



- (51) International Patent Classification:
H01F 27/36 (2006.01) *H01F 38/14* (2006.01)
- (21) International Application Number:
PCT/US2015/022222
- (22) International Filing Date:
24 March 2015 (24.03.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/969,337 24 March 2014 (24.03.2014) US
62/036,685 13 August 2014 (13.08.2014) US
- (71) Applicant: **APPLE INC.** [US/US]; One Infinite Loop, Cupertino, CA 95014 (US).
- (72) Inventors: **GOLKO, Albert J.**; One Infinite Loop, MS: 305-1DR, Cupertino, CA 95014 (US). **JOL, Eric S.**; One Infinite Loop, MS: 305-1PH, Cupertino, CA 95014 (US). **GRAHAM, Christopher S.**; One Infinite Loop, MS: 305-1PH, Cupertino, CA 95014 (US). **YAO, Stephen E.**; One Infinite Loop, MS: 305-1PH, Cupertino, CA 95014 (US). **BRZEZINSKI, Makiko K.**; One Infinite Loop, MS: 305-

1PH, Cupertino, CA 95014 (US). **WAGMAN, Daniel C.**; One Infinite Loop, MS: 305-1DR, Cupertino, CA 95014 (US). **THOMPSON, Paul J.**; One Infinite Loop, MS: 305-1DR, Cupertino, CA 95014 (US). **KALYANASUNDARAM, Nagarajan**; One Infinite Loop, MS: 306-3PD, Cupertino, CA 95014 (US).

- (74) Agents: **HEMENWAY, S. Craig** et al.; 410 Seventeenth Street, Suite 2200, Denver, Colorado 80202 (US).
- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,

[Continued on next page]

(54) Title: MAGNETIC SHIELDING IN INDUCTIVE POWER TRANSFER

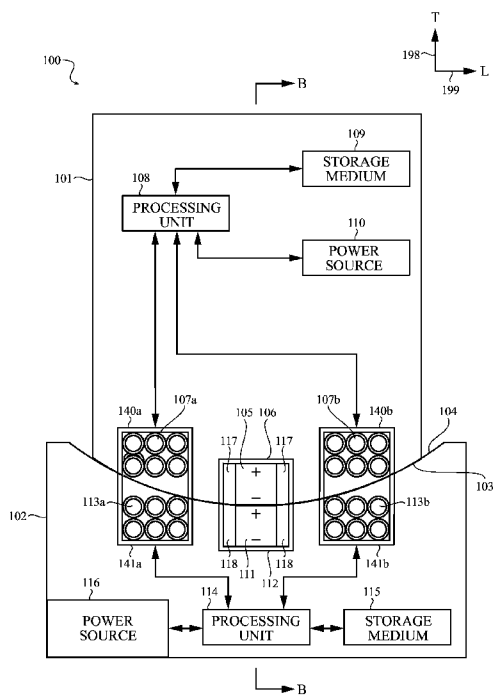


FIG. 2

(57) Abstract: A first electronic device connects with an second electronic device. The first electronic device may include a first connection surface and an inductive power transfer receiving coil and a first magnetic element positioned adjacent to the first connection surface. The second electronic device may similarly include a second connection surface and an inductive power transfer transmitting coil and second magnetic element positioned adjacent to the second connection surface. In the aligned position, alignment between the electronic devices may be maintained by magnetic elements and the inductive power coils may be configured to exchange power. The magnetic elements and/or the inductive power coils may include a shield that is configured to minimize or reduce eddy currents caused in the magnetic elements by the inductive power coils.

