US009941747B2

(12) **United States Patent**
Bell et al.

(10) **Patent No.: US 9,941,747 B2**
(45) **Date of Patent: Apr. 10, 2018**

(54) **SYSTEM AND METHOD FOR MANUALLY SELECTING AND DESELECTING DEVICES TO CHARGE IN A WIRELESS POWER NETWORK**

(71) Applicant: **ENERGOUS CORPORATION**, Pleasanton, CA (US)

(72) Inventors: **Douglas Bell**, Pleasanton, CA (US); **Michael Leabman**, San Ramon, CA (US)

(73) Assignee: **Energous Corporation**, San Jose, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 169 days.

(21) Appl. No.: **14/330,936**

(22) Filed: **Jul. 14, 2014**

(65) **Prior Publication Data**

US 2016/0013678 A1 Jan. 14, 2016

(51) **Int. Cl.**

G06F 1/00	(2006.01)
H02J 50/20	(2016.01)
H02J 7/02	(2016.01)
H02J 50/40	(2016.01)
H02J 50/80	(2016.01)
H02J 7/00	(2006.01)

(52) **U.S. Cl.**
CPC ***H02J 50/20*** (2016.02); ***H02J 7/025*** (2013.01); ***H02J 50/40*** (2016.02); ***H02J 50/80*** (2016.02); *H02J 2007/0001* (2013.01)

(58) **Field of Classification Search**
CPC H02J 7/025; H02J 50/80
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

787,412	A	4/1905	Tesla
3,434,678	A	5/1965	Brown et al.
3,696,384	A	10/1972	Lester
3,754,269	A	8/1973	Clavin
4,101,895	A	7/1978	Jones, Jr.
4,360,741	A	11/1982	Fitzsimmons et al.
4,944,036	A	7/1990	Hyatt
4,995,010	A	2/1991	Knight

(Continued)

FOREIGN PATENT DOCUMENTS

CN	203826555	U	9/2014
CN	104090265	A	10/2014

(Continued)

OTHER PUBLICATIONS

International Search Report dated Jan. 27, 2015 corresponding to International Patent Application No. PCT/US2014/037170, 4 pages.

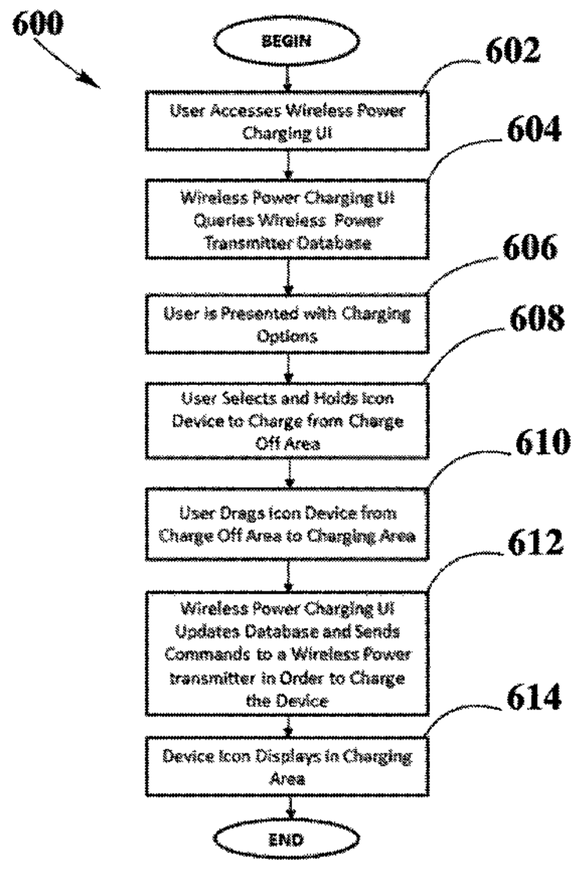
(Continued)

Primary Examiner — Austin Hicks
(74) *Attorney, Agent, or Firm* — Morgan, Lewis & Bockius LLP

(57) **ABSTRACT**

A system for selecting a deselecting charging devices in a wireless power network is disclosed here. The system includes a graphical user interface from which a user may select or deselect devices to be charged in a wireless power network. The disclosed system may store records from different components of a wireless power network into a database distributed throughout said network with copies stored within the memory of wireless power transmitters.

