** is interposed between the magnetic substrate **100** and the coil unit **200**/short-range communication antenna **600** to adhere the coil unit **200** to the magnetic substrate **100**, which will be described later in detail. Similar to the magnetic substrate **100**, a receiving space having the shape identical to the shape of the connecting unit **300** may be formed in the first dual-side adhesive layer **710**.

Referring again to FIG. 28, the second dual-side adhesive layer **720** adheres the protective film **800** to the release paper layer **730**, which will be described later in detail.

The coil unit **200** may be disposed on the magnetic substrate **100** and may have a spiral structure, but the embodiment is not limited thereto.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to still another embodiment will be described with reference to FIGS. 29 to ~~37~~36.

When the manufacturing process starts, as shown in FIG. 29, the conductor **201**, the adhesive layer **700** and the protective film **800** are prepared.

According to one embodiment, the conductor **201** may be formed by using an alloy including copper. The copper is in the form of roll annealed copper or electrodeposited copper. The conductor **201** may have various thicknesses depending on the specification of a product. According to one embodiment, the conductor **201** may have the thickness of 100μm, but the embodiment is not limited thereto.

The adhesive layer **700** is used to reinforce the adhesive strength between the conductor **201** and the protective film **800**. The adhesive layer **700** may include thermosetting resin, but the embodiment is not limited thereto. The adhesive layer may have the thickness of 17μm, but the embodiment is not limited thereto.

The protective film **800** protects the conductor **201** when a predetermined conductive pattern is formed in the conductor **201**. In detail, the protective film **800** supports the conductor **201** in the etching process, which will be described later, to protect the conductor **201** such that the predetermined conductive pattern can be formed in the conductor **201**.

According to one embodiment, the protective film **800** may include polyimide film (PI film), but the embodiment is not limited thereto.

Then, as shown in FIG. 30, the conductor **201** is formed on the protective film **800** by the adhesive layer **700**. The laminating process can be used to form the conductor **201** on the

protective film **800**. The laminating process refers to the process to bond heterogeneous materials with each other by applying predetermined heat and pressure.

Then, as shown in FIG. 31, a photoresist film **900** is attached onto the top surface of the conductor **201**. The photoresist film **900** is used for etching the conductor **201** to form a predetermined conductive pattern in the conductor **201**. A UV exposure type film or an LDI exposure type film may be used as the photoresist film **900**. According to another embodiment, a photoresist coating solution can be coated on the top surface of the conductor **201** without using the photoresist film **900**.

After that, as shown in FIG. 32, the photoresist film **900** is subject to the exposure and development processes to form a mask pattern **910**.

The mask pattern **910** may be formed on the top surface of the conductor **201** corresponding to the position of the conductive pattern.

The exposure process refers to the process for selectively irradiating light onto the photoresist film **900** corresponding to the conductive pattern. In detail, in the exposure process, the light is irradiated onto regions of the conductor **201** where the conductive pattern is not formed. The development process refers to the process for removing the regions to which the light is irradiated through the exposure process.

Due to the exposure and development processes, the mask pattern **910** may be formed in the regions corresponding to the coil unit **200** and the short-range communication antenna **600**. The conductor **201** exposed through the mask pattern **910** may be etched.

Then, as shown in FIG. 33, a predetermined portion of the conductor **201** where the mask pattern **910** is not formed may be removed through the etching process. The etching process refers to the process of removing the predetermined portion of the conductor **201** where the mask pattern **910** is not formed by using a chemical reacting with the predetermined portion of the conductor **201**. According to one embodiment, the conductor **201** may be patterned through the wet etching or dry etching.

After that, as shown in FIG. 34, the mask pattern **910** is removed so that the first and second connection terminals **210** and **220** of the coil unit **200**, the first and second connection terminals **610** and **620** of the short-range communication antenna **600**, the coil **230** having a

predetermined conductive pattern and the short-range communication antenna **600** having a predetermined conductive pattern may be formed.

Then, as shown in FIG. 35, the soldering process is performed to connect the coil unit **200** and the short-range communication antenna **600** to the connecting unit **300**. According to one embodiment, the soldering process includes the reflow process, but the embodiment is not limited thereto. The reflow process refers to the process for bonding the coil unit **230** and the short-range communication antenna **600** with the connecting unit **300** by melting solder cream using high-temperature heat to ensure the stable electrical connection between the connecting unit **300** and the coil unit **230**/NFC antenna **600**.

The first connection terminal **310** of the connecting unit **300** may be connected to the first connection terminal **210** of the coil unit **200** by a solder **30**, the second connection terminal **320** of the connecting unit **300** may be connected to the second connection terminal **220** of the coil unit **200** by the solder **30**, the third connection terminal **340** of the connecting unit **300** may be connected to the first connection terminal **610** of the short-range communication antenna **600** by the solder **30** and the fourth connection terminal **350** of the connecting unit **300** may be connected to the second connection terminal **620** of the short-range communication antenna **600**.

Then, as shown in FIG. 36, the magnetic substrate **100** is laminated on a predetermined portion of the conductive pattern where the connecting unit **300** is not present. In detail, the magnetic substrate **100** may be laminated on the top surfaces of the coil **230** and the short-range communication antenna **600**.

Prior to the above, the receiving space corresponding to the connecting unit **300** can be formed at the magnetic substrate **100**. The receiving space of the magnetic substrate **100** may have the shape identical to the shape of the connecting unit **300**.

As described above with reference to FIG. 26, since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

The coil **230**/short-range communication antenna **600** and the magnetic substrate **100** may be adhered with each other by the first dual-side adhesive layer **710**. According to one

embodiment, the magnetic substrate **100** may have the thickness in the range of 100μm to 800μm, but the embodiment is not limited thereto. According to one embodiment, the first dual-side adhesive layer **710** may have the thickness in the range of 10μm to 50μm, but the embodiment is not limited thereto.

After that, ~~as shown in FIG. 37,~~ the release paper layer **730** is attached to one side of the protective film **800** by interposing the second dual-size adhesive layer **720** therebetween. The release paper layer **730** is a paper layer for protecting the second dual-size adhesive layer **720** and may be removed when the wireless power receiver is disposed in a case of an electronic device, such as a portable terminal.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

CLAIMS

What is claimed is:

1. A wireless power receiver comprising:

a magnetic substrate; and

a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer on the magnetic substrate.

2. The wireless power receiver of claim 1, wherein the coil is formed as a conductive pattern on the magnetic substrate.

3. The wireless power receiver of claim 1, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

4. The wireless power receiver of claim 3, further comprising the connecting unit disposed in the receiving space and connected to the coil.

5. The wireless power receiver of claim 4, wherein the connecting unit comprises one of a flexible printed circuit board, a lead frame and a tape substrate.

6. The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the magnetic substrate to surround the coil.

7. The wireless power receiver of claim 6, wherein the short-range communication antenna comprises a near field communication (NFC) antenna.

8. The wireless power receiver of claim 6, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

9. The wireless power receiver of claim 8, further comprising the connecting unit disposed in the receiving space and connected to the coil and a near field communication signal process unit.

10. A wireless power receiver comprising:

a magnetic substrate; and

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.

11. The wireless power receiver of claim 10, wherein the coil is formed as a conductive pattern at the magnetic substrate.

12. The wireless power receiver of claim 10, wherein the magnetic substrate comprises a pattern groove for receiving a part of the coil and the part of the coil is disposed in the pattern groove.

13. The wireless power receiver of claim 10, wherein the coil has a thickness smaller than a thickness of the magnetic substrate and an upper portion of the coil is exposed out of the magnetic substrate.

14. A method of manufacturing a wireless power receiver for wirelessly receiving power, the method comprising:

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.

15. The method of claim 14, wherein the forming of the conductive pattern comprises etching the conductor to form the conductive pattern corresponding to a coil for wirelessly receiving the power and a near field communication antenna for making communication with an outside.

16. The method of claim 15, which comprises positioning connection terminals of the coil and the near field communication antenna in the receiving space.

17. The method of claim 14, wherein the disposing of the magnetic substrate comprises forming the magnetic substrate on the conductive pattern using a dual-side adhesive layer.

18. The method of claim 14, further comprising forming a release paper layer on the protective film using a dual-side adhesive layer.

19. A terminal equipped therein with a wireless power receiver of claim 1.

20. A terminal equipped therein with a wireless power receiver of claim 10.

ABSTRACT

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.

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 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.

First, referring to FIG. 14, the wireless power receiver **1000** according to the fifth embodiment may include a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using electromagnetic induction. In this case, the coil **230** of the coil unit **200** can wirelessly receive power through the electromagnetic induction with a coil of the transmission side.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using resonance.

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 leaked to the outside by changing the direction of the magnetic field received from the transmission side.

The magnetic substrate **100** can change the direction of the magnetic field received 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. 16, the magnetic substrate **100** may include a magnet **110** and a support **120**.

The magnet **110** may include a particle or a ceramic. According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

The magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

Referring again to FIG. 14, the coil unit **200** may include a first connection terminal **210**, a second connection terminal **220** and a coil **230**. The coil **230** may formed as a conductive layer or a conductive pattern.

The coil unit **200** may be disposed inside the magnetic substrate **100**. In detail, the coil unit **200** may be buried inside the magnetic substrate **100**. In more detail, the magnetic substrate **100** may include a pattern groove and the coil unit **200** may be disposed in the pattern groove. The pattern groove may be formed as a conductive pattern or a conductive layer similar to the coil unit **200**.

The coil unit **200** has a thickness smaller than that of the magnetic substrate **100** and an upper portion of the coil unit **200** may be exposed out of the magnetic substrate **100**.

A process for manufacturing the wireless power receiver **1000** by disposing the coil unit **200** and the connecting unit **300** in the magnetic substrate **100** will be described later with reference to FIGS. 17 to 21.

The first connection terminal **210** of the coil unit **200** is located at one end of the coil **230** and the second connection terminal **220** of the coil unit **200** is located at the other end of the coil **230**.

The first and second connection terminals **210** and **220** of the coil unit **200** are necessary for connection with the connecting unit **300**.

The coil **230** may be formed as a coil 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** may transfer the power wirelessly received from the transmission side to the connecting unit **300**. The coil unit **200** may transfer the power wirelessly received from the transmission side using the electromagnetic induction or resonance to the connecting unit **300**.

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 the wiring layer may include a wireless power receiving circuit, which will be described later.

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 receiver circuit. The wireless power receiver circuit may include a rectifier circuit (not shown) 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. 15 and 16 show the detailed structure of the wireless power receiver **1000** according to the fifth embodiment when the coil unit **200** is connected to the connecting unit **300**.

FIG. 15 shows the coil unit **200** and the connecting unit **300** interconnected with each other.

The coil unit **200** can be connected to the connecting unit **300** by a solder.

Referring to FIG. 16, 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 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**.

According to one embodiment, the via hole can be formed by using a laser. The laser may include a UV laser or a CO2 laser.

FIG. 16 is a sectional view of the wireless power receiver **1000** in which the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

That is, the first connection terminal **210**, the second connection terminal **220** and the coil **230** constituting the coil unit **200** may be disposed in a pattern groove **140** of the magnetic substrate **100**.

In addition, the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

The coil **230** may be designed to have a predetermined width **W** and a predetermined thickness **T** and the magnetic substrate **100** may be designed to have a predetermined thickness **T1**. According to one embodiment, the coil **230** has a thickness of 0.1mm and the magnetic substrate **100** has a thickness of 0.43 mm, but these numerical values are illustrative purposes only. According to one embodiment, the thickness **T** of the coil **230** may be smaller than the thickness **T1** of the magnetic substrate **100**.

In the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is directly disposed in the pattern groove **140** of the magnetic substrate **100**, so the overall thickness of an electronic appliance equipped with the wireless power receiver **1000** can be reduced as much as the thickness of the coil unit **200**. Thus, if the wireless power receiver **1000** according to the fifth embodiment is applied to the electronic device, such as the portable terminal, the overall thickness of the portable terminal can be reduced suitably for the current trend of slimness

In addition, in the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**. Thus, different from the electronic appliance in which a coil pattern is formed on an FPCB, the overall size of the electronic device equipped with the wireless power receiver **1000** can be reduced.

FIGS. 17 to 21 are views for explaining a method of manufacturing the wireless power receiver **1000** according to the fifth embodiment.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to the fifth embodiment will be described with reference to FIGS. 17 to 21 as well as FIGS. 14 to 16.

First, referring to FIG. 17, the magnetic substrate **100** is prepared. According to one embodiment, the magnetic substrate **100** may be produced by coating metal powder of sendust alloys, such as Al, Fe and SiO2, on polyethylene rubber and then forming an oxide layer on a surface of the polyethylene rubber.

Then, referring to FIG. 18, heat and pressure are applied using a mold **1** to form the pattern groove in the magnetic substrate **100** for receiving the coil unit **200**. The mold **1** may

have the shape corresponding to the shape of the coil unit **200**. According to one embodiment, the mold **1** can be manufactured by using an aluminum alloy, a copper alloy or a cast iron.

The mold **1** may be provided with a protrusion at a region corresponding to the coil unit **200** for wirelessly receiving the power.

When the heat is applied by using the mold **1**, the heat having the specific temperature is applied by taking the property of the metal powder of the sendust alloy constituting the magnetic substrate **100** into consideration. According to one embodiment, if the magnetic substrate **100** is produced by coating the metal powder of sendust alloy on the polyethylene rubber, when the heat and pressure are applied by using the mold **1**, high-pressure is applied at the temperature in the range of 100ºC to 180ºC, and then the mold **100** is cooled to the temperature of 100ºC or below. After that, the mold **1** is separated from the magnetic substrate **100**. If the mold **1** is separated just after the pressure has been applied to the magnetic substrate **100**, the desired pattern groove **140** may not be formed due to residual heat in the pattern groove **140**. For this reason, the mold **1** is separated from the magnetic substrate **100** after cooling the mold **100** to the temperature of 100ºC or below.

If the magnetic substrate **100** is prepared by using the metal powder of sendust alloy, the heat temperature and pressure may vary depending on the distribution and concentration of the metal powder. That is, if the distribution of the metal powder is not uniform, the higher temperature and pressure may be applied. In contrast, if the distribution of the metal powder is uniform, the lower temperature and pressure may be applied. In addition, if the concentration of the metal powder is low, the lower temperature and pressure may be applied as compared with the case in which the concentration of the metal powder is high. Further, the heat temperature and pressure may vary depending on the composition of the metal powder, that is, depending on the alloy constituting the metal powder.

In this manner, the temperature applied to the mold **1** may vary depending on the distribution, concentration and composition of the powder.

According to one embodiment, laser may be irradiated, instead of applying heat and pressure using the mold **1**, to form the pattern groove in the magnetic substrate **100** to receive the coil unit **200**. In this case, the pattern groove can be formed by using an excimer laser that irradiates the laser beam having a wavelength band of ultraviolet ray. The excimer laser may

include a KrF excimer laser (central wavelength 248 nm) or an ArF excimer laser (central wavelength 193 nm).

Next, referring to FIG. 19, the mold **1** is separated from the magnetic substrate **100** so that the magnetic substrate **100** is formed with the pattern groove **140**.

Then, referring to FIG. 20, the coil unit **200** is inserted into the pattern groove **140** formed in the magnetic substrate **100**. As the coil unit **200** is inserted into the pattern groove **140**, a predetermined conductive pattern is formed in the pattern groove **140** of the magnetic substrate **100**.

According to one embodiment, a process for forming the coil unit **200** in the pattern groove **140** of the magnetic substrate **100** may include a plating process or a process for inserting a metal which has been etched to have the conductive pattern formed by the coil unit **200**.

In detail, according to the plating process, the metallic material is filled in the pattern groove **140** to form the coil unit **200**. At this time, the metallic material may include one selected from Cu, Ag, Sn, Au, Ni and Pd and the filling of the metallic metal can be performed through one of electroless plating, screen printing, sputtering, evaporation, ink-jetting and dispensing or a combination thereof.

Then, referring to FIG. 21, the soldering process 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** is connected to the first connection terminal **310** of the connecting unit **300** through the solder **10** and 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**.

As described above, according to the method of manufacturing the wireless power receiver **1000** of the fifth embodiment, the pattern groove is formed in the magnetic substrate **100** and the coil unit **200** is disposed in the pattern groove, so that the overall thickness of the wireless power receiver **1000** can be reduced. In addition, the wireless power receiver **1000** can be manufactured by simply forming the pattern groove and then inserting the coil unit into the pattern groove, so that the manufacturing process can be simplified.

FIG. 22 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed on a top

surface of the magnetic substrate according to the first embodiment, and FIG. 23 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

The inductance, resistance and Q values of the coil unit **200** can be expressed as following equation 1.

[Equation 1]

$$Q=W*L/R$$

In equation 1, w is a frequency used when transmitting power, L is inductance of the coil unit **200** and R is resistance of the coil unit **200**.