WO 2015/148489 A3



TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:

28 January 2016

Published:

— *with international search report (Art. 21(3))*

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/022222

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01F27/36 H01F38/14
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
H01F H01R
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 2 535 906 A1 (HITACHI METALS LTD [JP]) 19 December 2012 (2012-12-19) figures 1,2,6a-7,8 paragraph [0044] paragraph [0064] paragraph [0065] paragraph [0067] paragraph [0057]	1,2,4-7, 9-16 3,8
X	JP 2012 199370 A (HITACHI METALS LTD) 18 October 2012 (2012-10-18) paragraph [0023]; figure 2 ----- -/--	1,4,5,7, 9-11,14, 16

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 1 December 2015	Date of mailing of the international search report 15/12/2015
--	--

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Rouzier, Brice
--	--

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/022222

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/105615 A2 (ACCESS BUSINESS GROUP INT LLC [US]; BAARMAN DAVID W [US]; NORCONK MATT) 27 August 2009 (2009-08-27) paragraph [0063] - paragraph [0067] paragraph [0050]; figures 20-25 -----	1,4,7, 9-11,14, 16
X	JP 2012 222926 A (HITACHI METALS LTD) 12 November 2012 (2012-11-12) paragraph [0034]; figure 5 -----	1,10
X	WO 2014/036558 A2 (SAGALIO INC [US]) 6 March 2014 (2014-03-06) figure 2a paragraph [0072] -----	1,10
Y	WO 03/081976 A2 (MED EL ELEKTRO MEDIZINISCHE GE [AT]) 9 October 2003 (2003-10-09) -----	3,8
A	page 8, line 26 - page 9, line 7; figure 5a -----	2,6,13, 15
A	US 2010/237827 A1 (SIP KIM-YEUNG [CN]) 23 September 2010 (2010-09-23) paragraph [0018]; figure 3 -----	1-16
A	WO 2012/152980 A1 (NOKIA CORP [FI]; TOIVOLA TIMO TAPANI [FI]; KARI JUHANI VALDEMAR [FI];) 15 November 2012 (2012-11-15) figure 4a/4b paragraph [0031] - paragraph [0032] -----	1-16
A	WO 2013/035282 A1 (PANASONIC CORP [JP]; TABATA KENICHIRO; NISHINO TOKUJI; KIKUI TOSHIAKI;) 14 March 2013 (2013-03-14) the whole document -----	1-16
A	US 2006/261778 A1 (ELIZALDE RODARTE LUIS E [US]) 23 November 2006 (2006-11-23) figure 7a -----	1-16
X	US 2012/112553 A1 (STONER JR WILLIAM T [US] ET AL) 10 May 2012 (2012-05-10) figures 2c,2b paragraph [0058] paragraph [0085] -----	17-26, 29-31
X	US 2011/234155 A1 (CHEN JOEY [US] ET AL) 29 September 2011 (2011-09-29) paragraph [0025]; figures 5a,5b paragraph [0020] -----	17
X	JP 2012 119615 A (FUJITSU TEN LTD) 21 June 2012 (2012-06-21) figure 4 -----	17
	-/--	

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/022222

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/121677 A1 (INOUE TETSUO [JP] ET AL) 14 May 2009 (2009-05-14) abstract; figures 5,6,15 -----	17,27,28
A	US 3 903 328 A (BURDETTE JR ERNEST RUSSELL ET AL) 2 September 1975 (1975-09-02) abstract -----	18,19
A	WO 2013/168242 A1 (TOYOTA MOTOR CO LTD [JP]; ICHIKAWA SHINJI [JP]) 14 November 2013 (2013-11-14) abstract; figure 17 -----	21
A	US 2014/008995 A1 (KANNO HIROSHI [JP]) 9 January 2014 (2014-01-09) figures 9,10 paragraph [0076] -----	23-25,28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/022222

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-16

a particular nonconductive coating

2. claims: 17-31

a magnetic field directing material for a housing of an electronic device

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/022222

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
EP 2535906	A1	19-12-2012	CN 102741954 A	17-10-2012
			EP 2535906 A1	19-12-2012
			JP 5477393 B2	23-04-2014
			US 2012319647 A1	20-12-2012
			WO 2011096569 A1	11-08-2011

JP 2012199370	A	18-10-2012	NONE	

WO 2009105615	A2	27-08-2009	AU 2009215464 A1	27-08-2009
			CA 2715918 A1	27-08-2009
			CN 102017353 A	13-04-2011
			EP 2258032 A2	08-12-2010
			JP 5543378 B2	09-07-2014
			JP 2011514796 A	06-05-2011
			KR 20100116627 A	01-11-2010
			KR 20150108939 A	30-09-2015
			RU 2010138845 A	27-03-2012
			TW 200952004 A	16-12-2009
			US 2009212637 A1	27-08-2009
			US 2012181876 A1	19-07-2012
			WO 2009105615 A2	27-08-2009