20 Claims, 7 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,200,759	A	4/1993	McGinnis	
5,211,471	A	5/1993	Rohrs	
5,548,292	A	8/1996	Hirshfield et al.	
5,556,749	A	9/1996	Mitsuhashi et al.	
5,646,633	A	7/1997	Dahlberg	
5,697,063	A	12/1997	Kishigami et al.	
5,712,642	A	1/1998	Hulderman	
5,936,527	A	8/1999	Isaacman et al.	
5,982,139	A	11/1999	Parise	
6,046,708	A	4/2000	MacDonald, Jr. et al.	
6,127,799	A	10/2000	Krishnan	
6,127,942	A	10/2000	Welle	
6,163,296	A	12/2000	Lier et al.	
6,289,237	B1	9/2001	Mickle et al.	
6,329,908	B1	12/2001	Frecska	
6,421,235	B2	7/2002	Ditzik	
6,437,685	B2	8/2002	Hanaki	
6,456,253	B1	9/2002	Rummeli et al.	
6,476,795	B1	11/2002	Derocher et al.	
6,501,414	B2	12/2002	Amdt et al.	
6,583,723	B2	6/2003	Watanabe et al.	
6,597,897	B2	7/2003	Tang	
6,615,074	B2	9/2003	Mickle et al.	
6,664,920	B1	12/2003	Mott et al.	
6,798,716	B1	9/2004	Charych	
6,803,744	B1	10/2004	Sabo	
6,856,291	B2	2/2005	Mickle et al.	
6,911,945	B2	6/2005	Korva	
6,960,968	B2	11/2005	Odendaal et al.	
6,967,462	B1	11/2005	Landis	
6,988,026	B2	1/2006	Breed et al.	
7,003,350	B2	2/2006	Denker et al.	
7,027,311	B2	4/2006	Vanderelli et al.	
7,068,991	B2	6/2006	Parise	
7,183,748	B1	2/2007	Unno et al.	
7,191,013	B1	3/2007	Miranda et al.	
7,196,663	B2	3/2007	Bolzer et al.	
7,205,749	B2	4/2007	Hagen et al.	
7,222,356	B1 *	5/2007	Yonezawa	H04N 7/181 348/14.02
7,274,334	B2	9/2007	o'Riordan et al.	
7,274,336	B2	9/2007	Carson	
7,351,975	B2	4/2008	Brady et al.	
7,359,730	B2	4/2008	Dennis et al.	
7,392,068	B2	6/2008	Dayan	
7,403,803	B2	7/2008	Mickle et al.	
7,451,839	B2	11/2008	Perlman	
7,463,201	B2	12/2008	Chiang et al.	
7,614,556	B2	11/2009	Overhultz et al.	
7,639,994	B2	12/2009	Greene et al.	
7,643,312	B2	1/2010	Vanderelli et al.	
7,652,577	B1	1/2010	Madhow et al.	
7,786,419	B2	8/2010	Hyde et al.	
7,812,771	B2	10/2010	Greene et al.	
7,830,312	B2	11/2010	Choudhury et al.	
7,844,306	B2	11/2010	Shearer et al.	
7,868,482	B2	1/2011	Greene et al.	
7,898,105	B2	3/2011	Greene et al.	
7,904,117	B2	3/2011	Doan et al.	
7,925,308	B2	4/2011	Greene et al.	
8,055,003	B2	11/2011	Mittleman et al.	
8,070,595	B2	12/2011	Alderucci et al.	
8,072,380	B2	12/2011	Crouch	
8,092,301	B2	1/2012	Alderucci et al.	
8,099,140	B2	1/2012	Arai	
8,115,448	B2	2/2012	John	
8,159,090	B2	4/2012	Greene et al.	
8,159,364	B2	4/2012	Zeine	
8,180,286	B2	5/2012	Yamasuge	
8,228,194	B2	7/2012	Mickle	
8,264,101	B2	9/2012	Hyde et al.	
8,264,291	B2	9/2012	Morita	
8,278,784	B2	10/2012	Cook et al.	
8,284,101	B2	10/2012	Fusco	
8,310,201	B1	11/2012	Wright	
8,362,745	B2	1/2013	Tinaphong	
8,380,255	B2	2/2013	Shearer et al.	
8,410,953	B2	4/2013	Zeine	
8,411,963	B2	4/2013	Luff	
8,432,062	B2	4/2013	Greene et al.	
8,432,071	B2	4/2013	Huang et al.	
8,446,248	B2	5/2013	Zeine	
8,447,234	B2	5/2013	Cook et al.	
8,451,189	B1	5/2013	Fluhler	
8,452,235	B2	5/2013	Kirby et al.	
8,457,656	B2	6/2013	Perkins et al.	
8,461,817	B2	6/2013	Martin et al.	
8,467,733	B2	6/2013	Leabman	
8,552,597	B2	10/2013	Song et al.	
8,558,661	B2	10/2013	Zeine	
8,560,026	B2	10/2013	Chanterac	
8,604,746	B2	12/2013	Lee	
8,614,643	B2	12/2013	Leabman	
8,621,245	B2	12/2013	Shearer et al.	
8,626,249	B2	1/2014	Kuusilinna et al.	
8,629,576	B2	1/2014	Levine	
8,653,966	B2	2/2014	Rao et al.	
8,674,551	B2	3/2014	Low et al.	
8,686,685	B2	4/2014	Moshfeghi	
8,712,355	B2	4/2014	Black et al.	
8,712,485	B2	4/2014	Tam	
8,718,773	B2	5/2014	Wills et al.	
8,729,737	B2	5/2014	Schatz et al.	
8,736,228	B1	5/2014	Freed et al.	
8,760,113	B2	6/2014	Keating	
8,770,482	B2	7/2014	Ackermann et al.	
8,772,960	B2	7/2014	Yoshida	
8,823,319	B2	9/2014	Von Novak, III et al.	
8,854,176	B2	10/2014	Zeine	
8,860,364	B2	10/2014	Low et al.	
8,897,770	B1	11/2014	Frolov et al.	
8,923,189	B2	12/2014	Leabman	
8,928,544	B2	1/2015	Massie et al.	
8,937,408	B2	1/2015	Ganem et al.	
8,946,940	B2	2/2015	Kim et al.	
8,963,486	B2	2/2015	Kirby et al.	
8,970,070	B2	3/2015	Sada et al.	
8,989,053	B1	3/2015	Skaaksrud et al.	
9,000,616	B2	4/2015	Greene et al.	
9,001,622	B2	4/2015	Perry	
9,006,934	B2	4/2015	Kozakai et al.	
9,021,277	B2	4/2015	Shearer et al.	
9,030,161	B2	5/2015	Lu et al.	
9,059,598	B2	6/2015	Kang et al.	
9,059,599	B2	6/2015	Won et al.	
9,077,188	B2	7/2015	Moshfeghi	
9,088,216	B2	7/2015	Garrity et al.	
9,124,125	B2	9/2015	Leabman et al.	
9,130,397	B2	9/2015	Leabman et al.	
9,130,602	B2	9/2015	Cook	
9,142,998	B2	9/2015	Yu et al.	
9,143,000	B2	9/2015	Leabman et al.	
9,143,010	B2	9/2015	Urano	
9,178,389	B2	11/2015	Hwang	
9,225,196	B2	12/2015	Huang et al.	
9,242,411	B2	1/2016	Kritchman et al.	
9,244,500	B2	1/2016	Cain et al.	
9,252,628	B2	2/2016	Leabman et al.	
9,270,344	B2	2/2016	Rosenberg	
9,282,582	B1	3/2016	Dunsbergen et al.	
9,294,840	B1	3/2016	Anderson et al.	
9,297,896	B1	3/2016	Andrews	
9,318,898	B2	4/2016	John	
9,401,977	B1	7/2016	Gaw	
9,450,449	B1	9/2016	Leabman et al.	
9,461,502	B2	10/2016	Lee et al.	
9,520,725	B2	12/2016	Masaoka et al.	
9,520,748	B2	12/2016	Hyde et al.	
9,522,270	B2	12/2016	Perryman et al.	
9,537,354	B2	1/2017	Bell et al.	
9,537,357	B2	1/2017	Leabman	
9,537,358	B2	1/2017	Leabman	
9,538,382	B2	1/2017	Bell et al.	
9,544,640	B2	1/2017	Lau	