As can be understood from equation 1, the Q value becomes high as the inductance of the coil unit **200** is increased. If the Q value is increased, the power transmission efficiency can be improved. The resistance of the coil unit **200** is a numerical value of power loss occurring in the coil unit **200** and the Q value becomes high as the resistance value is decreased.

Referring to FIGS. 22 and 23, when comparing the fifth embodiment, in which the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**, with the first embodiment, in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**, when the usable frequency is 150 kHz, the inductance of the coil unit **200** is increased by 352.42 um from about 9986.92 um to about 10339.34 um and the resistance of the coil unit **200** is reduced by 0.057 Ω from 0.910 Ω to 0.853 Ω. That is, the Q value is increased corresponding to the increment of the inductance and the reduction of the resistance.

Therefore, the wireless power receiver **1000** according to the fifth embodiment can increase the Q value by disposing the coil unit **200** in the pattern groove of the magnetic substrate **100**.

FIG. 24 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed on a top surface of the magnetic substrate according to the first embodiment, and FIG. 25 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

Referring to FIGS. 24 and 25, a greater amount of magnetic fields is radiated from the outer peripheral portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

In addition, a greater amount of magnetic fields is radiated at the inner portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is also because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

Referring to FIGS. 24 and 25, the wireless power receiver **1000** may further include a short-range communication antenna **600**.

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.

Hereinafter, a wireless power receiver according to another embodiment will be described with reference to FIGS. 26 to 36.

FIG. 26 is an exploded perspective view of the wireless power receiver **1000** according to still another embodiment, FIG. 27 is a perspective view of the wireless power receiver **1000** according to still another embodiment, and FIG. 28 is a sectional view of the wireless power receiver **1000** according to still another embodiment.

Meanwhile, FIG. 27 is a perspective view showing the assembled state of the elements of the wireless power receiver **1000** shown in FIG. 26, in which some elements are omitted.

The wireless power receiver **1000** according to still another embodiment may be disposed in an electronic device, such as a portable terminal.

Referring to FIGS. 26 to 28, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200**, a connecting unit **300**, a short-range communication antenna **600**, an adhesive layer **700**, a first dual-side adhesive layer **710**, a second dual-side adhesive layer **720**, a protective film **800** and a release paper layer **730**.

Referring to FIG. 26, the magnetic substrate **100** can change the direction of the magnetic field transferred from the transmission side.

The magnetic substrate **100** changes the direction of the magnetic field transferred to the coil unit **200** from the transmission side to reduce the amount of the magnetic field leaked to the outside. Thus, the magnetic substrate **100** may have the electromagnetic wave shielding effect.

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 transferred to the coil unit **200** 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. 28, the magnetic substrate **100** may include a magnet **110** and a support **120**.

According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

Referring again to FIG. 26, the magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

A receiving space **130** is formed at a predetermined area of the magnet substrate **100**. The receiving space **130** has a structure the same as that of the connecting unit **300**. The connecting unit **300** is disposed in the receiving space **130** and connected to the coil unit **200**.

The coil unit **200** can receive the power from the transmission side using the electromagnetic induction or resonance. Similar to the coil unit **200** illustrated in 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 connecting unit **300** connects a receiver 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 receiver circuit.

The connecting unit **300** may include a wiring layer and the wiring layer may include the wireless power receiving circuit. The wireless power receiving circuit may include a rectifier circuit for rectifying the power received from the coil unit **200**, a smoothing circuit for removing noise signals, and a main IC chip for performing the operation to wirelessly receive the power.

In addition, the receiver circuit can transfer the signal received from the short-range communication antenna **600** to a short-range communication signal processing unit (not shown).

The connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100** and connected to the coil unit **200**. FIG. 27 shows the connecting unit **300** disposed in the receiving space **130** of the magnetic substrate **100**.

The connecting unit **300** may include a first connection terminal **310**, a second connection terminal **320**, a third connection terminal **340** and a fourth connection terminal **350**. The first connection terminal **310** of the connecting unit **300** is connected to the first connection terminal **210** of the coil unit **200**, the second connection terminal **320** of the connecting unit **300** is connected to the second connection terminal **220** of the coil unit **200**, the third connection terminal **340** of the connecting unit **300** is connected to a first connection terminal **610** of the short-range communication antenna **600** and the fourth connection terminal **350** of the connecting unit **300** is connected to a second connection terminal **620** of the short-range communication antenna **600**.

The connecting unit **300** may have the shape corresponding to the shape of the receiving space **130** and may be disposed in the receiving space **130**. Since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

According to one embodiment, the connecting unit **300** may include a flexible printed circuit board (FPCB), a tape substrate (TS) or a lead frame (LF). If the tape substrate is used as the connecting unit **300**, the thickness of the connecting unit **300** can be reduced, so that the overall size of the wireless power receiver **1000** can be reduced.

If the lead frame is used as the connecting unit **300**, the wiring layer included in the connecting unit **300** can be protected from the heat, external moisture or impact and the mass production can be realized.

Referring again to FIG. 26, 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 NFC signal processing unit (not shown) can process the signal transferred to the short-range communication antenna **600** through the connecting unit **300**.

Various short-range communication technologies can be applied to the short-range communication antenna **600** and the NFC technology is preferable.

According to one embodiment, the short-range communication antenna **600** may be arranged at an outer peripheral portion of the coil unit **200**. Referring to FIG. 27, when the coil unit **200** is disposed at 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.

Referring again to FIG. 26, the adhesive layer (not shown) may be disposed under the protective film **800** to form the protective film **800** on the coil unit **200** and the short-range communication antenna **600**, which will be described later in detail.

The first dual-side adhesive layer **710** is interposed between the magnetic substrate **100** and the coil unit **200**/short-range communication antenna **600** to adhere the coil unit **200** to the magnetic substrate **100**, which will be described later in detail. Similar to the magnetic substrate **100**, a receiving space having the shape identical to the shape of the connecting unit **300** may be formed in the first dual-side adhesive layer **710**.

Referring again to FIG. 28, the second dual-side adhesive layer **720** adheres the protective film **800** to the release paper layer **730**, which will be described later in detail.

The coil unit **200** may be disposed on the magnetic substrate **100** and may have a spiral structure, but the embodiment is not limited thereto.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to still another embodiment will be described with reference to FIGS. 29 to 36.

When the manufacturing process starts, as shown in FIG. 29, the conductor **201**, the adhesive layer **700** and the protective film **800** are prepared.

According to one embodiment, the conductor **201** may be formed by using an alloy including copper. The copper is in the form of roll annealed copper or electrodeposited copper. The conductor **201** may have various thicknesses depending on the specification of a product. According to one embodiment, the conductor **201** may have the thickness of 100μm, but the embodiment is not limited thereto.

The adhesive layer **700** is used to reinforce the adhesive strength between the conductor **201** and the protective film **800**. The adhesive layer **700** may include thermosetting resin, but the embodiment is not limited thereto. The adhesive layer may have the thickness of 17μm, but the embodiment is not limited thereto.

The protective film **800** protects the conductor **201** when a predetermined conductive pattern is formed in the conductor **201**. In detail, the protective film **800** supports the conductor **201** in the etching process, which will be described later, to protect the conductor **201** such that the predetermined conductive pattern can be formed in the conductor **201**.

According to one embodiment, the protective film **800** may include polyimide film (PI film), but the embodiment is not limited thereto.

Then, as shown in FIG. 30, the conductor **201** is formed on the protective film **800** by the adhesive layer **700**. The laminating process can be used to form the conductor **201** on the

protective film **800**. The laminating process refers to the process to bond heterogeneous materials with each other by applying predetermined heat and pressure.

Then, as shown in FIG. 31, a photoresist film **900** is attached onto the top surface of the conductor **201**. The photoresist film **900** is used for etching the conductor **201** to form a predetermined conductive pattern in the conductor **201**. A UV exposure type film or an LDI exposure type film may be used as the photoresist film **900**. According to another embodiment, a photoresist coating solution can be coated on the top surface of the conductor **201** without using the photoresist film **900**.

After that, as shown in FIG. 32, the photoresist film **900** is subject to the exposure and development processes to form a mask pattern **910**.

The mask pattern **910** may be formed on the top surface of the conductor **201** corresponding to the position of the conductive pattern.

The exposure process refers to the process for selectively irradiating light onto the photoresist film **900** corresponding to the conductive pattern. In detail, in the exposure process, the light is irradiated onto regions of the conductor **201** where the conductive pattern is not formed. The development process refers to the process for removing the regions to which the light is irradiated through the exposure process.

Due to the exposure and development processes, the mask pattern **910** may be formed in the regions corresponding to the coil unit **200** and the short-range communication antenna **600**. The conductor **201** exposed through the mask pattern **910** may be etched.

Then, as shown in FIG. 33, a predetermined portion of the conductor **201** where the mask pattern **910** is not formed may be removed through the etching process. The etching process refers to the process of removing the predetermined portion of the conductor **201** where the mask pattern **910** is not formed by using a chemical reacting with the predetermined portion of the conductor **201**. According to one embodiment, the conductor **201** may be patterned through the wet etching or dry etching.

After that, as shown in FIG. 34, the mask pattern **910** is removed so that the first and second connection terminals **210** and **220** of the coil unit **200**, the first and second connection terminals **610** and **620** of the short-range communication antenna **600**, the coil **230** having a

predetermined conductive pattern and the short-range communication antenna **600** having a predetermined conductive pattern may be formed.

Then, as shown in FIG. 35, the soldering process is performed to connect the coil unit **200** and the short-range communication antenna **600** to the connecting unit **300**. According to one embodiment, the soldering process includes the reflow process, but the embodiment is not limited thereto. The reflow process refers to the process for bonding the coil unit **230** and the short-range communication antenna **600** with the connecting unit **300** by melting solder cream using high-temperature heat to ensure the stable electrical connection between the connecting unit **300** and the coil unit **230**/NFC antenna **600**.

The first connection terminal **310** of the connecting unit **300** may be connected to the first connection terminal **210** of the coil unit **200** by a solder **30**, the second connection terminal **320** of the connecting unit **300** may be connected to the second connection terminal **220** of the coil unit **200** by the solder **30**, the third connection terminal **340** of the connecting unit **300** may be connected to the first connection terminal **610** of the short-range communication antenna **600** by the solder **30** and the fourth connection terminal **350** of the connecting unit **300** may be connected to the second connection terminal **620** of the short-range communication antenna **600**.

Then, as shown in FIG. 36, the magnetic substrate **100** is laminated on a predetermined portion of the conductive pattern where the connecting unit **300** is not present. In detail, the magnetic substrate **100** may be laminated on the top surfaces of the coil **230** and the short-range communication antenna **600**.

Prior to the above, the receiving space corresponding to the connecting unit **300** can be formed at the magnetic substrate **100**. The receiving space of the magnetic substrate **100** may have the shape identical to the shape of the connecting unit **300**.

As described above with reference to FIG. 26, since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

The coil **230**/short-range communication antenna **600** and the magnetic substrate **100** may be adhered with each other by the first dual-side adhesive layer **710**. According to one

embodiment, the magnetic substrate **100** may have the thickness in the range of 100μm to 800μm, but the embodiment is not limited thereto. According to one embodiment, the first dual-side adhesive layer **710** may have the thickness in the range of 10μm to 50μm, but the embodiment is not limited thereto.

After that, the release paper layer **730** is attached to one side of the protective film **800** by interposing the second dual-size adhesive layer **720** therebetween. The release paper layer **730** is a paper layer for protecting the second dual-size adhesive layer **720** and may be removed when the wireless power receiver is disposed in a case of an electronic device, such as a portable terminal.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

CLAIMS

What is claimed is:

1. A wireless power receiver comprising:

a magnetic substrate; and

a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer on the magnetic substrate.

2. The wireless power receiver of claim 1, wherein the coil is formed as a conductive pattern on the magnetic substrate.

3. The wireless power receiver of claim 1, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

4. The wireless power receiver of claim 3, further comprising the connecting unit disposed in the receiving space and connected to the coil.

5. The wireless power receiver of claim 4, wherein the connecting unit comprises one of a flexible printed circuit board, a lead frame and a tape substrate.

6. The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the magnetic substrate to surround the coil.

7. The wireless power receiver of claim 6, wherein the short-range communication antenna comprises a near field communication (NFC) antenna.

8. The wireless power receiver of claim 6, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

9. The wireless power receiver of claim 8, further comprising the connecting unit disposed in the receiving space and connected to the coil and a near field communication signal process unit.

10. A wireless power receiver comprising:

a magnetic substrate; and

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.

11. The wireless power receiver of claim 10, wherein the coil is formed as a conductive pattern at the magnetic substrate.

12. The wireless power receiver of claim 10, wherein the magnetic substrate comprises a pattern groove for receiving a part of the coil and the part of the coil is disposed in the pattern groove.

13. The wireless power receiver of claim 10, wherein the coil has a thickness smaller than a thickness of the magnetic substrate and an upper portion of the coil is exposed out of the magnetic substrate.

14. A method of manufacturing a wireless power receiver for wirelessly receiving power, the method comprising:

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.

15. The method of claim 14, wherein the forming of the conductive pattern comprises etching the conductor to form the conductive pattern corresponding to a coil for wirelessly receiving the power and a near field communication antenna for making communication with an outside.

16. The method of claim 15, which comprises positioning connection terminals of the coil and the near field communication antenna in the receiving space.

17. The method of claim 14, wherein the disposing of the magnetic substrate comprises forming the magnetic substrate on the conductive pattern using a dual-side adhesive layer.

18. The method of claim 14, further comprising forming a release paper layer on the protective film using a dual-side adhesive layer.

19. A terminal equipped therein with a wireless power receiver of claim 1.

20. A terminal equipped therein with a wireless power receiver of claim 10.

ABSTRACT

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.

Electronic Acknowledgement Receipt

EFS ID:	14758976
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 H LAMPP
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	22-JAN-2013
Filing Date:	29-OCT-2012
Time Stamp:	16:01:40
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	Applicant Response to Pre-Exam Formalities Notice	Resp-Notice-Repl-Figs.pdf	115280 5ae3f62bac4db21f29c2fface35948019cda1ca2	no	3

Warnings:

Information:

2	Specification	as-filed-marked-up.pdf	161027 d42bcb75ed8726533a238b5aadb4aa7699 1cb318	no	32
Warnings:					
Information:					
3	Specification	as-filed-clean.pdf	160136 3a6d82cb1af489f1f8eca2f423be44cb30a29 ba9	no	32
Warnings:					
Information:					
			Total Files Size (in bytes):	436443	

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.

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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

FILING RECEIPT

OC000000057674033

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Date Mailed: 11/21/2012

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**

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Assignment For Published Patent Application

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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.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0029987 03/23/2012
REPUBLIC OF KOREA 10-2012-0079004 07/19/2012

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 11/16/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/663,012**

Projected Publication Date: To Be Determined - pending completion of Omitted Items

Non-Publication Request: No

Early Publication Request: No
Title

WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Preliminary Class

340

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

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

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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

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

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

NOT GRANTED

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

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($)	ADDITIONAL FEE($)	OR	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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420

CONFIRMATION NO. 3575

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

FORMALITIES LETTER

OC000000057674034

Date Mailed: 11/21/2012

NOTICE OF OMITTED ITEM(S) IN A NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

A filing date has been accorded to the above-identified nonprovisional application papers; however, the following item(s) appear to have been omitted from the application:

- Figure(s) **37** described in the specification.

Applicant must reply to this notice within the time period set forth in this notice to avoid abandonment of this application. Applicant must select one of the three following options and the reply must comply with the requirements set forth in the selected option and any other requirements set forth in this notice. The reply should also indicate which option applicant has selected.

I. Petition for date of deposit: Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and $400.00 petition fee *(37 CFR 1.17(f))*) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if it is determined that the item(s) was received by the USPTO. **THIS TWO MONTH PERIOD IS EXTENDABLE UNDER 37 CFR 1.136(a) or (b).**

II. Petition for later filing date: Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the $400.00 petition fee *(37 CFR 1.17(f))* requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice. **THIS TWO MONTH PERIOD IS EXTENDABLE UNDER 37 CFR 1.136(a) or (b).**
Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(f)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted item(s) and the petition (and petition fee) requesting the later filing date.

III. Acceptance of application as deposited: Applicant may accept the application as deposited in the USPTO by filing an appropriate amendment as set forth in either (A) or (B) below within **TWO MONTHS** of the date of this Notice. **THIS TWO MONTH PERIOD IS EXTENDABLE UNDER 37 CFR 1.136(a) or (b)** . The application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (i.e., the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit. A petition is not required for this option.