JP 2012222926	A	12-11-2012	JP 5721001 B2	20-05-2015
			JP 2012222926 A	12-11-2012

WO 2014036558	A2	06-03-2014	CN 104854760 A	19-08-2015
			EP 2893595 A2	15-07-2015
			JP 2015529382 A	05-10-2015
			KR 20150065698 A	15-06-2015
			US 2014065847 A1	06-03-2014
			US 2014066128 A1	06-03-2014
			US 2014240085 A1	28-08-2014
			US 2015199858 A1	16-07-2015
			WO 2014036558 A2	06-03-2014

WO 03081976	A2	09-10-2003	AU 2003233025 A1	13-10-2003
			AU 2008203243 A1	07-08-2008
			CA 2478324 A1	09-10-2003
			EP 1490148 A2	29-12-2004
			US RE45701 E1	29-09-2015
			US 2004012470 A1	22-01-2004
			US 2005062567 A1	24-03-2005
			US 2006244560 A1	02-11-2006
			US 2010004716 A1	07-01-2010
			US 2011224756 A1	15-09-2011
			WO 03081976 A2	09-10-2003

US 2010237827	A1	23-09-2010	CN 101841173 A	22-09-2010
			US 2010237827 A1	23-09-2010

WO 2012152980	A1	15-11-2012	EP 2705520 A1	12-03-2014
			WO 2012152980 A1	15-11-2012

WO 2013035282	A1	14-03-2013	CN 103782357 A	07-05-2014
			JP 4900528 B1	21-03-2012
			JP 2013058717 A	28-03-2013
			JP 2013059195 A	28-03-2013
			KR 20140037968 A	27-03-2014

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/022222

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2014217970 A1	07-08-2014
		WO 2013035282 A1	14-03-2013

US 2006261778	A1 23-11-2006	US 2006261778 A1	23-11-2006
		US 2009121681 A1	14-05-2009
		US 2010207576 A1	19-08-2010

US 2012112553	A1 10-05-2012	TW 201236299 A	01-09-2012
		US 2012112553 A1	10-05-2012
		WO 2012061378 A2	10-05-2012

US 2011234155	A1 29-09-2011	AU 2011229869 A1	04-10-2012
		CA 2793182 A1	29-09-2011
		EP 2552541 A1	06-02-2013
		ES 2474592 T3	09-07-2014
		JP 2013523260 A	17-06-2013
		US 2011234155 A1	29-09-2011
		US 2015224323 A1	13-08-2015
		WO 2011119352 A1	29-09-2011

JP 2012119615	A 21-06-2012	NONE	

US 2009121677	A1 14-05-2009	JP 5231993 B2	10-07-2013
		JP 5613645 B2	29-10-2014
		JP 2012084893 A	26-04-2012
		KR 20080110861 A	19-12-2008
		US 2009121677 A1	14-05-2009
		WO 2007111019 A1	04-10-2007

US 3903328	A 02-09-1975	CA 1032418 A	06-06-1978
		DE 2460482 A1	20-11-1975
		FR 2279829 A1	20-02-1976
		GB 1439126 A	09-06-1976
		IT 1031596 B	10-05-1979
		JP S5534966 B2	10-09-1980
		JP S50139994 A	10-11-1975
		US 3903328 A	02-09-1975

WO 2013168242	A1 14-11-2013	CN 104884295 A	02-09-2015
		EP 2848453 A1	18-03-2015
		KR 20150015491 A	10-02-2015
		US 2015123465 A1	07-05-2015
		WO 2013168242 A1	14-11-2013

US 2014008995	A1 09-01-2014	CN 104471832 A	25-03-2015
		US 2014008995 A1	09-01-2014
		WO 2014006895 A1	09-01-2014