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,559,553	B2	1/2017	Bae
9,564,773	B2	2/2017	Pogorelik et al.
9,590,444	B2	3/2017	Walley
9,620,996	B2	4/2017	Zeine
2002/0001307	A1	1/2002	Nguyen et al.
2002/0028655	A1	3/2002	Rosener et al.
2002/0034958	A1	3/2002	Oberschmidt et al.
2002/0054330	A1	5/2002	Jinbo et al.
2002/0072784	A1	6/2002	Sheppard et al.
2002/0095980	A1	7/2002	Breed et al.
2002/0103447	A1	8/2002	Terry
2002/0133592	A1	9/2002	Matsuda
2002/0172223	A1	11/2002	Stilp
2003/0058187	A1	3/2003	Billiet et al.
2003/0076274	A1	4/2003	Phelan et al.
2003/0179152	A1	9/2003	Watada et al.
2003/0179573	A1	9/2003	Chun
2003/0192053	A1	10/2003	Sheppard et al.
2004/0019624	A1	1/2004	Sukegawa
2004/0020100	A1	2/2004	O'Brian et al.
2004/0036657	A1	2/2004	Forster et al.
2004/0107641	A1	6/2004	Walton et al.
2004/0113543	A1	6/2004	Daniels
2004/0119675	A1	6/2004	Washio et al.
2004/0130425	A1	7/2004	Dayan et al.
2004/0130442	A1	7/2004	Breed
2004/0142733	A1	7/2004	Parise
2004/0145342	A1	7/2004	Lyon
2004/0196190	A1	10/2004	Mendolia et al.
2004/0207559	A1	10/2004	Milosavljevic
2004/0218759	A1	11/2004	Yacobi
2004/0259604	A1	12/2004	Mickle et al.
2004/0263124	A1	12/2004	Wieck et al.
2005/0007276	A1	1/2005	Barrick et al.
2005/0030118	A1	2/2005	Wang
2005/0046584	A1	3/2005	Breed
2005/0055316	A1	3/2005	Williams
2005/0116683	A1	6/2005	Cheng
2005/0117660	A1	6/2005	Vialle et al.
2005/0171411	A1	8/2005	KenKnight
2005/0198673	A1	9/2005	Kit et al.
2005/0227619	A1	10/2005	Lee et al.
2005/0232469	A1	10/2005	Schofield
2005/0282591	A1	12/2005	Shaff
2006/0013335	A1	1/2006	Leabman
2006/0019712	A1	1/2006	Choi
2006/0030279	A1	2/2006	Leabman et al.
2006/0092079	A1	5/2006	de Rochemont
2006/0094425	A1	5/2006	Mickle et al.
2006/0113955	A1	6/2006	Nunally
2006/0119532	A1	6/2006	Yun et al.
2006/0160517	A1	7/2006	Yoon
2006/0183473	A1	8/2006	Ukon
2006/0190063	A1	8/2006	Kanzius
2006/0192913	A1	8/2006	Shutou et al.
2006/0199620	A1	9/2006	Greene et al.
2006/0238365	A1	10/2006	Vecchione et al.
2006/0266564	A1	11/2006	Perlman et al.
2006/0266917	A1	11/2006	Baldis et al.
2006/0278706	A1	12/2006	Hatakayama et al.
2006/0284593	A1	12/2006	Nagy et al.
2006/0287094	A1	12/2006	Mahaffey et al.
2007/0007821	A1	1/2007	Rossetti
2007/0019693	A1	1/2007	Graham
2007/0021140	A1	1/2007	Keyes
2007/0060185	A1	3/2007	Simon et al.
2007/0070490	A1	3/2007	Tsunoda et al.
2007/0093269	A1	4/2007	Leabman et al.
2007/0097653	A1	5/2007	Gilliland et al.
2007/0103110	A1	5/2007	Sagoo
2007/0106894	A1	5/2007	Zhang
2007/0109121	A1	5/2007	Cohen
2007/0139000	A1	6/2007	Kozuma
2007/0149162	A1	6/2007	Greene et al.
2007/0173196	A1	7/2007	Gallic
2007/0173214	A1	7/2007	Mickle et al.
2007/0178857	A1	8/2007	Greene et al.
2007/0178945	A1	8/2007	Cook et al.
2007/0182367	A1	8/2007	Partovi
2007/0191074	A1	8/2007	Harrist et al.
2007/0191075	A1	8/2007	Greene et al.
2007/0197281	A1	8/2007	Stronach
2007/0210960	A1	9/2007	Rofougaran et al.
2007/0222681	A1	9/2007	Greene et al.
2007/0273486	A1	11/2007	Shiotsu
2007/0298846	A1	12/2007	Greene et al.
2008/0062062	A1	3/2008	Borau et al.
2008/0062255	A1	3/2008	Gal
2008/0067874	A1	3/2008	Tseng
2008/0074324	A1	3/2008	Puzella et al.
2008/0089277	A1	4/2008	Aledander et al.
2008/0113816	A1	5/2008	Mahaffey et al.
2008/0122297	A1	5/2008	Arai
2008/0123383	A1	5/2008	Shionoiri
2008/0129536	A1	6/2008	Randall et al.
2008/0169910	A1	7/2008	Greene et al.
2008/0197802	A1	8/2008	Onishi
2008/0204342	A1	8/2008	Kharadly
2008/0204350	A1	8/2008	Tam et al.
2008/0210762	A1	9/2008	Osada et al.
2008/0211458	A1	9/2008	Lawther et al.
2008/0248758	A1	10/2008	Schedelbeck et al.
2008/0248846	A1	10/2008	Stronach et al.
2008/0278378	A1	11/2008	Chang et al.
2008/0309452	A1	12/2008	Zeine
2009/0002493	A1	1/2009	Kates
2009/0019183	A1	1/2009	Wu et al.
2009/0036065	A1	2/2009	Siu
2009/0047998	A1	2/2009	Alberth, Jr.
2009/0058354	A1	3/2009	Harrison
2009/0058361	A1	3/2009	John
2009/0067208	A1	3/2009	Martin et al.
2009/0096412	A1	4/2009	Huang
2009/0096413	A1	4/2009	Partovi
2009/0102292	A1	4/2009	Cook et al.
2009/0102296	A1	4/2009	Greene et al.
2009/0108679	A1	4/2009	Porwal
2009/0128262	A1	5/2009	Lee et al.
2009/0157911	A1	6/2009	Aihara
2009/0200985	A1	8/2009	Zane et al.
2009/0206791	A1	8/2009	Jung
2009/0207092	A1	8/2009	Nysen et al.
2009/0218884	A1	9/2009	Soar
2009/0218891	A1	9/2009	McCollough
2009/0219903	A1	9/2009	Alamouti et al.
2009/0243397	A1	10/2009	Cook et al.
2009/0264069	A1	10/2009	Yamasuge
2009/0280866	A1	11/2009	Lo et al.
2009/0281678	A1	11/2009	Wakamatsu
2009/0284082	A1	11/2009	Mohammadian
2009/0284083	A1	11/2009	Karalis et al.
2009/0284220	A1	11/2009	Toncich et al.
2009/0284227	A1	11/2009	Mohammadian et al.
2009/0284325	A1	11/2009	Rossiter et al.
2009/0286475	A1	11/2009	Toncich et al.
2009/0291634	A1 *	11/2009	Saarisalo H04M 1/72527 455/41.1
2009/0299175	A1	12/2009	Bernstein et al.
2009/0315412	A1	12/2009	Yamamoto et al.
2009/0322281	A1	12/2009	Kamijo et al.
2010/0001683	A1	1/2010	Huang et al.
2010/0007307	A1	1/2010	Baarman et al.
2010/0007569	A1	1/2010	Sim et al.
2010/0019686	A1	1/2010	Gutierrez, Jr.
2010/0026605	A1	2/2010	Yang et al.
2010/0027379	A1	2/2010	Saulnier et al.
2010/0029383	A1	2/2010	Dai
2010/0033021	A1	2/2010	Bennett
2010/0033390	A1	2/2010	Alamouti et al.
2010/0041453	A1	2/2010	Grimm, Jr.
2010/0044123	A1	2/2010	Perlman et al.
2010/0054200	A1	3/2010	Tsai
2010/0060534	A1	3/2010	Oodachi
2010/0075607	A1	3/2010	Hosoya