(A) If applicant wants to accept the application as deposited without adding the subject matter that was in the omitted item (e.g., a missing page or figure), applicant is required to submit one or more of the following items without adding any new matter (see 35 U.S.C. 132(a)):

1. For a missing page of the specification,
   a) a substitute specification including claims that amends the specification to renumber the pages consecutively and cancels any incomplete sentences, and
   b) a statement that the substitute specification includes no new matter, in compliance with 37 CFR 1.121(b)(3) and 1.125;
2. For a missing figure of the drawings,
   a) replacement drawing sheets in compliance with 37 CFR 1.121(d) to renumber the drawing figures consecutively (if necessary),
   b) a substitute specification excluding claims that amends the specification to cancel any references to any omitted drawing(s) and corrects the references in the specification to the drawing figures to correspond with any relabeled drawing figures, and
   c) a statement that the substitute specification includes no new matter, in compliance with 37 CFR 1.121(b)(3) and 1.125;
3. For a missing page of the claim listing only, a replacement claim listing with the claims renumbered consecutively or, if amendment to the claims is also necessary, then a complete claim listing in compliance with 37 CFR 1.121(c);
4. For a missing or unreadable compact disc,
   a) a substitute specification (excluding the claims) deleting the reference to the compact disc and the files contained on the compact disc, and
   b) a statement that the substitute specification includes no new matter, in compliance with 37 CFR 1.121(b)(3) and 1.125; and
5. For a missing or unreadable file submitted on a compact disc,
   a) a substitute specification (excluding the claims) deleting the reference to the missing or unreadable file, and a statement that the substitute specification includes no new matter, in compliance with 37 CFR 1.121(b)(3) and 1.125; and
   b) a replacement transmittal letter listing all of the files except the missing or unreadable file in compliance with 37 CFR 1.52(e)(3)(ii).

(B) Alternatively, if applicant wants to accept the application as deposited but wishes to add the subject matter in the omitted item (e.g., a missing page or figure) by relying on an incorporation by reference under 37 CFR 1.57 or other portions of the original disclosure, applicant is required to submit one or more of the following items without adding any new matter (see 35 U.S.C. 132(a)):

1. To add the subject matter in a missing page of specification,
   a) a substitute specification excluding claims and
   b) a statement that the substitute specification includes no new matter, in compliance with 37 CFR 1.121(b)(3) and 1.125;
2. To add a missing figure of the drawings, new and replacement drawing sheets in compliance with 37 CFR 1.121(d);
3. To add the subject matter in a missing page of the claim listing, a complete claim listing in compliance with 37 CFR 1.121(c) (e.g., a claim in the missing page should be submitted as a new claim);
4. To add the subject matter in a missing or unreadable compact disc,
   a) a replacement compact disc and a duplicate copy of the compact disc, in compliance with 37 CFR 1.52(e); and
   b) a statement that the replacement compact disc contains no new matter in compliance with 37 CFR 1.52(e)(4); and,
5. To add the subject matter in a missing or unreadable file submitted on a compact disc,
   a) a replacement compact disc that contains all of the files listed in the specification including the missing or unreadable file and a duplicate copy of the compact disc, in compliance with 37 CFR 1.52(e); and

b) a statement that the replacement compact disc contains no new matter in compliance with 37 CFR 1.52(e)(4).

If applicant is relying on an incorporation by reference under 37 CFR 1.57 to add the omitted subject matter, then applicant must also comply with the requirements of 37 CFR 1.57.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/kung/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420

CONFIRMATION NO. 3575

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

POA ACCEPTANCE LETTER

OC000000057674065

Date Mailed: 11/21/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/02/2012.

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

/hngo/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): 23557

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

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

I am the Applicant:

☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature	Jeong Joong Kim	Date	October 5, 2012
Name	Jeong-Joong Kim	Telephone	+82-31-436-7890
Title and Company	Vice President, LG Innotek Co., Ltd.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below *.

☐ *Total of ___________ forms are submitted.

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Title	Wireless Power Receiver and Method of Manufacturing the Same
Art Unit	
Examiner Name	
Attorney Docket Number	SUN.LGI.420

SIGNATURE of Applicant or Patent Practitioner

Signature	/Jeff Lloyd/	Date	November 2, 2012
Name	Jeff Lloyd	Telephone	352-375-8100
Registration Number	35,589		

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

☐ *Total of ___________ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Electronic Acknowledgement Receipt

EFS ID:	14137472
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/Wea Sto Domingo
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	02-NOV-2012
Filing Date:	
Time Stamp:	15:17:27
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		Comm-POA-Transmittal.pdf	210148 63518bbf07d0f15959533f328e7c0156392cf20b	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Power of Attorney	2	3
Warnings:			
Information:			
	Total Files Size (in bytes):	210148	

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.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on November 2, 2012.

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

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

COMMUNICATION

Sir:

Attached hereto, please find a Power of Attorney by Applicant (PTO/AIA/82B) executed by a representative of the assignee, LG Innotek Co., Ltd., and a Transmittal for Power of Attorney to One or More Registered Practitioners (PTO/AIA/82A) for the patent application referenced above.

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/whs

Attachments: Power of Attorney by Applicant (PTO/AIA/82B);
Transmittal for Power of Attorney to One or More Registered Practitioners (PTO/AIA/82A).

J:\SUN\LGI\420\PTO-misc\Comm-POA-Transmittal.doc/whs

SCORE Placeholder Sheet for IFW Content

Application Number: 13663012 Document Date: 10/29/2012

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

- Drawing

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

To access the documents in the SCORE database, refer to instructions developed by SIRA.

At the time of document entry (noted above):

• Examiners may access SCORE content via the eDAN interface.
• Other USPTO employees can bookmark the current SCORE URL (http://es/ScoreAccessWeb/).
• External customers may access SCORE content via the Public and Private PAIR interfaces.

Form Revision Date: February 8, 2006

COMBINED DECLARATION (37 C.F.R. § 1.63) AND ASSIGNMENT

As a below-named inventor, I hereby declare that:

I believe I am the original inventor or an original joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

Insert Title:

WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

the specification for which

- ☒ is attached hereto.
- ☐ was filed ____________________, Serial No. ____________________.

The above-identified application was made or authorized to be made by me.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

ASSIGNMENT

WHEREAS, the undersigned has invented certain new and useful improvements described in the application identified above.

WHEREAS,

Insert Assignee(s) Name/Address:	**LG INNOTEK CO., LTD.,** a corporation of the country of the Seoul Square, 541, Namdaemunno 5-ga, Jung-gu, Seoul, 100-714, Republic of Korea

(hereinafter ASSIGNEE), is desirous of acquiring the entire right, title, and interest in and to said invention and in and to any Letters Patent which may be granted therefor in the United States and in any and all foreign countries;

NOW, THEREFORE, in view of valuable consideration, receipt of which is hereby acknowledged, I/we, the undersigned, have sold, assigned, and transferred, and by these presents do sell, assign, and transfer, unto said ASSIGNEE, its successors and assigns, the full and exclusive right to the said invention in the United States and its territorial possessions and in all foreign countries and the entire right, title, and interest in and to any and all Letters Patent which may be granted therefor in the United States and its territorial possessions and in any and all foreign countries and in and to any and all divisions, reissues, continuations, and extensions thereof.

I/we hereby authorize and request the Patent Office Officials in the United States and in any and all foreign countries to issue any and all of said Letters Patent, when granted, to ASSIGNEE, as the assignee of the entire right, title, and interest in and to the same, for the sole use and behoof of said ASSIGNEE, its successors and assigns.

FURTHER, I/we agree that we will communicate to said ASSIGNEE, or its representatives, any facts known to me respecting said invention; testify in any legal proceedings; sign all lawful papers; execute all divisional, continuation, substitution, renewal, and reissue applications; execute all necessary assignment papers to cause any and all of said Letters Patent to be issued to said ASSIGNEE; make all rightful oaths; and generally do everything possible to aid the said ASSIGNEE, its successors and assigns, to obtain and enforce proper protection for said invention in the United States and in any and all foreign countries.

In witness whereof, executed by the undersigned on the date opposite the undersigned name.

Legal Name of inventor	AN, Jeong Wook	Date:	29 / oct / 2012
Inventor's Signature	안정욱		

☒ Additional inventors are being named on the 1 supplemental sheet(s) attached hereto.

Docket No. SUN.LGI.420

Docket No. P2012-Z0451US

2012/10/29 이정오
LG이노텍/X.X.X.117 이정오

SUPPLEMENTAL SHEET FOR DECLARATION AND ASSIGNMENT

ADDITIONAL INVENTOR(S)
Supplemental Sheet Page 1 of 1

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: LEE, Jung Oh

Date: 29 oct. 2012

Inventor's Signature:

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: LEEM, Sung Hyun

Date: 29. oct, 2012

Inventor's Signature: 임성현

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: KIM, Yang Hyun

Date:

Inventor's Signature:

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor:

Date:

Inventor's Signature:

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor:

Date:

Inventor's Signature:

SUPPLEMENTAL SHEET FOR DECLARATION AND ASSIGNMENT

ADDITIONAL INVENTOR(S)
Supplemental Sheet Page _1_ of _1_

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: LEE, Jung Oh

Date: ____________

Inventor's Signature: ____________

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: LEEM, Sung Hyun

Date: ____________

Inventor's Signature: ____________

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: KIM, Yang Hyun

Date: 2012.10.30

Inventor's Signature: ____________

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: ____________

Date: ____________

Inventor's Signature: ____________

LEGAL NAME OF JOINT INVENTOR, IF ANY:

Legal Name of inventor: ____________

Date: ____________

Inventor's Signature: ____________

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	

Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jeong Wook		AN	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	Seoul Square, 541, Namdaemunno 5-ga, Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Postal Code	100-714	**Country**	KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jung Oh		LEE	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	Seoul Square, 541, Namdaemunno 5-ga, Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Postal Code	100-714	**Country**	KR

Inventor 3 Remove

Legal Name

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	

Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Sung Hyun		LEEM	

Residence Information (Select One) ◯ US Residency ◉ Non US Residency ◯ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	Seoul Square, 541, Namdaemunno 5-ga, Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Postal Code	100-714	**Country**	KR

Inventor 4 Remove
Legal Name

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Yang Hyun		KIM	

Residence Information (Select One) ◯ US Residency ◉ Non US Residency ◯ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	Seoul Square, 541, Namdaemunno 5-ga, Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Postal Code	100-714	**Country**	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	23557		
Email Address	jl@slepatents.com	Add Email	Remove Email

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	
Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME	

Application Information:

Title of the Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME		
Attorney Docket Number	SUN.LGI.420	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	36	**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	23557		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	

Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
10-2012-0029987	KR	2012-03-23	◉ Yes ○ No

Remove

Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
10-2012-0079004	KR	2012-07-19	◉ Yes ○ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Add

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	

Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Remove

- (●) Assignee
- ( ) Legal Representative under 35 U.S.C. 117
- ( ) Person to whom the inventor is obligated to assign.
- ( ) Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Assignee is an Organization check here. ☒

Organization Name	LG INNOTEK CO., LTD.

Mailing Address Information:

Address 1	Seoul Square, 541, Namdaemunno 5-ga, Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Country i	KR	Postal Code	100-714
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

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

Signature	/JEFF LLOYD/			Date (YYYY-MM-DD)	2012-10-29
First Name	JEFF	Last Name	LLOYD	Registration Number	35589

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SUN.LGI.420
	Application Number	

Title of Invention	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

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.

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Electronic Patent Application Fee Transmittal

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

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	390	390
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			**1260**

Electronic Acknowledgement Receipt

EFS ID:	14097730
Application Number:	13663012
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Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook An
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Deposit Account	190065
Authorized User	LLOYD, JEFF

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		as-filed.pdf	773882 40f4f4471a6b1bcfc45d946ecb0254e68b8cab26	yes	53

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	28
Claims	29	31
Abstract	32	32
Drawings-other than black and white line drawings	33	53

Warnings:

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Oath or Declaration filed	Dec-Assignment-AF.pdf	124776 9e09d875d5e7ff99b7d4e2c8b1e69b183f0bbddd	no	4

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Application Data Sheet	ADS.pdf	1002295 00b1c1a30cbc71ba156ded5d9f497b6cb81328d0	no	7

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Fee Worksheet (SB06)	fee-info.pdf	33113 073d3b6545de9e5f52a0a706f89b19157d17c831	no	2

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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
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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 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.

First, referring to FIG. 14, the wireless power receiver **1000** according to the fifth embodiment may include a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using electromagnetic induction. In this case, the coil **230** of the coil unit **200** can wirelessly receive power through the electromagnetic induction with a coil of the transmission side.

According to one embodiment, the wireless power receiver **1000** can wirelessly receive power from the transmission side using resonance.

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 leaked to the outside by changing the direction of the magnetic field received from the transmission side.

The magnetic substrate **100** can change the direction of the magnetic field received 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. 16, the magnetic substrate **100** may include a magnet **110** and a support **120**.

The magnet **110** may include a particle or a ceramic. According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

The magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

Referring again to FIG. 14, the coil unit **200** may include a first connection terminal **210**, a second connection terminal **220** and a coil **230**. The coil **230** may formed as a conductive layer or a conductive pattern.

The coil unit **200** may be disposed inside the magnetic substrate **100**. In detail, the coil unit **200** may be buried inside the magnetic substrate **100**. In more detail, the magnetic substrate **100** may include a pattern groove and the coil unit **200** may be disposed in the pattern groove. The pattern groove may be formed as a conductive pattern or a conductive layer similar to the coil unit **200**.

The coil unit **200** has a thickness smaller than that of the magnetic substrate **100** and an upper portion of the coil unit **200** may be exposed out of the magnetic substrate **100**.

A process for manufacturing the wireless power receiver **1000** by disposing the coil unit **200** and the connecting unit **300** in the magnetic substrate **100** will be described later with reference to FIGS. 17 to 21.

The first connection terminal **210** of the coil unit **200** is located at one end of the coil **230** and the second connection terminal **220** of the coil unit **200** is located at the other end of the coil **230**.

The first and second connection terminals **210** and **220** of the coil unit **200** are necessary for connection with the connecting unit **300**.

The coil **230** may be formed as a coil 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** may transfer the power wirelessly received from the transmission side to the connecting unit **300**. The coil unit **200** may transfer the power wirelessly received from the transmission side using the electromagnetic induction or resonance to the connecting unit **300**.

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 the wiring layer may include a wireless power receiving circuit, which will be described later.

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 receiver circuit. The wireless power receiver circuit may include a rectifier circuit (not shown) 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. 15 and 16 show the detailed structure of the wireless power receiver **1000** according to the fifth embodiment when the coil unit **200** is connected to the connecting unit **300**.

FIG. 15 shows the coil unit **200** and the connecting unit **300** interconnected with each other.

The coil unit **200** can be connected to the connecting unit **300** by a solder.

Referring to FIG. 16, 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 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**.

According to one embodiment, the via hole can be formed by using a laser. The laser may include a UV laser or a CO2 laser.

FIG. 16 is a sectional view of the wireless power receiver **1000** in which the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

That is, the first connection terminal **210**, the second connection terminal **220** and the coil **230** constituting the coil unit **200** may be disposed in a pattern groove **140** of the magnetic substrate **100**.

In addition, the magnetic substrate **100** and the coil unit **200** are connected to the connecting unit **300**.

The coil **230** may be designed to have a predetermined width **W** and a predetermined thickness **T** and the magnetic substrate **100** may be designed to have a predetermined thickness **T1**. According to one embodiment, the coil **230** has a thickness of 0.1mm and the magnetic substrate **100** has a thickness of 0.43 mm, but these numerical values are illustrative purposes only. According to one embodiment, the thickness **T** of the coil **230** may be smaller than the thickness **T1** of the magnetic substrate **100**.

In the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is directly disposed in the pattern groove **140** of the magnetic substrate **100**, so the overall thickness of an electronic appliance equipped with the wireless power receiver **1000** can be reduced as much as the thickness of the coil unit **200**. Thus, if the wireless power receiver **1000** according to the fifth embodiment is applied to the electronic device, such as the portable terminal, the overall thickness of the portable terminal can be reduced suitably for the current trend of slimness

In addition, in the wireless power receiver **1000** according to the fifth embodiment, the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**. Thus, different from the electronic appliance in which a coil pattern is formed on an FPCB, the overall size of the electronic device equipped with the wireless power receiver **1000** can be reduced.

FIGS. 17 to 21 are views for explaining a method of manufacturing the wireless power receiver **1000** according to the fifth embodiment.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to the fifth embodiment will be described with reference to FIGS. 17 to 21 as well as FIGS. 14 to 16.

First, referring to FIG. 17, the magnetic substrate **100** is prepared. According to one embodiment, the magnetic substrate **100** may be produced by coating metal powder of sendust alloys, such as Al, Fe and SiO2, on polyethylene rubber and then forming an oxide layer on a surface of the polyethylene rubber.

Then, referring to FIG. 18, heat and pressure are applied using a mold **1** to form the pattern groove in the magnetic substrate **100** for receiving the coil unit **200**. The mold **1** may

have the shape corresponding to the shape of the coil unit **200**. According to one embodiment, the mold **1** can be manufactured by using an aluminum alloy, a copper alloy or a cast iron.

The mold **1** may be provided with a protrusion at a region corresponding to the coil unit **200** for wirelessly receiving the power.

When the heat is applied by using the mold **1**, the heat having the specific temperature is applied by taking the property of the metal powder of the sendust alloy constituting the magnetic substrate **100** into consideration. According to one embodiment, if the magnetic substrate **100** is produced by coating the metal powder of sendust alloy on the polyethylene rubber, when the heat and pressure are applied by using the mold **1**, high-pressure is applied at the temperature in the range of 100ºC to 180ºC, and then the mold **100** is cooled to the temperature of 100ºC or below. After that, the mold **1** is separated from the magnetic substrate **100**. If the mold **1** is separated just after the pressure has been applied to the magnetic substrate **100**, the desired pattern groove **140** may not be formed due to residual heat in the pattern groove **140**. For this reason, the mold **1** is separated from the magnetic substrate **100** after cooling the mold **100** to the temperature of 100ºC or below.

If the magnetic substrate **100** is prepared by using the metal powder of sendust alloy, the heat temperature and pressure may vary depending on the distribution and concentration of the metal powder. That is, if the distribution of the metal powder is not uniform, the higher temperature and pressure may be applied. In contrast, if the distribution of the metal powder is uniform, the lower temperature and pressure may be applied. In addition, if the concentration of the metal powder is low, the lower temperature and pressure may be applied as compared with the case in which the concentration of the metal powder is high. Further, the heat temperature and pressure may vary depending on the composition of the metal powder, that is, depending on the alloy constituting the metal powder.

In this manner, the temperature applied to the mold **1** may vary depending on the distribution, concentration and composition of the powder.

According to one embodiment, laser may be irradiated, instead of applying heat and pressure using the mold **1**, to form the pattern groove in the magnetic substrate **100** to receive the coil unit **200**. In this case, the pattern groove can be formed by using an excimer laser that irradiates the laser beam having a wavelength band of ultraviolet ray. The excimer laser may

include a KrF excimer laser (central wavelength 248 nm) or an ArF excimer laser (central wavelength 193 nm).

Next, referring to FIG. 19, the mold **1** is separated from the magnetic substrate **100** so that the magnetic substrate **100** is formed with the pattern groove **140**.

Then, referring to FIG. 20, the coil unit **200** is inserted into the pattern groove **140** formed in the magnetic substrate **100**. As the coil unit **200** is inserted into the pattern groove **140**, a predetermined conductive pattern is formed in the pattern groove **140** of the magnetic substrate **100**.

According to one embodiment, a process for forming the coil unit **200** in the pattern groove **140** of the magnetic substrate **100** may include a plating process or a process for inserting a metal which has been etched to have the conductive pattern formed by the coil unit **200**.

In detail, according to the plating process, the metallic material is filled in the pattern groove **140** to form the coil unit **200**. At this time, the metallic material may include one selected from Cu, Ag, Sn, Au, Ni and Pd and the filling of the metallic metal can be performed through one of electroless plating, screen printing, sputtering, evaporation, ink-jetting and dispensing or a combination thereof.

Then, referring to FIG. 21, the soldering process 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** is connected to the first connection terminal **310** of the connecting unit **300** through the solder **10** and 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**.

As described above, according to the method of manufacturing the wireless power receiver **1000** of the fifth embodiment, the pattern groove is formed in the magnetic substrate **100** and the coil unit **200** is disposed in the pattern groove, so that the overall thickness of the wireless power receiver **1000** can be reduced. In addition, the wireless power receiver **1000** can be manufactured by simply forming the pattern groove and then inserting the coil unit into the pattern groove, so that the manufacturing process can be simplified.

FIG. 22 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed on a top

surface of the magnetic substrate according to the first embodiment, and FIG. 23 is a view for explaining variation of inductance, resistance and Q values of the coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

The inductance, resistance and Q values of the coil unit **200** can be expressed as following equation 1.

[Equation 1]

Q=W*L/R

In equation 1, w is a frequency used when transmitting power, L is inductance of the coil unit **200** and R is resistance of the coil unit **200**.

As can be understood from equation 1, the Q value becomes high as the inductance of the coil unit **200** is increased. If the Q value is increased, the power transmission efficiency can be improved. The resistance of the coil unit **200** is a numerical value of power loss occurring in the coil unit **200** and the Q value becomes high as the resistance value is decreased.

Referring to FIGS. 22 and 23, when comparing the fifth embodiment, in which the coil unit **200** is disposed in the pattern groove **140** of the magnetic substrate **100**, with the first embodiment, in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**, when the usable frequency is 150 kHz, the inductance of the coil unit **200** is increased by 352.42 um from about 9986.92 um to about 10339.34 um and the resistance of the coil unit **200** is reduced by 0.057 Ω from 0.910 Ω to 0.853 Ω. That is, the Q value is increased corresponding to the increment of the inductance and the reduction of the resistance.

Therefore, the wireless power receiver **1000** according to the fifth embodiment can increase the Q value by disposing the coil unit **200** in the pattern groove of the magnetic substrate **100**.

FIG. 24 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed on a top surface of the magnetic substrate according to the first embodiment, and FIG. 25 is an H-field for illustrating a radiation pattern of a magnetic field when the coil unit is disposed in the pattern groove formed in the magnetic substrate according to the fifth embodiment.

Referring to FIGS. 24 and 25, a greater amount of magnetic fields is radiated from the outer peripheral portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

In addition, a greater amount of magnetic fields is radiated at the inner portion of the coil unit **200** when the coil unit **200** is disposed in the pattern groove formed in the magnetic substrate **100** as compared with the case in which the coil unit **200** is disposed on the top surface of the magnetic substrate **100**. This is also because the magnetic field directed to the outside is changed in the lateral direction of the coil unit **200** due to the coil unit **200** buried in the magnetic substrate **100**.

Referring to FIGS. 24 and 25, the wireless power receiver **1000** may further include a short-range communication antenna **600**.

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.

Hereinafter, a wireless power receiver according to another embodiment will be described with reference to FIGS. 26 to 37.

FIG. 26 is an exploded perspective view of the wireless power receiver **1000** according to still another embodiment, FIG. 27 is a perspective view of the wireless power receiver **1000** according to still another embodiment, and FIG. 28 is a sectional view of the wireless power receiver **1000** according to still another embodiment.

Meanwhile, FIG. 27 is a perspective view showing the assembled state of the elements of the wireless power receiver **1000** shown in FIG. 26, in which some elements are omitted.

The wireless power receiver **1000** according to still another embodiment may be disposed in an electronic device, such as a portable terminal.

Referring to FIGS. 26 to 28, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200**, a connecting unit **300**, a short-range communication antenna **600**, an adhesive layer **700**, a first dual-side adhesive layer **710**, a second dual-side adhesive layer **720**, a protective film **800** and a release paper layer **730**.

Referring to FIG. 26, the magnetic substrate **100** can change the direction of the magnetic field transferred from the transmission side.

The magnetic substrate **100** changes the direction of the magnetic field transferred to the coil unit **200** from the transmission side to reduce the amount of the magnetic field leaked to the outside. Thus, the magnetic substrate **100** may have the electromagnetic wave shielding effect.

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 transferred to the coil unit **200** 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. 28, the magnetic substrate **100** may include a magnet **110** and a support **120**.

According to one embodiment, the magnet **110** may be one of a spinel type magnet, a hexa type magnet, a sendust type magnet and a permalloy type magnet.

The support **120** may include thermosetting resin or thermoplastic resin and support the magnetic substrate **100**.

Referring again to FIG. 26, the magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

A receiving space **130** is formed at a predetermined area of the magnet substrate **100**. The receiving space **130** has a structure the same as that of the connecting unit **300**. The connecting unit **300** is disposed in the receiving space **130** and connected to the coil unit **200**.

The coil unit **200** can receive the power from the transmission side using the electromagnetic induction or resonance. Similar to the coil unit **200** illustrated in 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 connecting unit **300** connects a receiver 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 receiver circuit.

The connecting unit **300** may include a wiring layer and the wiring layer may include the wireless power receiving circuit. The wireless power receiving circuit may include a rectifier circuit for rectifying the power received from the coil unit **200**, a smoothing circuit for removing noise signals, and a main IC chip for performing the operation to wirelessly receive the power.

In addition, the receiver circuit can transfer the signal received from the short-range communication antenna **600** to a short-range communication signal processing unit (not shown).

The connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100** and connected to the coil unit **200**. FIG. 27 shows the connecting unit **300** disposed in the receiving space **130** of the magnetic substrate **100**.

The connecting unit **300** may include a first connection terminal **310**, a second connection terminal **320**, a third connection terminal **340** and a fourth connection terminal **350**. The first connection terminal **310** of the connecting unit **300** is connected to the first connection terminal **210** of the coil unit **200**, the second connection terminal **320** of the connecting unit **300** is connected to the second connection terminal **220** of the coil unit **200**, the third connection terminal **340** of the connecting unit **300** is connected to a first connection terminal **610** of the short-range communication antenna **600** and the fourth connection terminal **350** of the connecting unit **300** is connected to a second connection terminal **620** of the short-range communication antenna **600**.

The connecting unit **300** may have the shape corresponding to the shape of the receiving space **130** and may be disposed in the receiving space **130**. Since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

According to one embodiment, the connecting unit **300** may include a flexible printed circuit board (FPCB), a tape substrate (TS) or a lead frame (LF). If the tape substrate is used as the connecting unit **300**, the thickness of the connecting unit **300** can be reduced, so that the overall size of the wireless power receiver **1000** can be reduced.

If the lead frame is used as the connecting unit **300**, the wiring layer included in the connecting unit **300** can be protected from the heat, external moisture or impact and the mass production can be realized.

Referring again to FIG. 26, 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 NFC signal processing unit (not shown) can process the signal transferred to the short-range communication antenna **600** through the connecting unit **300**.

Various short-range communication technologies can be applied to the short-range communication antenna **600** and the NFC technology is preferable.

According to one embodiment, the short-range communication antenna **600** may be arranged at an outer peripheral portion of the coil unit **200**. Referring to FIG. 27, when the coil unit **200** is disposed at 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.

Referring again to FIG. 26, the adhesive layer (not shown) may be disposed under the protective film **800** to form the protective film **800** on the coil unit **200** and the short-range communication antenna **600**, which will be described later in detail.

The first dual-side adhesive layer **710** is interposed between the magnetic substrate **100** and the coil unit **200**/short-range communication antenna **600** to adhere the coil unit **200** to the magnetic substrate **100**, which will be described later in detail. Similar to the magnetic substrate **100**, a receiving space having the shape identical to the shape of the connecting unit **300** may be formed in the first dual-side adhesive layer **710**.

Referring again to FIG. 28, the second dual-side adhesive layer **720** adheres the protective film **800** to the release paper layer **730**, which will be described later in detail.

The coil unit **200** may be disposed on the magnetic substrate **100** and may have a spiral structure, but the embodiment is not limited thereto.

Hereinafter, the method of manufacturing the wireless power receiver **1000** according to still another embodiment will be described with reference to FIGS. 29 to 37.

When the manufacturing process starts, as shown in FIG. 29, the conductor **201**, the adhesive layer **700** and the protective film **800** are prepared.

According to one embodiment, the conductor **201** may be formed by using an alloy including copper. The copper is in the form of roll annealed copper or electrodeposited copper. The conductor **201** may have various thicknesses depending on the specification of a product. According to one embodiment, the conductor **201** may have the thickness of 100μm, but the embodiment is not limited thereto.

The adhesive layer **700** is used to reinforce the adhesive strength between the conductor **201** and the protective film **800**. The adhesive layer **700** may include thermosetting resin, but the embodiment is not limited thereto. The adhesive layer may have the thickness of 17μm, but the embodiment is not limited thereto.

The protective film **800** protects the conductor **201** when a predetermined conductive pattern is formed in the conductor **201**. In detail, the protective film **800** supports the conductor **201** in the etching process, which will be described later, to protect the conductor **201** such that the predetermined conductive pattern can be formed in the conductor **201**.

According to one embodiment, the protective film **800** may include polyimide film (PI film), but the embodiment is not limited thereto.

Then, as shown in FIG. 30, the conductor **201** is formed on the protective film **800** by the adhesive layer **700**. The laminating process can be used to form the conductor **201** on the

protective film **800**. The laminating process refers to the process to bond heterogeneous materials with each other by applying predetermined heat and pressure.

Then, as shown in FIG. 31, a photoresist film **900** is attached onto the top surface of the conductor **201**. The photoresist film **900** is used for etching the conductor **201** to form a predetermined conductive pattern in the conductor **201**. A UV exposure type film or an LDI exposure type film may be used as the photoresist film **900**. According to another embodiment, a photoresist coating solution can be coated on the top surface of the conductor **201** without using the photoresist film **900**.

After that, as shown in FIG. 32, the photoresist film **900** is subject to the exposure and development processes to form a mask pattern **910**.

The mask pattern **910** may be formed on the top surface of the conductor **201** corresponding to the position of the conductive pattern.

The exposure process refers to the process for selectively irradiating light onto the photoresist film **900** corresponding to the conductive pattern. In detail, in the exposure process, the light is irradiated onto regions of the conductor **201** where the conductive pattern is not formed. The development process refers to the process for removing the regions to which the light is irradiated through the exposure process.

Due to the exposure and development processes, the mask pattern **910** may be formed in the regions corresponding to the coil unit **200** and the short-range communication antenna **600**. The conductor **201** exposed through the mask pattern **910** may be etched.

Then, as shown in FIG. 33, a predetermined portion of the conductor **201** where the mask pattern **910** is not formed may be removed through the etching process. The etching process refers to the process of removing the predetermined portion of the conductor **201** where the mask pattern **910** is not formed by using a chemical reacting with the predetermined portion of the conductor **201**. According to one embodiment, the conductor **201** may be patterned through the wet etching or dry etching.

After that, as shown in FIG. 34, the mask pattern **910** is removed so that the first and second connection terminals **210** and **220** of the coil unit **200**, the first and second connection terminals **610** and **620** of the short-range communication antenna **600**, the coil **230** having a

predetermined conductive pattern and the short-range communication antenna **600** having a predetermined conductive pattern may be formed.

Then, as shown in FIG. 35, the soldering process is performed to connect the coil unit **200** and the short-range communication antenna **600** to the connecting unit **300**. According to one embodiment, the soldering process includes the reflow process, but the embodiment is not limited thereto. The reflow process refers to the process for bonding the coil unit **230** and the short-range communication antenna **600** with the connecting unit **300** by melting solder cream using high-temperature heat to ensure the stable electrical connection between the connecting unit **300** and the coil unit **230**/NFC antenna **600**.

The first connection terminal **310** of the connecting unit **300** may be connected to the first connection terminal **210** of the coil unit **200** by a solder **30**, the second connection terminal **320** of the connecting unit **300** may be connected to the second connection terminal **220** of the coil unit **200** by the solder **30**, the third connection terminal **340** of the connecting unit **300** may be connected to the first connection terminal **610** of the short-range communication antenna **600** by the solder **30** and the fourth connection terminal **350** of the connecting unit **300** may be connected to the second connection terminal **620** of the short-range communication antenna **600**.

Then, as shown in FIG. 36, the magnetic substrate **100** is laminated on a predetermined portion of the conductive pattern where the connecting unit **300** is not present. In detail, the magnetic substrate **100** may be laminated on the top surfaces of the coil **230** and the short-range communication antenna **600**.

Prior to the above, the receiving space corresponding to the connecting unit **300** can be formed at the magnetic substrate **100**. The receiving space of the magnetic substrate **100** may have the shape identical to the shape of the connecting unit **300**.

As described above with reference to FIG. 26, since the connecting unit **300** is disposed in the receiving space **130** of the magnetic substrate **100**, the thickness of the wireless power receiver **1000** can be remarkably reduced as much as the thickness of the connecting unit **300**. Thus, the thickness of the electronic device, such as a portable terminal, equipped with the wireless power receiver **1000** can be remarkably reduced.

The coil **230**/short-range communication antenna **600** and the magnetic substrate **100** may be adhered with each other by the first dual-side adhesive layer **710**. According to one

embodiment, the magnetic substrate **100** may have the thickness in the range of 100μm to 800μm, but the embodiment is not limited thereto. According to one embodiment, the first dual-side adhesive layer **710** may have the thickness in the range of 10μm to 50μm, but the embodiment is not limited thereto.

After that, as shown in FIG. 37, the release paper layer **730** is attached to one side of the protective film **800** by interposing the second dual-size adhesive layer **720** therebetween. The release paper layer **730** is a paper layer for protecting the second dual-size adhesive layer **720** and may be removed when the wireless power receiver is disposed in a case of an electronic device, such as a portable terminal.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

CLAIMS

What is claimed is:

1. A wireless power receiver comprising:

a magnetic substrate; and

a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer on the magnetic substrate.