(56) **References Cited**

U.S. PATENT DOCUMENTS

2010/0079005	A1	4/2010	Hyde et al.	
2010/0082193	A1	4/2010	Chiappetta	
2010/0087227	A1	4/2010	Francos et al.	
2010/0090656	A1	4/2010	Shearer et al.	
2010/0109443	A1	5/2010	Cook et al.	
2010/0119234	A1	5/2010	Suematsu et al.	
2010/0123618	A1	5/2010	Martin et al.	
2010/0123624	A1	5/2010	Minear et al.	
2010/0127660	A1	5/2010	Cook et al.	
2010/0142418	A1	6/2010	Nishioka et al.	
2010/0142509	A1	6/2010	Zhu et al.	
2010/0151808	A1	6/2010	Toncich et al.	
2010/0156721	A1	6/2010	Alamouti et al.	
2010/0164433	A1	7/2010	Janefalker et al.	
2010/0171461	A1	7/2010	Baarman et al.	
2010/0174629	A1	7/2010	Taylor et al.	
2010/0176934	A1	7/2010	Chou et al.	
2010/0181961	A1	7/2010	Novak et al.	
2010/0181964	A1	7/2010	Huggins et al.	
2010/0194206	A1	8/2010	Burdo et al.	
2010/0201189	A1	8/2010	Kirby et al.	
2010/0201201	A1	8/2010	Mobarhan et al.	
2010/0201314	A1	8/2010	Toncich et al.	
2010/0207572	A1	8/2010	Kirby et al.	
2010/0214177	A1	8/2010	Parsche	
2010/0225270	A1	9/2010	Jacobs et al.	
2010/0227570	A1	9/2010	Hendin	
2010/0237709	A1	9/2010	Hall et al.	
2010/0244576	A1	9/2010	Hillan et al.	
2010/0256831	A1	10/2010	Abramo et al.	
2010/0259110	A1	10/2010	Kurs et al.	
2010/0259447	A1	10/2010	Crouch	
2010/0264747	A1	10/2010	Hall et al.	
2010/0277003	A1	11/2010	Von Novak et al.	
2010/0277121	A1	11/2010	Hall et al.	
2010/0279606	A1	11/2010	Hillan et al.	
2010/0289341	A1	11/2010	Ozaki et al.	
2010/0295372	A1	11/2010	Hyde et al.	
2010/0308767	A1	12/2010	Rofougaran et al.	
2010/0309079	A1	12/2010	Rofougaran et al.	
2010/0309088	A1	12/2010	Hyvonen et al.	
2010/0315045	A1*	12/2010	Zeine	H02J 7/025 320/137
2010/0316163	A1	12/2010	Forenza et al.	
2010/0327766	A1	12/2010	Recker et al.	
2010/0328044	A1	12/2010	Waffenschmidt et al.	
2010/0332401	A1	12/2010	Prahlad et al.	
2011/0018360	A1	1/2011	Baarman et al.	
2011/0028114	A1	2/2011	Kerselaers	
2011/0031928	A1	2/2011	Soar	
2011/0032149	A1	2/2011	Leabman	
2011/0032866	A1	2/2011	Leabman	
2011/0034190	A1	2/2011	Leabman	
2011/0034191	A1	2/2011	Leabman	
2011/0043047	A1	2/2011	Karalis et al.	
2011/0043163	A1	2/2011	Baarman	
2011/0043327	A1	2/2011	Baarman et al.	
2011/0050166	A1	3/2011	Cook et al.	
2011/0055037	A1	3/2011	Hayashigawa et al.	
2011/0056215	A1	3/2011	Ham	
2011/0057607	A1	3/2011	Carobolante	
2011/0074342	A1	3/2011	MacLaughlin	
2011/0074349	A1	3/2011	Ghovanloo	
2011/0074620	A1	3/2011	Wintermantel	
2011/0078092	A1	3/2011	Kim et al.	
2011/0090126	A1	4/2011	Szini et al.	
2011/0114401	A1	5/2011	Kanno et al.	
2011/0115303	A1	5/2011	Baarman et al.	
2011/0115432	A1	5/2011	El-Maleh	
2011/0115605	A1	5/2011	Dimig et al.	
2011/0121660	A1	5/2011	Azancot et al.	
2011/0122026	A1	5/2011	DeLaquil et al.	
2011/0127845	A1	6/2011	Walley et al.	
2011/0127952	A1	6/2011	Walley et al.	
2011/0133655	A1	6/2011	Recker et al.	
2011/0133691	A1	6/2011	Hautanen	
2011/0148578	A1	6/2011	Aloi et al.	
2011/0151789	A1	6/2011	Viglione et al.	
2011/0154429	A1	6/2011	Stantchev	
2011/0156494	A1	6/2011	Mashinsky	
2011/0156640	A1	6/2011	Moshfeghi	
2011/0163128	A1	7/2011	Taguchi et al.	
2011/0175455	A1	7/2011	Hashiguchi	
2011/0175461	A1	7/2011	Tinaphong	
2011/0181120	A1	7/2011	Liu et al.	
2011/0182245	A1	7/2011	Malkamaki et al.	
2011/0184842	A1	7/2011	Melen	
2011/0188207	A1	8/2011	Won et al.	
2011/0194543	A1	8/2011	Zhao et al.	
2011/0195722	A1	8/2011	Walter et al.	
2011/0199046	A1	8/2011	Tsai et al.	
2011/0215086	A1	9/2011	Yeh	
2011/0217923	A1	9/2011	Ma	
2011/0220634	A1	9/2011	Yeh	
2011/0221389	A1	9/2011	Won et al.	
2011/0222272	A1	9/2011	Yeh	
2011/0243040	A1	10/2011	Khan et al.	
2011/0243050	A1	10/2011	Yanover	
2011/0244913	A1	10/2011	Kim et al.	
2011/0248573	A1	10/2011	Kanno et al.	
2011/0248575	A1	10/2011	Kim et al.	
2011/0249678	A1	10/2011	Bonicatto	
2011/0254377	A1	10/2011	Widmer et al.	
2011/0254503	A1	10/2011	Widmer et al.	
2011/0259953	A1	10/2011	Baarman et al.	
2011/0273977	A1	11/2011	Shapira et al.	
2011/0278941	A1	11/2011	Krishna et al.	
2011/0279226	A1	11/2011	Chen et al.	
2011/0281535	A1	11/2011	Low et al.	
2011/0282415	A1	11/2011	Eckhoff et al.	
2011/0285213	A1	11/2011	Kowalewski	
2011/0286374	A1	11/2011	Shin et al.	
2011/0291489	A1	12/2011	Tsai et al.	
2011/0302078	A1	12/2011	Failing	
2011/0304216	A1	12/2011	Baarman	
2011/0304437	A1	12/2011	Beeler	
2012/0013196	A1	1/2012	Kim et al.	
2012/0013198	A1	1/2012	Uramoto et al.	
2012/0013296	A1	1/2012	Heydari et al.	
2012/0019419	A1	1/2012	Prat et al.	
2012/0043887	A1	2/2012	Mesibov	
2012/0051109	A1	3/2012	Kim et al.	
2012/0051294	A1	3/2012	Guillouard	
2012/0056486	A1	3/2012	Endo et al.	
2012/0056741	A1	3/2012	Zhu et al.	
2012/0074891	A1	3/2012	Anderson et al.	
2012/0231856	A1	3/2012	Lee et al.	
2012/0080957	A1	4/2012	Cooper et al.	
2012/0086284	A1	4/2012	Capanella et al.	
2012/0098350	A1	4/2012	Campanella et al.	
2012/0098485	A1	4/2012	Kang et al.	
2012/0099675	A1	4/2012	Kitamura et al.	
2012/0103562	A1	5/2012	Clayton	
2012/0104849	A1	5/2012	Jackson	
2012/0105252	A1	5/2012	Wang	
2012/0112532	A1	5/2012	Kesler et al.	
2012/0119914	A1	5/2012	Uchida	
2012/0126743	A1	5/2012	Rivers, Jr.	
2012/0132647	A1	5/2012	Beverly et al.	
2012/0133214	A1	5/2012	Yun et al.	
2012/0146426	A1	6/2012	Sabo	
2012/0146576	A1	6/2012	Partovi	
2012/0146577	A1	6/2012	Tanabe	
2012/0147802	A1	6/2012	Ukita et al.	
2012/0150670	A1	6/2012	Taylor et al.	
2012/0153894	A1	6/2012	Widmer et al.	
2012/0157019	A1	6/2012	Li	
2012/0161531	A1	6/2012	Kim et al.	
2012/0161544	A1	6/2012	Kashiwagi et al.	
2012/0169276	A1	7/2012	Wang	
2012/0169278	A1	7/2012	Choi	
2012/0173418	A1	7/2012	Beardsmore et al.	
2012/0181973	A1	7/2012	Lyden	
2012/0182427	A1	7/2012	Marshall	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2012/0187851 A1 8/2012 Huggins et al.
2012/0193999 A1 8/2012 Zeine
2012/0200399 A1 8/2012 Chae
2012/0201153 A1 8/2012 Bharadia et al.
2012/0201173 A1 8/2012 Jian et al.