2. The wireless power receiver of claim 1, wherein the coil is formed as a conductive pattern on the magnetic substrate.

3. The wireless power receiver of claim 1, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

4. The wireless power receiver of claim 3, further comprising the connecting unit disposed in the receiving space and connected to the coil.

5. The wireless power receiver of claim 4, wherein the connecting unit comprises one of a flexible printed circuit board, a lead frame and a tape substrate.

6. The wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the magnetic substrate to surround the coil.

7. The wireless power receiver of claim 6, wherein the short-range communication antenna comprises a near field communication (NFC) antenna.

8. The wireless power receiver of claim 6, wherein the magnetic substrate has a receiving space of a predetermined shape formed therein corresponding to a shape of a connecting unit connected to a wireless power receiving circuit.

9. The wireless power receiver of claim 8, further comprising the connecting unit disposed in the receiving space and connected to the coil and a near field communication signal process unit.

10. A wireless power receiver comprising:

a magnetic substrate; and

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.

11. The wireless power receiver of claim 10, wherein the coil is formed as a conductive pattern at the magnetic substrate.

12. The wireless power receiver of claim 10, wherein the magnetic substrate comprises a pattern groove for receiving a part of the coil and the part of the coil is disposed in the pattern groove.

13. The wireless power receiver of claim 10, wherein the coil has a thickness smaller than a thickness of the magnetic substrate and an upper portion of the coil is exposed out of the magnetic substrate.

14. A method of manufacturing a wireless power receiver for wirelessly receiving power, the method comprising:

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.

15. The method of claim 14, wherein the forming of the conductive pattern comprises etching the conductor to form the conductive pattern corresponding to a coil for wirelessly receiving the power and a near field communication antenna for making communication with an outside.

16. The method of claim 15, which comprises positioning connection terminals of the coil and the near field communication antenna in the receiving space.

17. The method of claim 14, wherein the disposing of the magnetic substrate comprises forming the magnetic substrate on the conductive pattern using a dual-side adhesive layer.

18. The method of claim 14, further comprising forming a release paper layer on the protective film using a dual-side adhesive layer.

19. A terminal equipped therein with a wireless power receiver of claim 1.

20. A terminal equipped therein with a wireless power receiver of claim 10.

ABSTRACT

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.

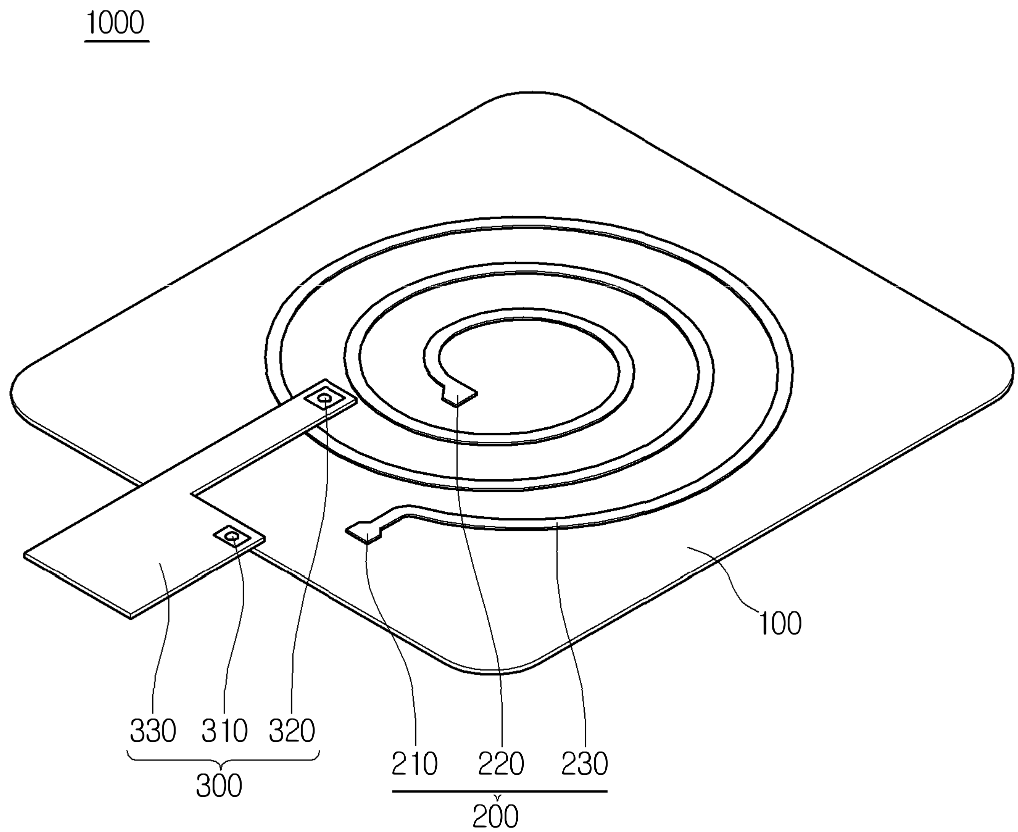


FIG. 1

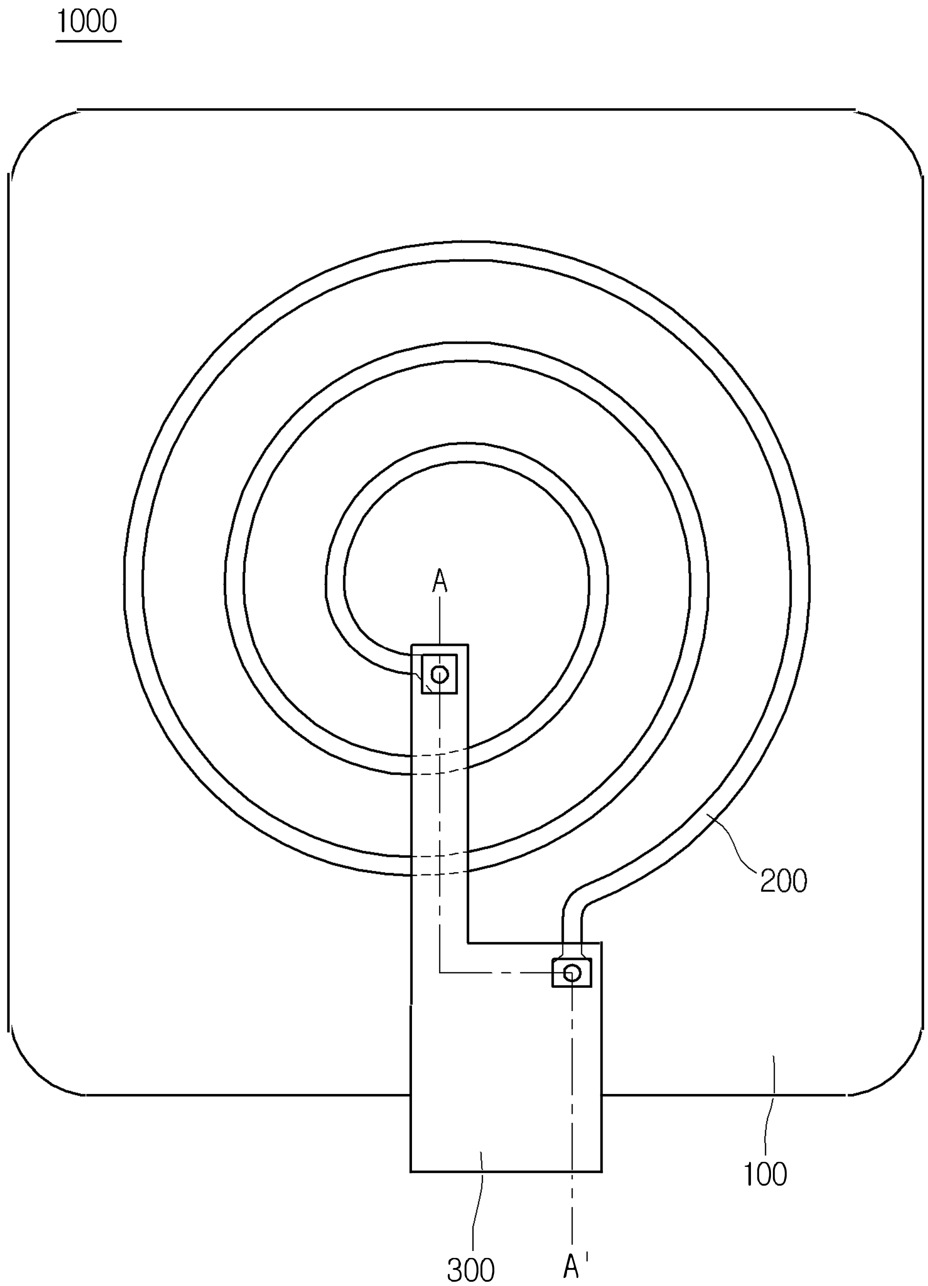
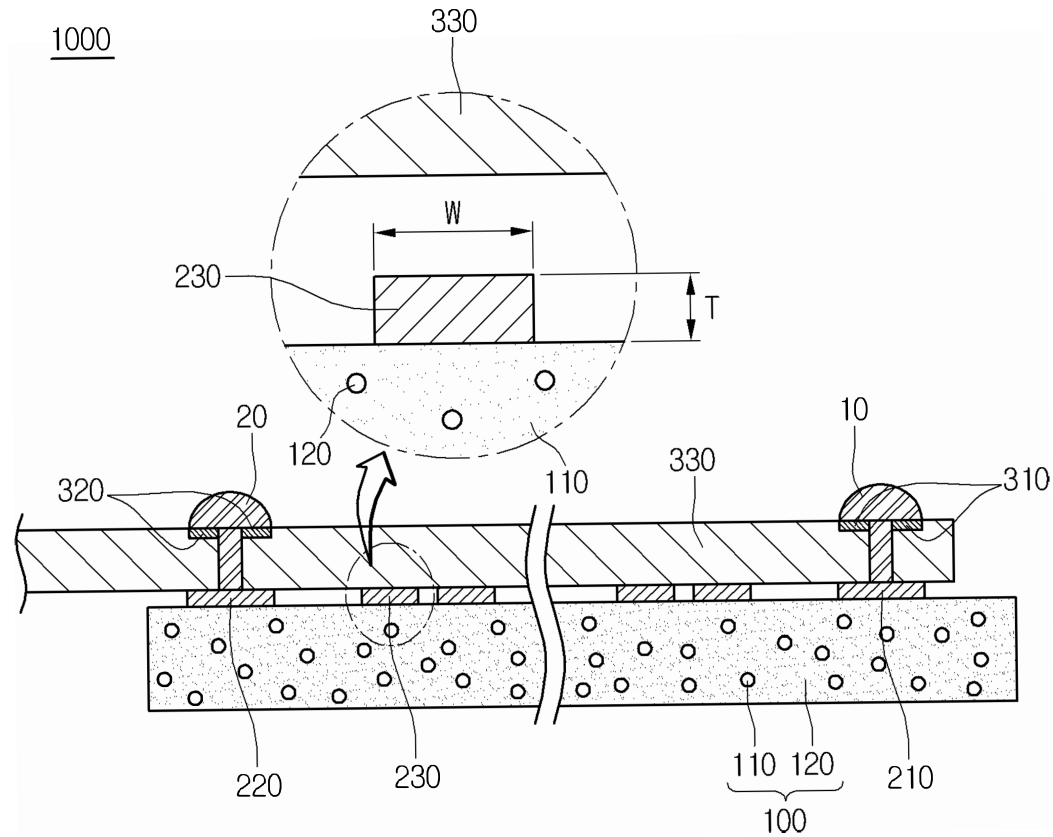


FIG. 2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110 120
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100

FIG. 3

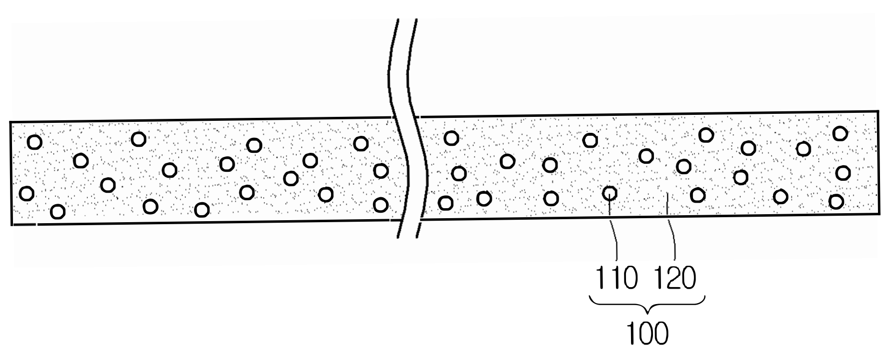

110 120
100

FIG. 4

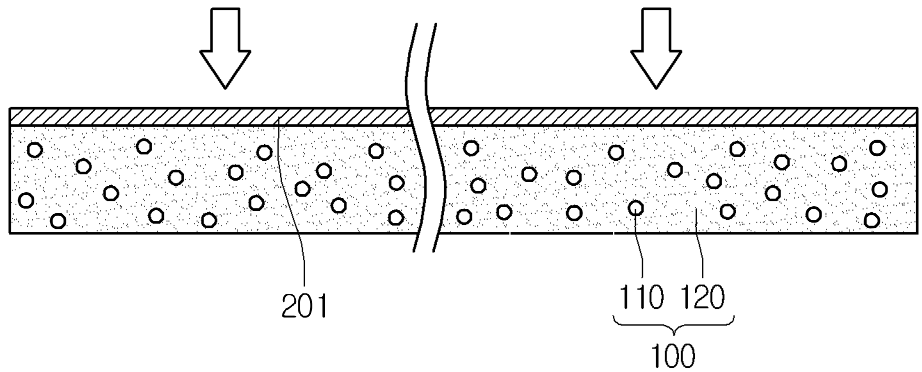


FIG. 5

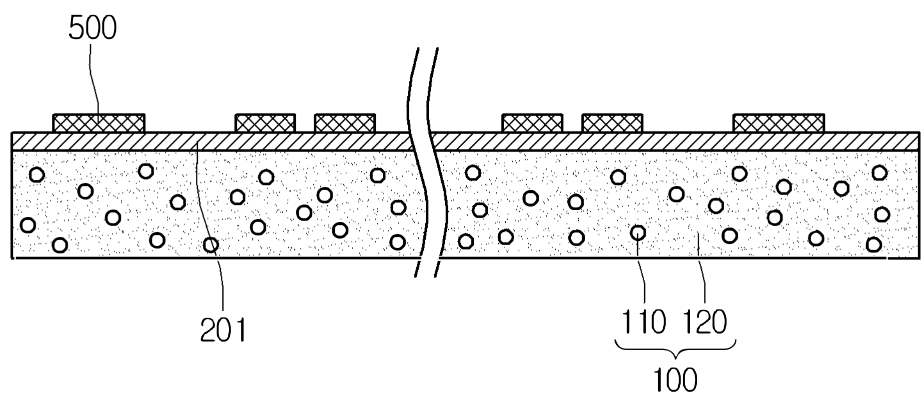


FIG. 6

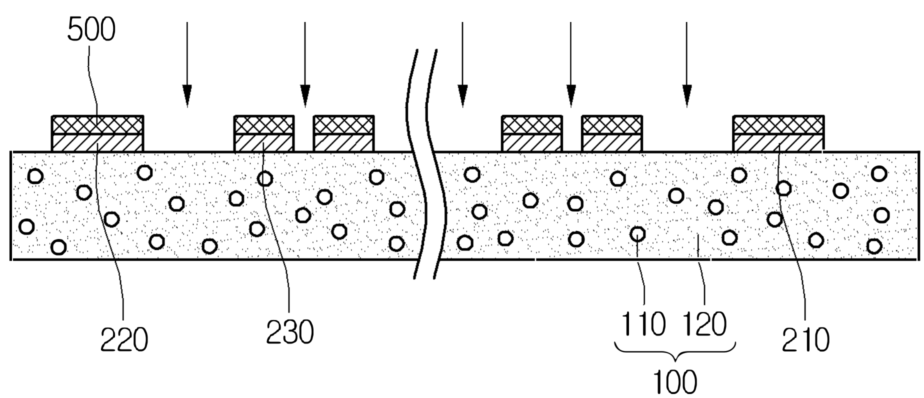
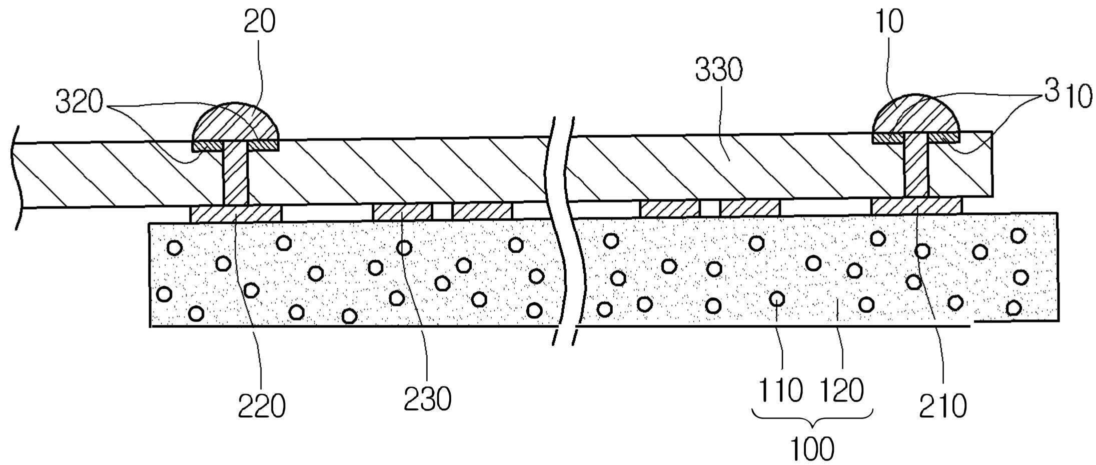


FIG. 7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110 120
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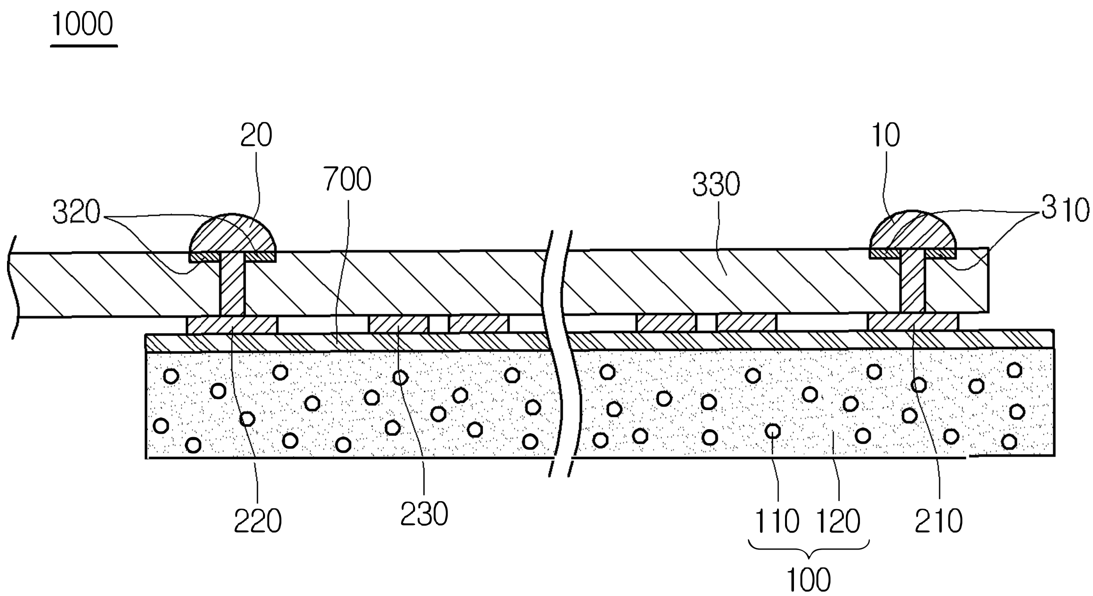
FIG. 8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110 120
210
100

FIG. 9

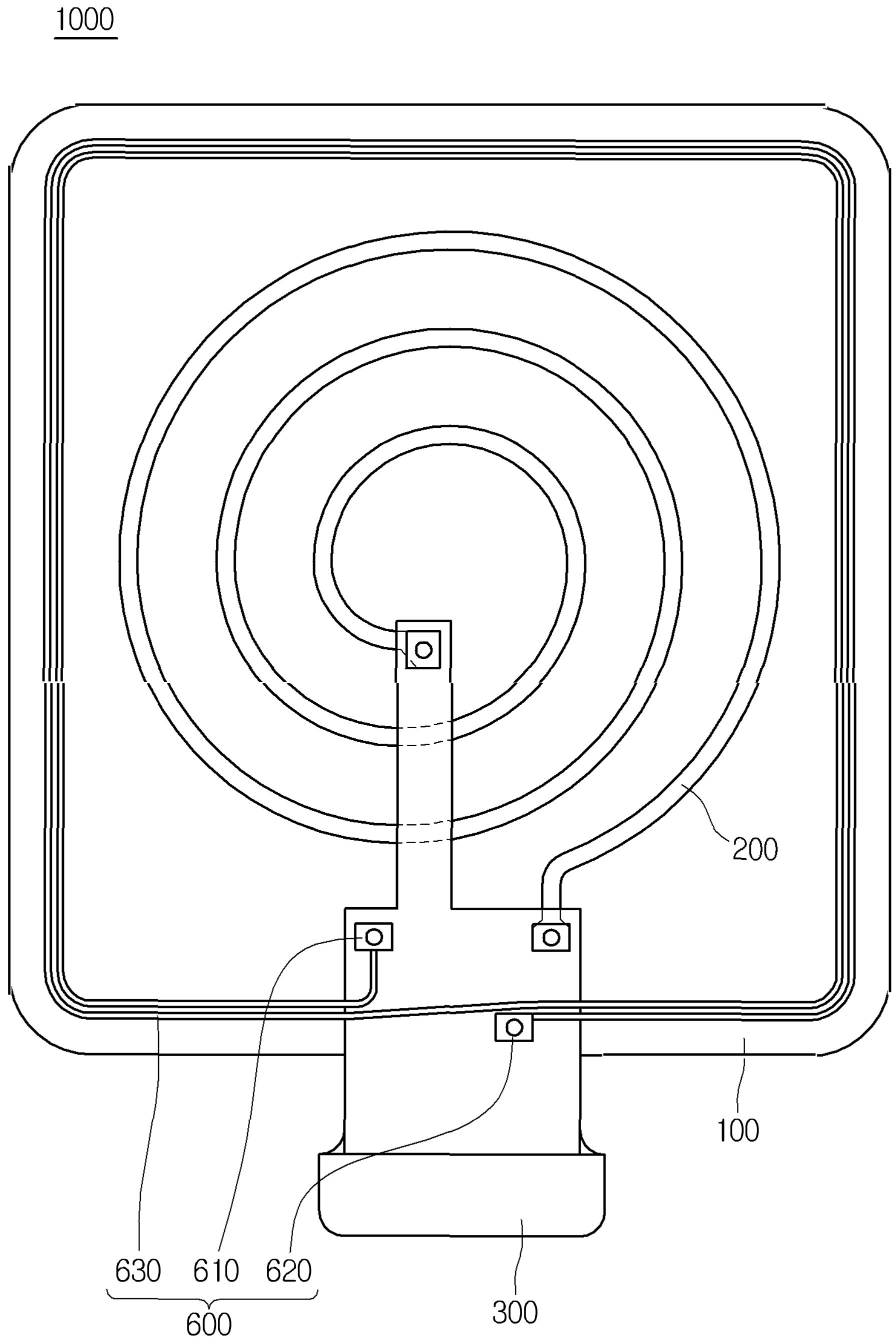

FIG. 10

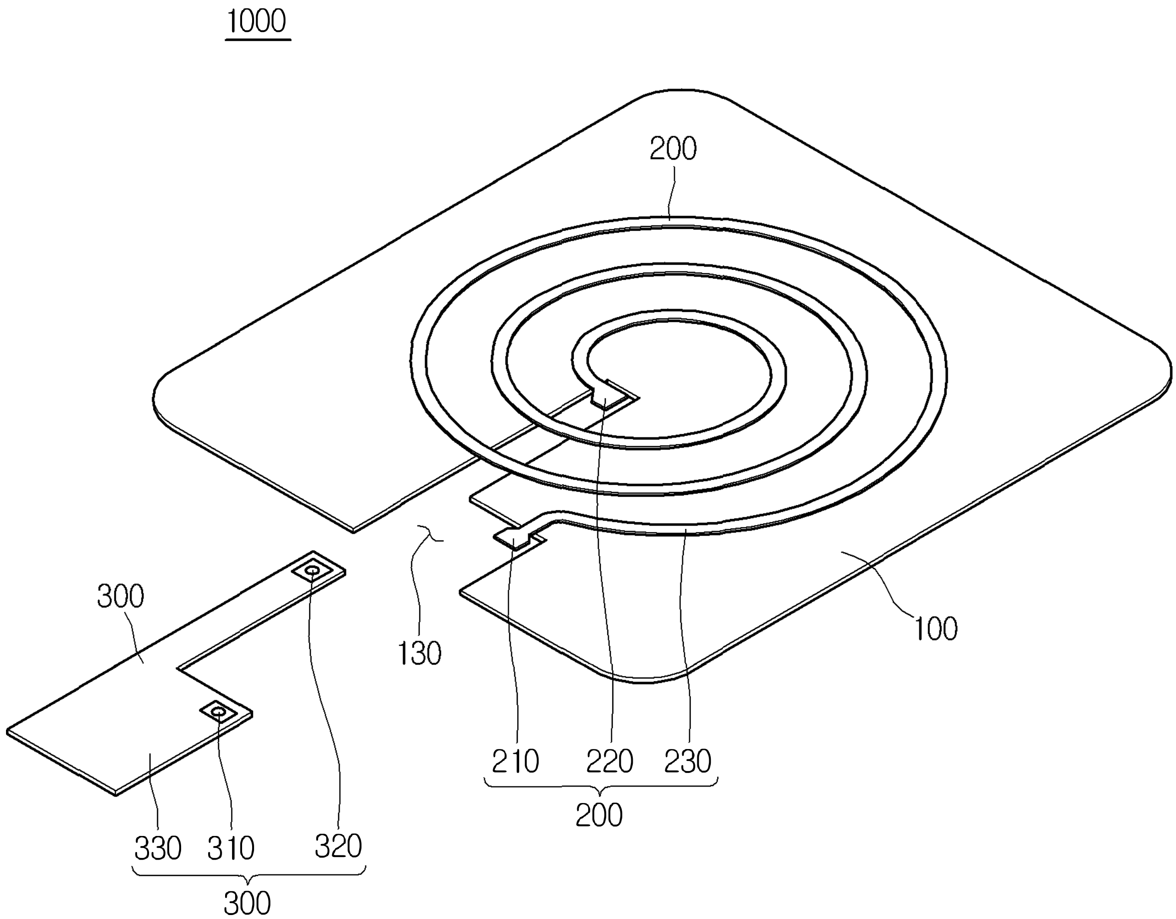

FIG. 11

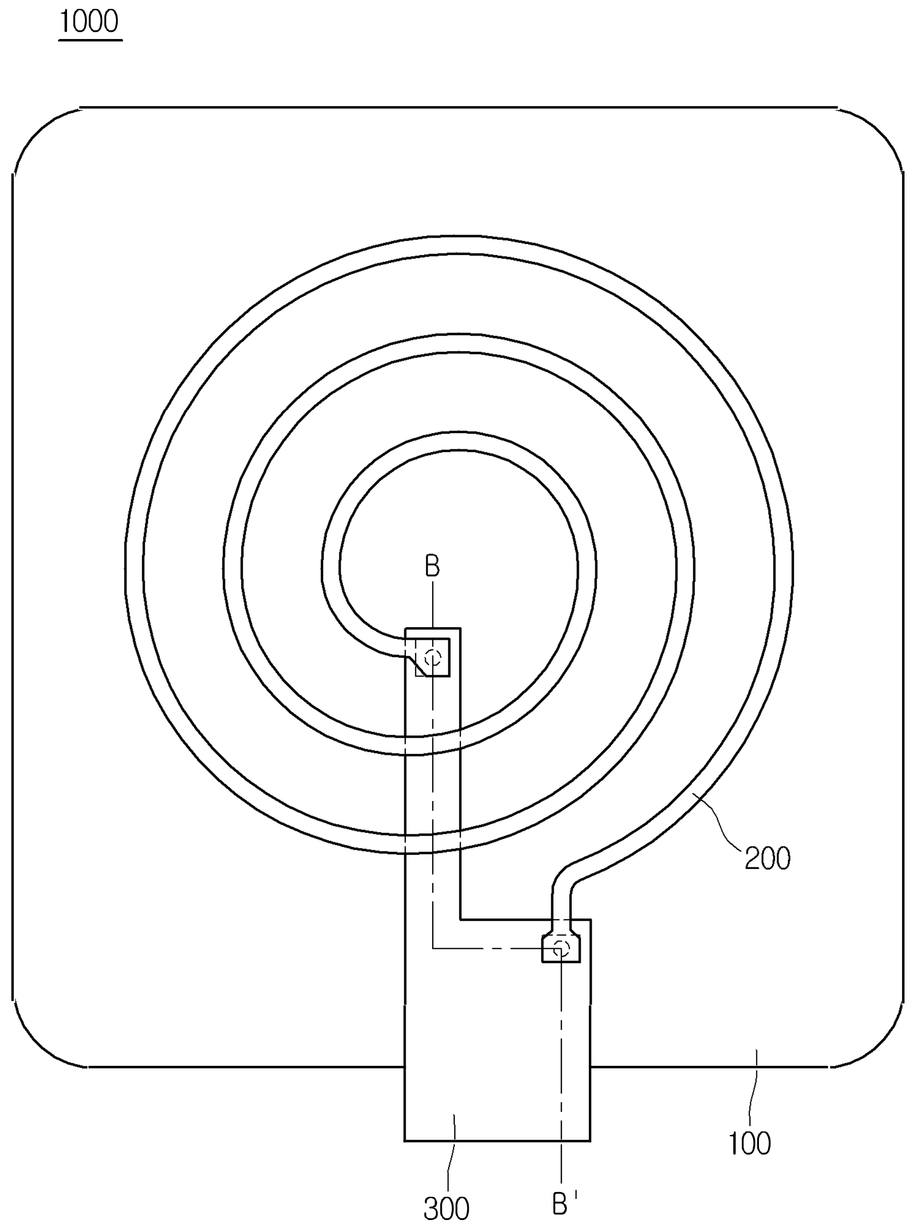

FIG. 12

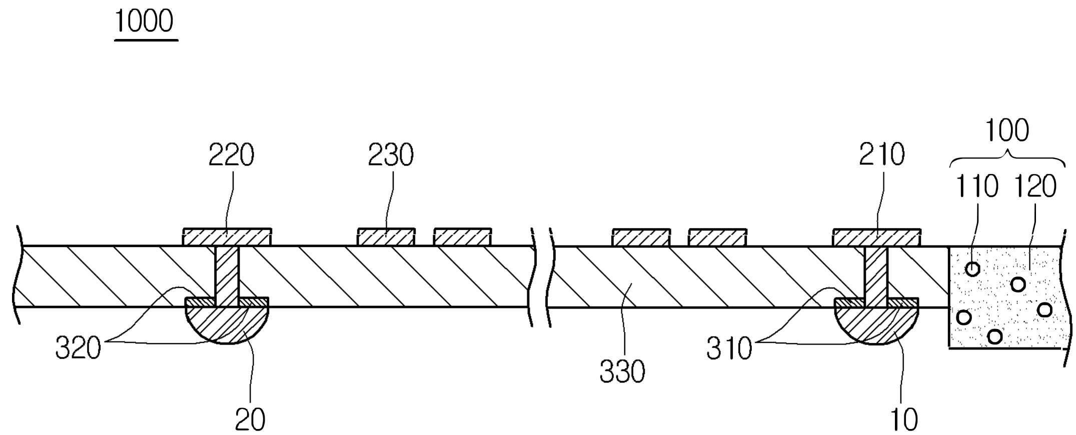
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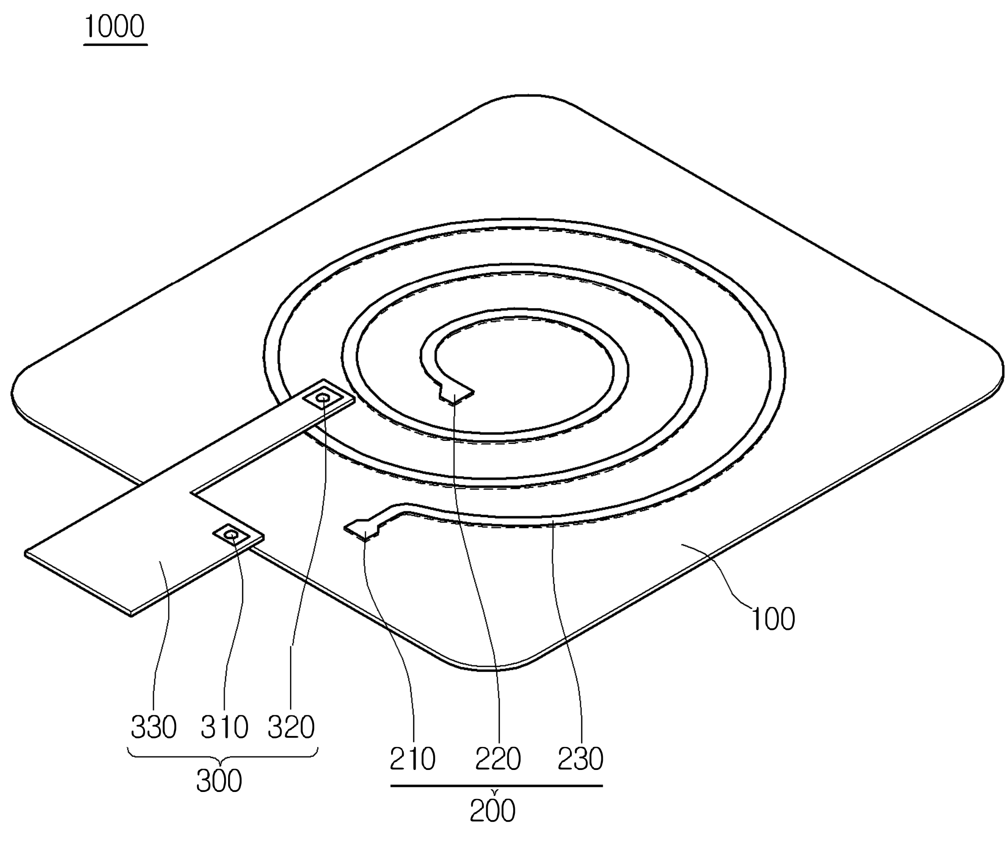
FIG. 13