2012/0206299 A1 8/2012 Valdes-Garcia
2012/0212072 A1 8/2012 Miyabayashi et al.
2012/0214536 A1 8/2012 Kim et al.
2012/0228956 A1 9/2012 Kamata
2012/0235636 A1 9/2012 Partovi
2012/0242283 A1 9/2012 Kim et al.
2012/0248886 A1 10/2012 Kesler et al.
2012/0248891 A1 10/2012 Drennen
2012/0249051 A1 10/2012 Son et al.
2012/0262002 A1 10/2012 Widmer et al.
2012/0267900 A1 10/2012 Huffman et al.
2012/0268238 A1 10/2012 Park et al.
2012/0274154 A1 11/2012 DeLuca
2012/0280650 A1 11/2012 Kim et al.
2012/0292993 A1 11/2012 Mettler et al.
2012/0293021 A1 11/2012 Teggatz et al.
2012/0293119 A1 11/2012 Park et al.
2012/0299389 A1 11/2012 Lee et al.
2012/0299540 A1 11/2012 Perry
2012/0299541 A1 11/2012 Perry
2012/0299542 A1 11/2012 Perry
2012/0300588 A1 11/2012 Perry
2012/0300592 A1 11/2012 Perry
2012/0300593 A1 11/2012 Perry
2012/0306705 A1 12/2012 Sakurai et al.
2012/0309295 A1 12/2012 Maguire
2012/0309308 A1 12/2012 Kim et al.
2012/0309332 A1 12/2012 Liao
2012/0313449 A1 12/2012 Kurs
2012/0326660 A1 12/2012 Lu et al.
2013/0002550 A1 1/2013 Zalewski
2013/0024059 A1 1/2013 Miller et al.
2013/0026981 A1 1/2013 Van Der Lee
2013/0026982 A1 1/2013 Rothenbaum
2013/0032589 A1 2/2013 Chung
2013/0033571 A1 2/2013 Steen
2013/0038124 A1 2/2013 Newdoll et al.
2013/0038402 A1 2/2013 Karalis et al.
2013/0043738 A1 2/2013 Park et al.
2013/0049471 A1 2/2013 Oleynik
2013/0049475 A1 2/2013 Kim et al.
2013/0057078 A1 3/2013 Lee
2013/0057205 A1 3/2013 Lee et al.
2013/0057210 A1 3/2013 Negaard et al.
2013/0057364 A1 3/2013 Kesler et al.
2013/0063082 A1 3/2013 Lee et al.
2013/0063143 A1 3/2013 Adalsteinsson et al.
2013/0069444 A1 3/2013 Waffenschmidt et al.
2013/0077650 A1 3/2013 Traxler et al.
2013/0078918 A1 3/2013 Crowley et al.
2013/0082651 A1 4/2013 Park et al.
2013/0082653 A1 4/2013 Lee et al.
2013/0083774 A1 4/2013 Son et al.
2013/0088082 A1 4/2013 Kang et al.
2013/0088090 A1 4/2013 Wu
2013/0088192 A1 4/2013 Eaton
2013/0088331 A1 4/2013 Cho
2013/0093388 A1 4/2013 Partovi
2013/0099389 A1 4/2013 Hong et al.
2013/0099586 A1 4/2013 Kato
2013/0106197 A1 5/2013 Bae et al.
2013/0107023 A1 5/2013 Tanaka et al.
2013/0119777 A1 5/2013 Rees
2013/0119929 A1 5/2013 Partovi
2013/0120217 A1 5/2013 Ueda et al.
2013/0132010 A1 5/2013 Winger et al.
2013/0134923 A1 5/2013 Smith
2013/0137455 A1 5/2013 Xia
2013/0141037 A1 6/2013 Jenwatanavet et al.
2013/0148341 A1 6/2013 Williams
2013/0149975 A1 6/2013 Yu et al.
2013/0154387 A1 6/2013 Lee et al.
2013/0155748 A1 6/2013 Sundstrom
2013/0157729 A1 6/2013 Tabe
2013/0169061 A1 7/2013 Microshnichenko et al.
2013/0169219 A1 7/2013 Gray
2013/0169348 A1 7/2013 Shi
2013/0171939 A1 7/2013 Tian et al.
2013/0178253 A1 7/2013 Karaoguz
2013/0181881 A1 7/2013 Christie et al.
2013/0193769 A1 8/2013 Mehta et al.
2013/0197320 A1 8/2013 Albert et al.
2013/0200064 A1 8/2013 Alexander
2013/0207477 A1 8/2013 Nam et al.
2013/0207604 A1 8/2013 Zeine
2013/0210357 A1 8/2013 Qin et al.
2013/0221757 A1 8/2013 Cho et al.
2013/0234530 A1 9/2013 Miyauchi
2013/0234536 A1 9/2013 Chemishkian et al.
2013/0234658 A1 9/2013 Endo et al.
2013/0241306 A1 9/2013 Aber et al.
2013/0241468 A1 9/2013 Moshfeghi
2013/0241474 A1 9/2013 Moshfeghi
2013/0249478 A1 9/2013 Hirano
2013/0249479 A1 9/2013 Partovi
2013/0254578 A1 9/2013 Huang
2013/0264997 A1 10/2013 Lee et al.
2013/0268782 A1 10/2013 Tam et al.
2013/0270923 A1 10/2013 Cook et al.
2013/0278209 A1 10/2013 Von Novak
2013/0285477 A1 10/2013 Lo et al.
2013/0285606 A1 10/2013 Ben-Shalom et al.
2013/0288600 A1 10/2013 Kuusilinna et al.
2013/0293423 A1 11/2013 Moshfeghi
2013/0310020 A1* 11/2013 Kazuhiro H04W 52/367 455/422.1
2013/0311798 A1 11/2013 Sultenfuss
2013/0328417 A1 12/2013 Takeuchi
2013/0339108 A1 12/2013 Ryder et al.
2013/0343251 A1 12/2013 Zhang
2014/0001846 A1 1/2014 Mosebrook
2014/0001875 A1 1/2014 Nahidipour
2014/0001876 A1 1/2014 Fujiwara et al.
2014/0006017 A1 1/2014 Sen
2014/0008992 A1 1/2014 Leabman
2014/0008993 A1 1/2014 Leabman
2014/0009108 A1 1/2014 Leabman
2014/0011531 A1 1/2014 Burstrom et al.
2014/0015336 A1 1/2014 Weber et al.
2014/0015344 A1 1/2014 Mohamadi
2014/0021907 A1 1/2014 Yu et al.
2014/0021908 A1 1/2014 McCool
2014/0035524 A1 2/2014 Zeine
2014/0035526 A1 2/2014 Tripathi et al.
2014/0049422 A1 2/2014 Von Novak et al.
2014/0055098 A1* 2/2014 Lee H02J 7/025 320/137
2014/0057618 A1 2/2014 Zirwas et al.
2014/0062395 A1 3/2014 Kwon et al.
2014/0086125 A1 3/2014 Polo et al.
2014/0091756 A1 4/2014 Ofstein et al.
2014/0091968 A1 4/2014 Hard et al.
2014/0111147 A1 4/2014 Soar
2014/0113689 A1 4/2014 Lee
2014/0117946 A1 5/2014 Muller et al.
2014/0118140 A1 5/2014 Amis
2014/0133279 A1 5/2014 Khuri-Yakub
2014/0139034 A1 5/2014 Sankar et al.
2014/0139039 A1 5/2014 Cook et al.
2014/0139180 A1 5/2014 Kim et al.
2014/0141838 A1 5/2014 Cai et al.
2014/0142876 A1 5/2014 John et al.
2014/0143933 A1 5/2014 Low et al.
2014/0145879 A1 5/2014 Pan
2014/0152117 A1 6/2014 Sanker
2014/0159652 A1 6/2014 Hall et al.
2014/0159662 A1 6/2014 Furui
2014/0159667 A1 6/2014 Kim et al.
2014/0175893 A1 6/2014 Sengupta et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2014/0176054 A1 6/2014 Porat et al.
2014/0177399 A1 6/2014 Teng et al.
2014/0184148 A1 7/2014 Van Der Lee et al.
2014/0184155 A1 7/2014 Cha
2014/0184163 A1 7/2014 Das et al.
2014/0184170 A1* 7/2014 Jeong B60L 11/184 320/137
2014/0191568 A1 7/2014 Partovi
2014/0194092 A1 7/2014 Wanstedt et al.
2014/0194095 A1 7/2014 Wanstedt et al.
2014/0206384 A1 7/2014 Kim et al.
2014/0210281 A1 7/2014 Ito et al.
2014/0217967 A1 8/2014 Zeine et al.
2014/0225805 A1 8/2014 Pan et al.
2014/0232320 A1 8/2014 Ento July et al.
2014/0239733 A1 8/2014 Mach et al.
2014/0241231 A1 8/2014 Zeine
2014/0245036 A1 8/2014 Oishi
2014/0246416 A1 9/2014 White
2014/0247152 A1 9/2014 Proud
2014/0252813 A1 9/2014 Lee et al.
2014/0252866 A1 9/2014 Walsh et al.
2014/0265725 A1 9/2014 Angle et al.