1000
100
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300
210
220
230
200

FIG. 14

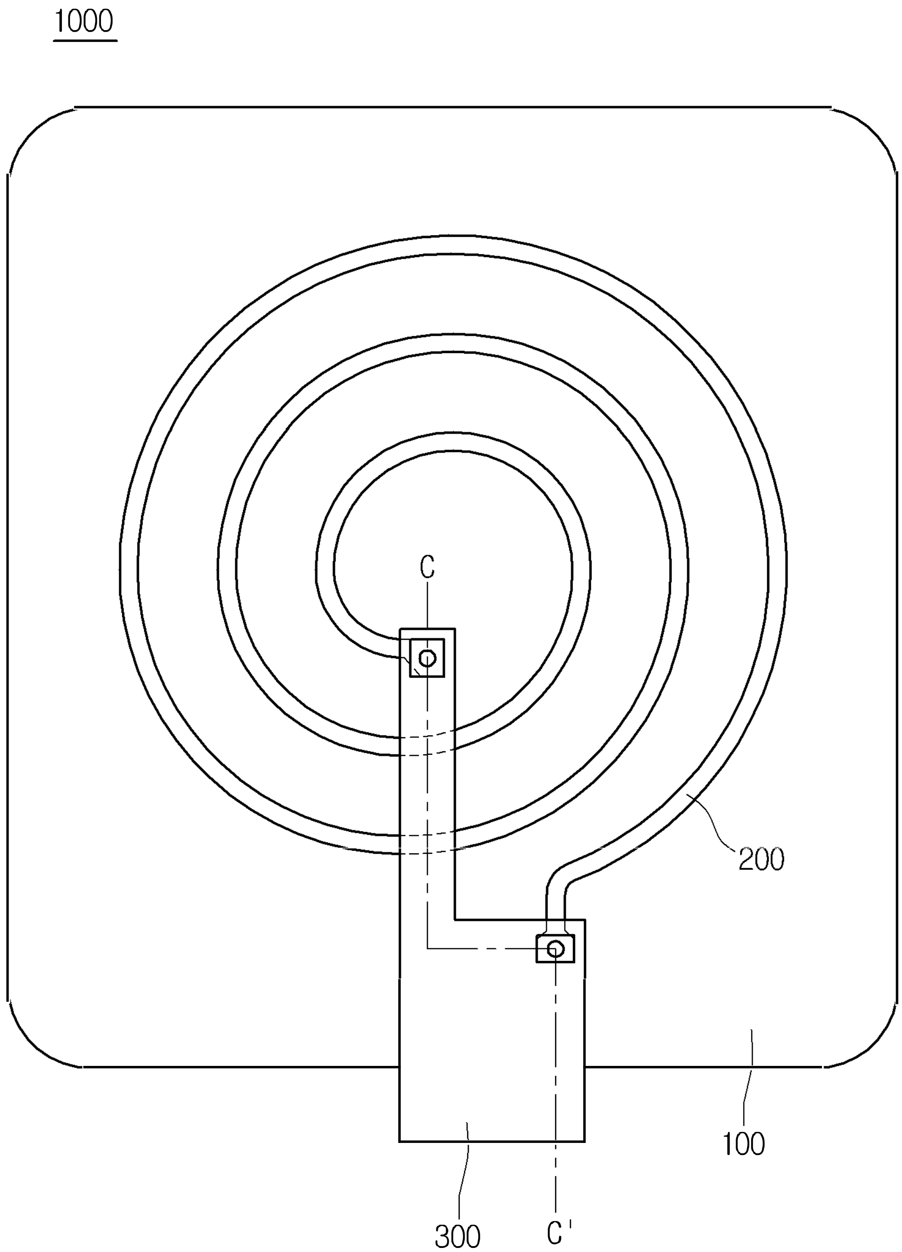
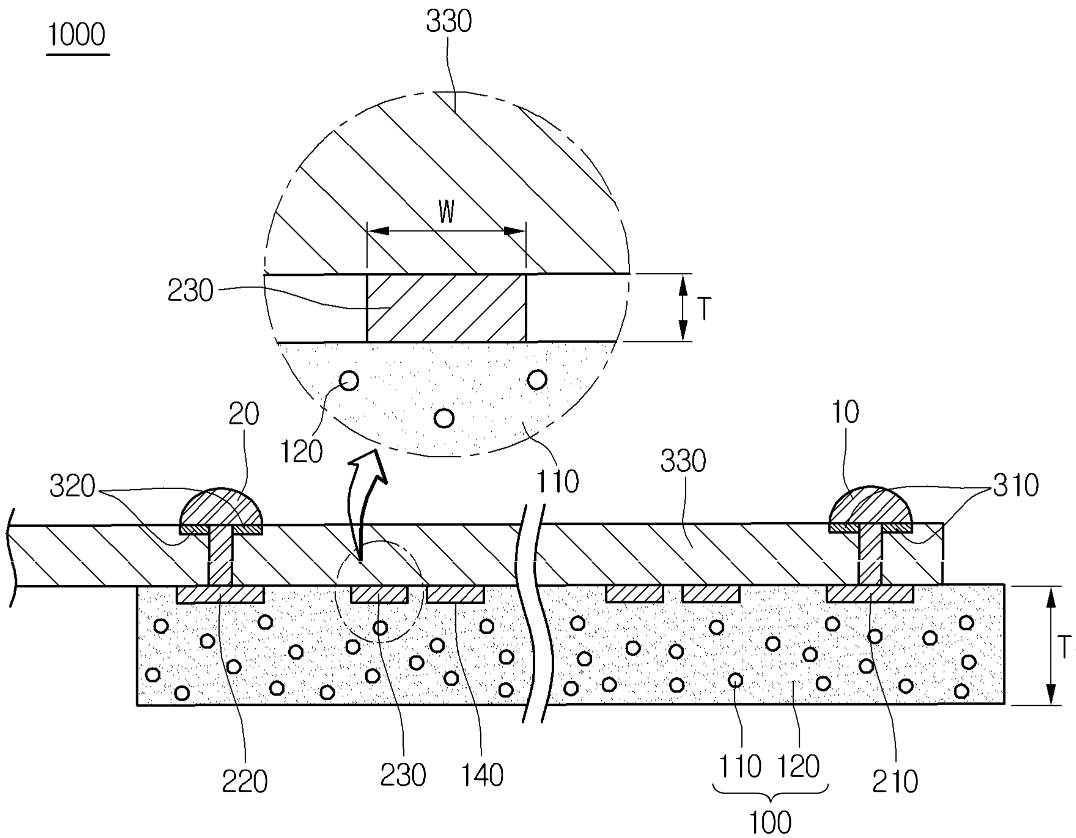


FIG. 15


1000
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220
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140
110 120
100
210
T_1