2014/0265727 A1 9/2014 Berte
2014/0265943 A1 9/2014 Angle et al.
2014/0266025 A1 9/2014 Jakubowski
2014/0273892 A1 9/2014 Nourbakhsh
2014/0281655 A1 9/2014 Angle et al.
2014/0292090 A1 10/2014 Cordeiro et al.
2014/0312706 A1 10/2014 Fiorello et al.
2014/0325218 A1 10/2014 Shimizu et al.
2014/0327320 A1 11/2014 Muhs et al.
2014/0327390 A1 11/2014 Park et al.
2014/0346860 A1 11/2014 Aubry et al.
2014/0354063 A1 12/2014 Leabman et al.
2014/0354221 A1 12/2014 Leabman et al.
2014/0355718 A1 12/2014 Guan et al.
2014/0357309 A1 12/2014 Leabman et al.
2014/0368048 A1 12/2014 Leabman
2014/0368161 A1 12/2014 Leabman et al.
2014/0375253 A1 12/2014 Leabman et al.
2014/0375255 A1 12/2014 Leabman et al.
2014/0375258 A1 12/2014 Arkhipenkov
2014/0375261 A1 12/2014 Manova-Elssibony et al.
2014/0376646 A1 12/2014 Leabman et al.
2015/0001949 A1 1/2015 Leabman et al.
2015/0002086 A1 1/2015 Matos et al.
2015/0003207 A1 1/2015 Lee et al.
2015/0008980 A1 1/2015 Kim et al.
2015/0011160 A1 1/2015 Uurgovan et al.
2015/0015180 A1 1/2015 Miller et al.
2015/0015192 A1 1/2015 Leabman et al.
2015/0015194 A1 1/2015 Leabman et al.
2015/0015195 A1 1/2015 Leabman et al.
2015/0021990 A1 1/2015 Myer et al.
2015/0022008 A1 1/2015 Leabman et al.
2015/0022009 A1 1/2015 Leabman et al.
2015/0022010 A1 1/2015 Leabman et al.
2015/0028688 A1 1/2015 Masaoka
2015/0028694 A1 1/2015 Leabman et al.
2015/0028697 A1 1/2015 Leabman et al.
2015/0029397 A1 1/2015 Leabman et al.
2015/0035715 A1 2/2015 Kim et al.
2015/0041459 A1 2/2015 Leabman et al.
2015/0042264 A1 2/2015 Leabman et al.
2015/0042265 A1 2/2015 Leabman et al.
2015/0044977 A1 2/2015 Ramasamy et al.
2015/0046526 A1 2/2015 Bush et al.
2015/0061404 A1 3/2015 Lamenza et al.
2015/0076917 A1 3/2015 Leabman et al.
2015/0076927 A1 3/2015 Leabman et al.
2015/0077036 A1 3/2015 Leabman et al.
2015/0077037 A1 3/2015 Leabman et al.
2015/0091520 A1 4/2015 Blum et al.
2015/0097663 A1 4/2015 Sloo et al.
2015/0102681 A1 4/2015 Leabman et al.
2015/0102764 A1 4/2015 Leabman et al.
2015/0102769 A1 4/2015 Leabman et al.
2015/0108848 A1 4/2015 Joehren
2015/0115877 A1 4/2015 Aria et al.
2015/0115878 A1 4/2015 Park
2015/0123483 A1 5/2015 Leabman et al.
2015/0123496 A1 5/2015 Leabman et al.
2015/0128733 A1 5/2015 Taylor et al.
2015/0130285 A1 5/2015 Leabman et al.
2015/0148664 A1 5/2015 Stolka et al.
2015/0155737 A1 6/2015 Mayo
2015/0155738 A1 6/2015 Leabman et al.
2015/0162751 A1 6/2015 Leabman et al.
2015/0162779 A1 6/2015 Lee et al.
2015/0171656 A1 6/2015 Leabman et al.
2015/0171658 A1 6/2015 Manova-Elssibony et al.
2015/0171931 A1 6/2015 Won et al.
2015/0177326 A1 6/2015 Chakraborty et al.
2015/0188352 A1 7/2015 Peek et al.
2015/0199665 A1 7/2015 Chu
2015/0222126 A1 8/2015 Leabman et al.
2015/0236520 A1 8/2015 Baarman
2015/0244187 A1 8/2015 Horie
2015/0244201 A1 8/2015 Chu
2015/0244341 A1 8/2015 Ritter et al.
2015/0249484 A1 9/2015 Mach et al.
2015/0255989 A1 9/2015 Walley et al.
2015/0263534 A1 9/2015 Lee et al.
2015/0263548 A1 9/2015 Cooper
2015/0270741 A1 9/2015 Leabman et al.
2015/0280484 A1 10/2015 Radziemski et al.
2015/0288438 A1 10/2015 Maltsev et al.
2015/0318729 A1 11/2015 Leabman
2015/0326024 A1 11/2015 Bell et al.
2015/0326025 A1 11/2015 Bell et al.
2015/0326063 A1 11/2015 Leabman et al.
2015/0326068 A1 11/2015 Bell et al.
2015/0326069 A1 11/2015 Petras et al.
2015/0326070 A1 11/2015 Petras et al.
2015/0326072 A1 11/2015 Petras et al.
2015/0326142 A1 11/2015 Petras et al.
2015/0333528 A1 11/2015 Leabman
2015/0333529 A1 11/2015 Leabman
2015/0333573 A1 11/2015 Leabman
2015/0333800 A1 11/2015 Perry et al.
2015/0340759 A1 11/2015 Bridgelall et al.
2015/0340903 A1 11/2015 Bell et al.
2015/0340909 A1 11/2015 Bell et al.
2015/0340910 A1 11/2015 Petras et al.
2015/0340911 A1 11/2015 Bell et al.
2015/0341087 A1 11/2015 Moore et al.
2015/0349574 A1 12/2015 Leabman
2015/0358222 A1 12/2015 Berger et al.
2015/0365138 A1 12/2015 Miller et al.
2016/0005068 A1 1/2016 Im et al.
2016/0012695 A1 1/2016 Bell et al.
2016/0013656 A1 1/2016 Bell et al.
2016/0013677 A1 1/2016 Bell et al.
2016/0013678 A1 1/2016 Bell et al.
2016/0013855 A1 1/2016 Campos
2016/0020636 A1 1/2016 Khlat
2016/0020649 A1 1/2016 Bell et al.
2016/0020830 A1 1/2016 Bell et al.
2016/0042206 A1 2/2016 Pesavento et al.
2016/0054396 A1 2/2016 Bell et al.
2016/0054440 A1 2/2016 Younis
2016/0056635 A1 2/2016 Bell
2016/0056640 A1 2/2016 Mao
2016/0056669 A1 2/2016 Bell
2016/0056966 A1 2/2016 Bell
2016/0065005 A1 3/2016 Won et al.
2016/0079799 A1 3/2016 Khlat
2016/0099601 A1 4/2016 Leabman et al.
2016/0099602 A1 4/2016 Leabman et al.
2016/0099609 A1 4/2016 Leabman et al.
2016/0099610 A1 4/2016 Leabman et al.
2016/0099611 A1 4/2016 Leabman et al.
2016/0099612 A1 4/2016 Leabman et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2016/0099613	A1	4/2016	Leabman et al.
2016/0099614	A1	4/2016	Leabman et al.
2016/0099755	A1	4/2016	Leabman et al.
2016/0099756	A1	4/2016	Leabman et al.
2016/0099757	A1	4/2016	Leabman et al.
2016/0099758	A1	4/2016	Leabman et al.
2016/0100124	A1	4/2016	Leabman et al.
2016/0100312	A1	4/2016	Bell et al.
2016/0126752	A1	5/2016	Vuori et al.
2016/0126776	A1	5/2016	Kim et al.
2016/0141908	A1	5/2016	Jakl et al.
2016/0164563	A1	6/2016	Khawand et al.
2016/0181867	A1	6/2016	Daniel et al.
2016/0181873	A1	6/2016	Mitcheson et al.
2016/0191121	A1	6/2016	Bell
2016/0204622	A1	7/2016	Leabman
2016/0204642	A1	7/2016	Oh
2016/0238365	A1	8/2016	Wixey et al.
2016/0323000	A1	11/2016	Liu et al.
2016/0336804	A1	11/2016	Son et al.
2016/0339258	A1	11/2016	Perryman et al.
2016/0359367	A1	12/2016	Rothschild
2017/0005516	A9	1/2017	Leabman et al.
2017/0025903	A1	1/2017	Song et al.
2017/0026087	A1	1/2017	Tanabe
2017/0043675	A1	2/2017	Jones et al.
2017/0047784	A1	2/2017	Jung et al.
2017/0085120	A1	3/2017	Leabman et al.
2017/0085437	A1	3/2017	Condeixa et al.
2017/0092115	A1	3/2017	Sloo et al.