FIG. 16

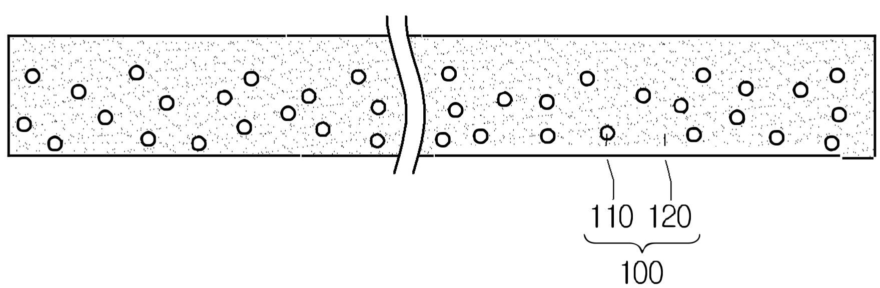

110 120
100

FIG. 17

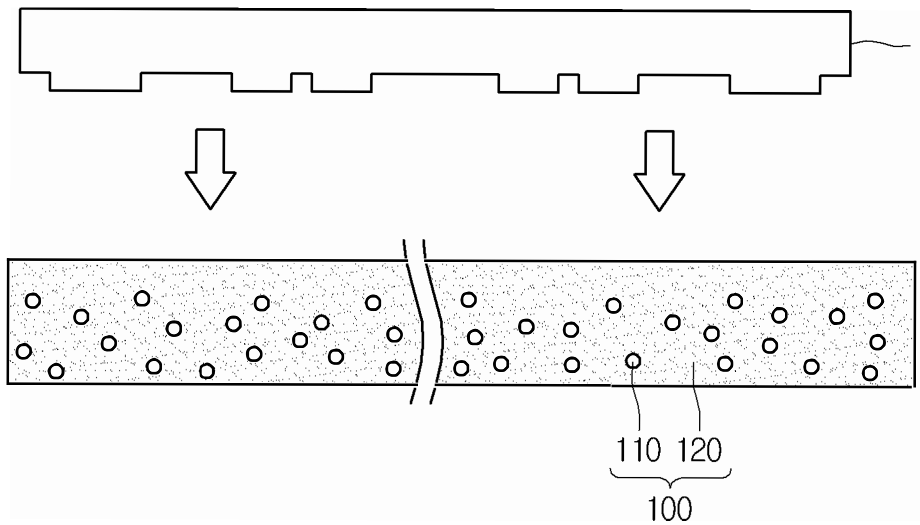


FIG. 18

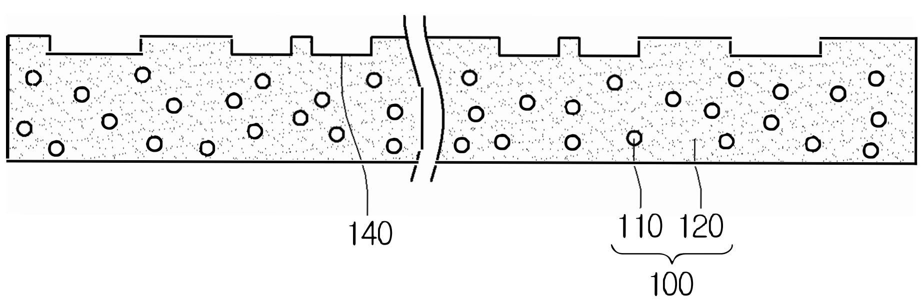


FIG. 19

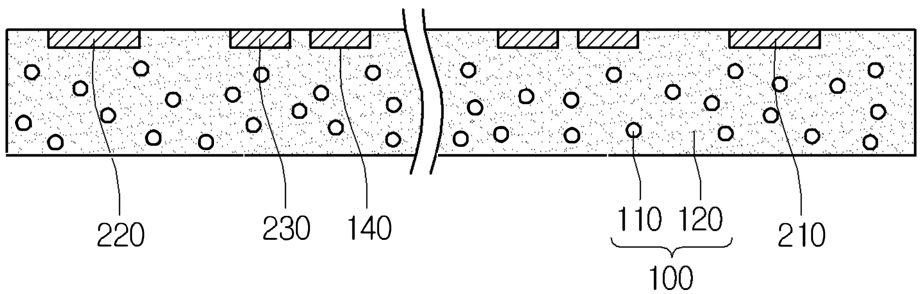

220
230
140
110
120
100
210

FIG. 20

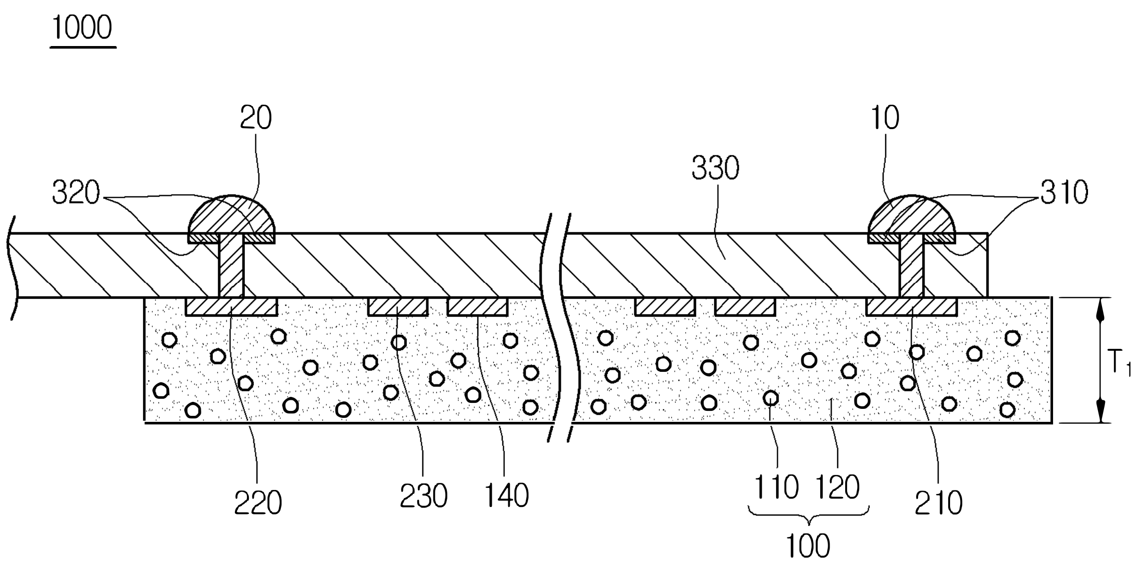

1000
20
10
330
320
310
T_1
220
230
140
110
120
100
210

FIG. 21

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

FIG. 22

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

FIG. 23

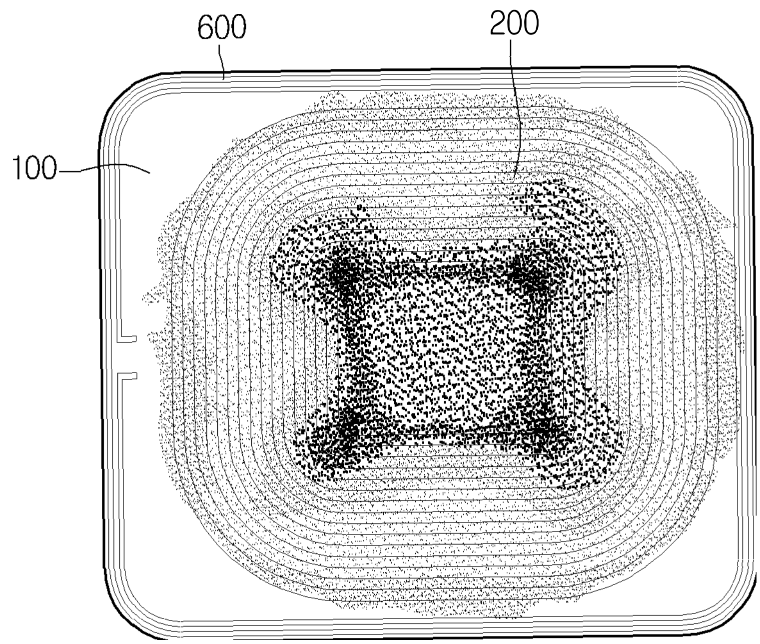


FIG. 24

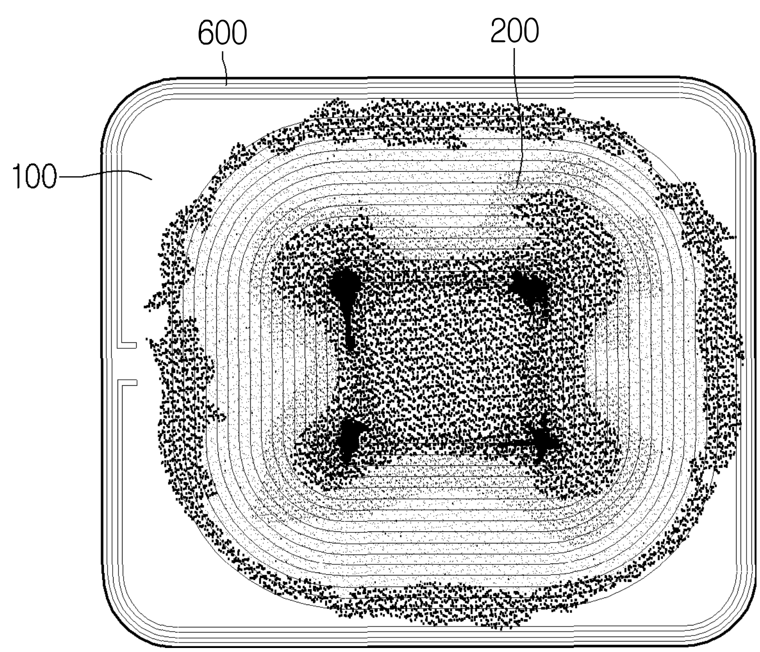


FIG. 25

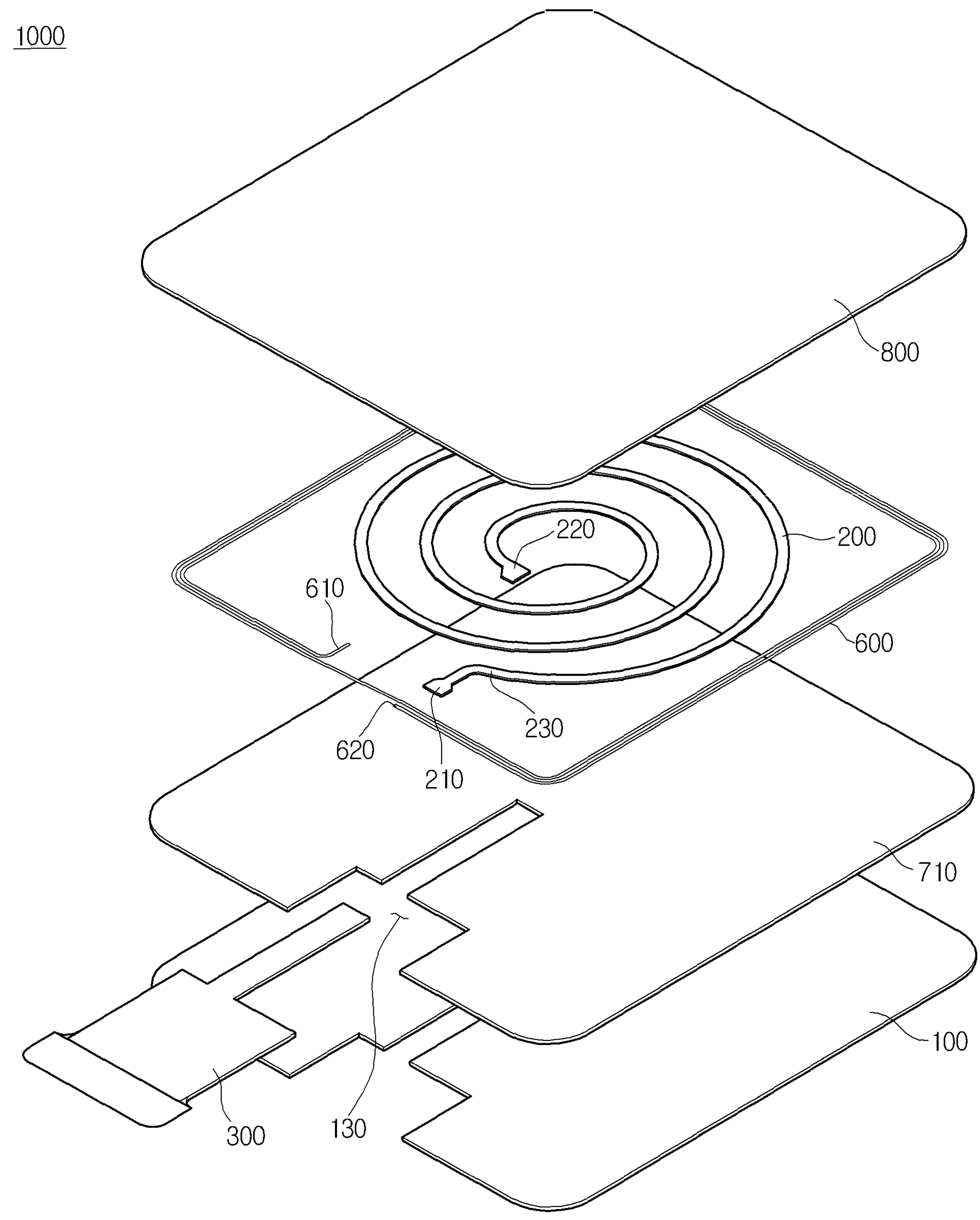


FIG. 26

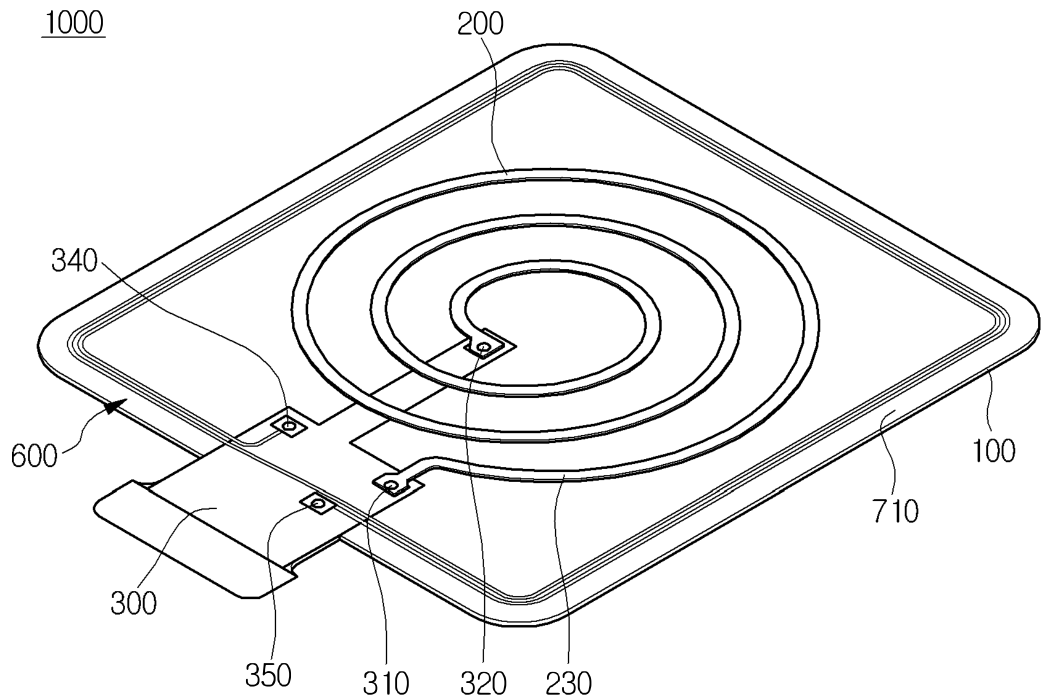

1000
200
340
600
300
350
310
320
230
710
100

FIG. 27

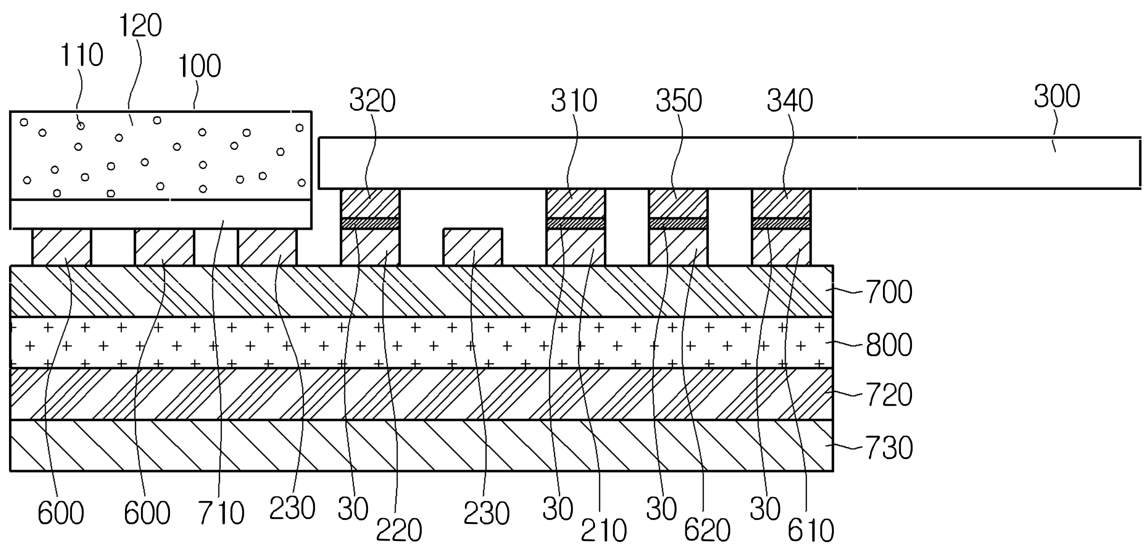

120
110
100
320
310
350
340
300
700
800
720
730
600
600
710
230
30
220
230
30
210
30
620
30
610

FIG. 28

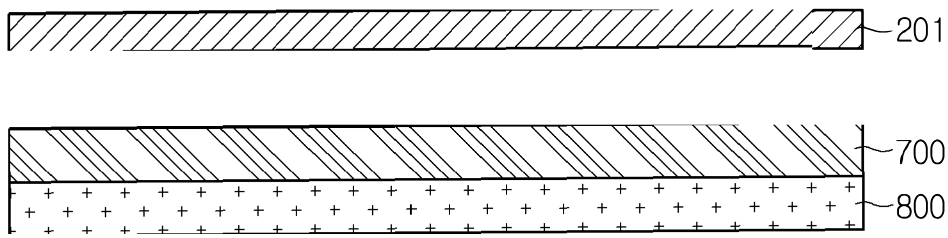


FIG. 29

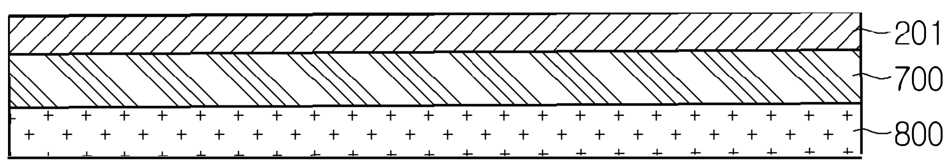


FIG. 30

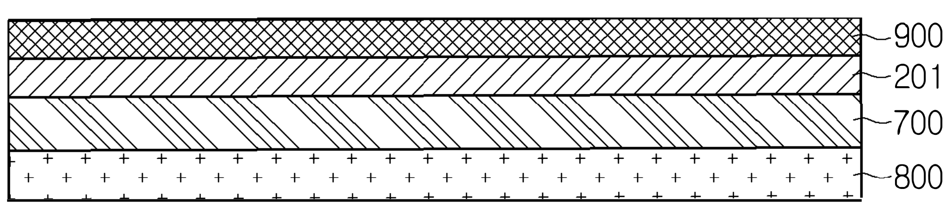


FIG. 31

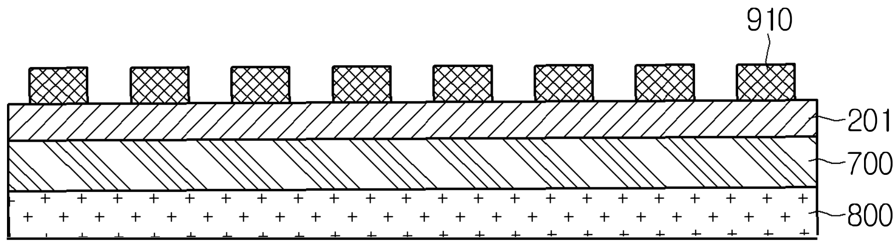


FIG. 32

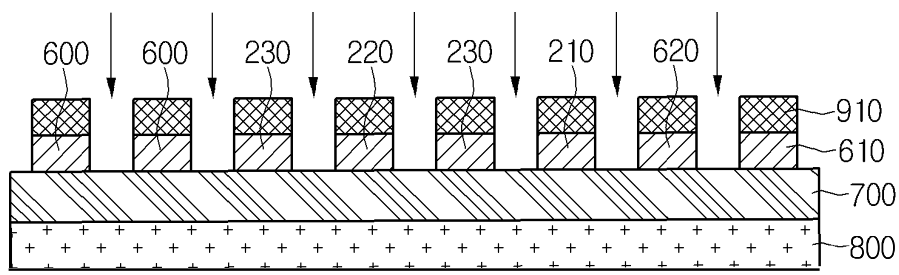


FIG. 33

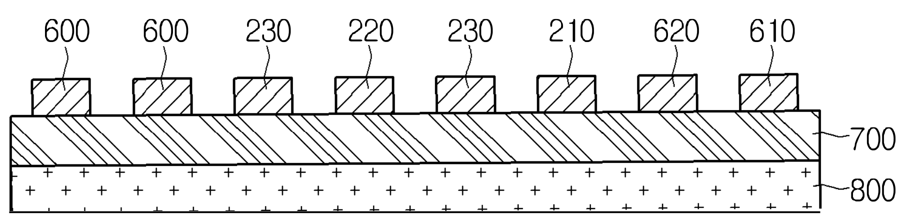
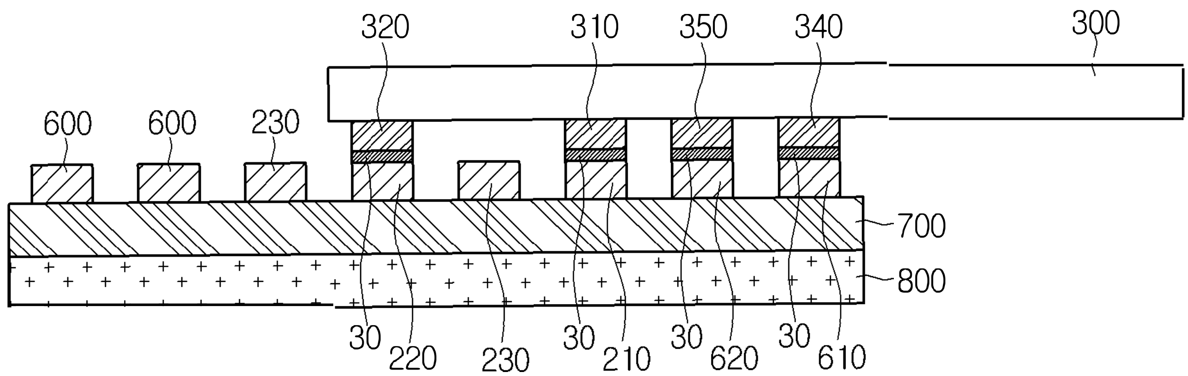


FIG. 34


320
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700
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220
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210
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620
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610

FIG. 35

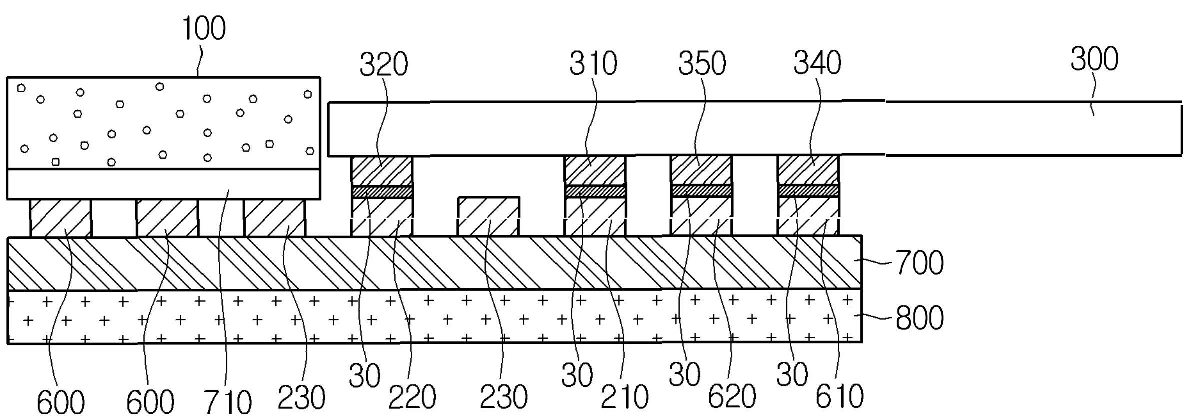
100
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FIG. 36