FOREIGN PATENT DOCUMENTS

EP	1028482	A2	8/2000
EP	1081506	A1	3/2001
EP	2397973	A1	6/2010
EP	2346136	A1	7/2011
EP	2545635	A2	1/2013
JP	2006157586	A	6/2006
JP	2007043432	A	2/2007
JP	2008167017	A	7/2008
KR	20060061776	A	6/2006
KR	20070044302	A	4/2007
KR	100755144	B1	9/2007
KR	20110132059	A	12/2011
KR	20110135540	A1	12/2011
KR	20120009843	A	2/2012
KR	20120108759	A	10/2012
KR	1020130026977	A	3/2013
WO	9952173	A2	10/1999
WO	WO 200111716	A1	2/2001
WO	2004077550	A1	9/2004
WO	2003091943	A1	11/2006
WO	WO 2006122783		11/2006
WO	2008156571	A2	12/2008
WO	2010022181	A1	2/2010
WO	WO 2010039246	A1	4/2010
WO	WO 2010138994	A1	12/2010
WO	2011112022	A2	9/2011
WO	2013035190	A1	3/2013
WO	WO 2013031988	A1	3/2013
WO	WO 2013042399	A1	3/2013
WO	WO 2013052950	A1	4/2013
WO	WO 2013105920	A2	7/2013
WO	WO 2014075103	A1	5/2014
WO	WO 2014132258	A1	9/2014
WO	WO 2014182788	A2	11/2014
WO	WO 2014182788	A3	11/2014
WO	WO 2014197472	A1	12/2014
WO	WO 2014209587	A1	12/2014
WO	WO 2015038773	A1	3/2015
WO	WO 2015097809	A1	7/2015
WO	WO 2015161323	A1	10/2015
WO	WO 2016048512	A1	3/2016
WO	WO 2016187357	A1	11/2016

OTHER PUBLICATIONS

International Search Report dated Oct. 16, 2014 corresponding to International Patent Application No. PCT/US2014/041546, 4 pages.
International Search Report dated Oct. 13, 2014 corresponding to International Patent Application No. PCT/US2014/041534, 4 pages.
International Search Report dated Nov. 12, 2014 corresponding to International Patent Application No. PCT/US2014/046956, 4 pages.
Written Opinion of the International Searching Authority dated Nov. 12, 2014 corresponding to International Patent Application No. PCT/US2014/046956, 6 pages.
International Search Report dated Sep. 12, 2014 corresponding to International Patent Application No. PCT/US2014/037072, 3 pages.
Energous Corp., Written Opinion, PCT/US2014/037170 , dated Sep. 15, 2014, 7 pgs.
Energous Corp., IPRP, PCT/US2014/037170, dated Nov. 10, 2015, 8 pgs.
Energous Corp., Written Opinion, PCT/US2014/041534, dated Oct. 13, 2014, 6 pgs.
Energous Corp., IPRP, PCT/US2014/041534, dated Dec. 29, 2015, 7 pgs.
Energous Corp., IPRP, PCT/US2014/046956, dated Jan. 19, 2016, 7 pgs.
Energous Corp., Written Opinion, PCT/US2014/037072, dated Sep. 12, 2014, 5 pgs.
Energous Corp., IPRP, PCT/US2014/037072, dated Nov. 10, 2015, 6 pgs.
Energous Corp., ISRWO, PCT/US2014/068568, dated Mar. 20, 2015, 10 pgs.
Energous Corp., IPRP, PCT/US2014/068568, dated Jun. 14, 2016, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/055195, dated Dec. 22, 2014, 11 pgs.
Energous Corp., IPRP, PCT/US2014/055195, dated Mar. 22, 2016, 9 pgs.
Energous Corp., ISRWO, PCT/US2015/067291, dated Mar. 4, 2016, 10 pgs.
Energous Corp., IPRP, PCT/US2015/067291, dated Jul. 4, 2017, 4 pgs.
Energous Corp., ISRWO, PCT/US2015/067242, dated Mar. 16, 2016, 9 pgs.
Energous Corp., IPRP, PCT/US2015/067242, dated Jun. 27, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2015/067243, dated Mar. 10, 2016, 11 pgs.
Energous Corp., IPRP, PCT/US2015/067243, dated Jun. 27, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2014/037109, dated Apr. 8, 2016, 12 pgs.
Energous Corp., IPRP, PCT/US2014/037109, dated Apr. 12, 2016, 9 pgs.
Energous Corp., ISRWO, PCT/US2015/067275, dated Mar. 3, 2016, 8 pgs.
Energous Corp., IPRP, PCT/US2015/067275, dated Jul. 4, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2015/067245, dated Mar. 17, 2016, 8 pgs.
Energous Corp., IPRP, PCT/US2015/067245, dated Jun. 27, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2014/041546, dated Oct. 16, 2014, 12 pgs.
Energous Corp., IPRP, PCT/US2014/041546, dated Dec. 29, 2015, 9 pgs.
Energous Corp., ISRWO, PCT/US2015/67250, dated Mar. 30, 2016, 11 pgs.
Energous Corp., IPRP, PCT/US2015/67250, dated Mar. 30, 2016, 10 pgs.
Energous Corp., ISRWO, PCT/US2015/067325, dated Mar. 10, 2016, 9 pgs.
Energous Corp., IPRP, PCT/US2015/067325, dated Jul. 4, 2017, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/040697, dated Oct. 1, 2014, 12 pgs.

(56) **References Cited**

OTHER PUBLICATIONS

Energous Corp., IPRP, PCT/US2014/040697, dated Dec. 8, 2015, 9 pgs.
Energous Corp., ISRWO, PCT/US2014/040705, dated Sep. 23, 2014, 8 pgs.
Energous Corp., IPRP, PCT/US2014/040705, dated Dec. 8, 2015, 6 pgs.
Energous Corp., ISRWO, PCT/US2015/067249, dated Mar. 29, 2016, 8 pgs.
Energous Corp., IPRP, PCT/US2015/067249, dated Jun. 27, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2015/067246, dated May 11, 2016, 18 pgs.
Energous Corp., IPRP, PCT/US2015/067246, dated Jun. 27, 2017, 9 pgs.
Energous Corp., ISRWO, PCT/US2014/059317, dated Feb. 24, 2015, 13 pgs.
Energous Corp., IPRP, PCT/US2014/059317, dated Apr. 12, 2016, 10 pgs.
Energous Corp., ISRWO, PCT/US2014/049669, dated Nov. 13, 2014, 10 pgs.
Energous Corp., IPRP, PCT/US2014/049669, dated Feb. 9, 2016, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/041323, dated Oct. 1, 2014, 10 pgs.
Energous Corp., IPRP, PCT/US2014/041323, dated Dec. 22, 2015, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/048002, dated Nov. 13, 2014, 11 pgs.
Energous Corp., IPRP, PCT/US2014/048002, dated Feb. 12, 2015, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/062682, dated Feb. 12, 2015, 10 pgs.
Energous Corp., IPRP, PCT/US2014/062682, dated May 3, 2016, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/049666, dated Nov. 10, 2014, 7 pgs.
Energous Corp., IPRP, PCT/US2014/049666, dated Feb. 9, 2016, 5 pgs.
Energous Corp., ISRWO, PCT/US2014/046961, dated Nov. 24, 2014, 16 pgs.
Energous Corp., IPRP, PCT/US2014/046961, dated Jan. 19, 2016, 8 pgs.
Energous Corp., ISRWO, PCT/US2015/067279, dated Mar. 11, 2015, 13 pgs.
Energous Corp., IPRP, PCT/US2015/067279, dated Jul. 4, 2017, 7 pgs.
Energous Corp., ISRWO, PCT/US2014/041342, dated Jan. 27, 2015, 10 pgs.
Energous Corp., IPRP, PCT/US2014/041342, dated Dec. 15, 2015, 8 pgs.
Energous Corp., ISRWO, PCT/US2014/046941, dated Nov. 6, 2014, 11 pgs.
Energous Corp., IPRP, PCT/US2014/046941, dated Jan. 19, 2016, 9 pgs.
Energous Corp., ISRWO, PCT/US2014/062661, dated Jan. 27, 2015, 12 pgs.
Energous Corp., IPRP, PCT/US2014/062661, dated May 3, 2016, 10 pgs.
Energous Corp., ISRWO, PCT/US2014/059871, dated Jan. 23, 2015, 12 pgs.
Energous Corp., IPRP, PCT/US2014/059871, dated Apr. 12, 2016, 9 pgs.
Energous Corp., ISRWO, PCT/US2014/045102, dated Oct. 28, 2014, 14 pgs.
Energous Corp., IPRP, PCT/US2014/045102, dated Jan. 12, 2016, 11 pgs.
Energous Corp., ISRWO, PCT/US2014/059340, dated Jan. 15, 2015, 13 pgs.
Energous Corp., IPRP, PCT/US2014/059340, dated Apr. 12, 2016, 11 pgs.
Energous Corp., ISRWO, PCT/US2015/067282, dated Jul. 5, 2016, 7 pgs.
Energous Corp., IPRP, PCT/US2015/067282, dated Jul. 4, 2017, 6 pgs.
Energous Corp., ISRWO, PCT/US2014/041558, dated Oct. 10, 2014, 8 pgs.
Energous Corp., IPRP, PCT/US2014/041558, dated Dec. 29, 2015, 6 pgs.
Energous Corp., ISRWO, PCT/US2014/045119, dated Oct. 13, 2014, 11 pgs.
Energous Corp., IPRP, PCT/US2014/045119, dated Jan. 12, 2016, 9 pgs.
Energous Corp., ISRWO PCT/US2014/045237, dated Oct. 13, 2014, 16 pgs.
Energous Corp., IPRP , PCT/US2014/045237, dated Jan. 12, 2016, 12 pgs.
Energous Corp., ISRWO , PCT/US2014/054897, dated Feb. 17, 2015, 10 pgs.
Energous Corp., IPRP , PCT/US2014/054897, dated Mar. 15, 2016, 8 pgs.
Energous Corp., ISRWO , PCT/US2015/067334, dated Mar. 3, 2016, 6 pgs.
Energous Corp., IPRP , PCT/US2015/067334, dated Jul. 4, 2017, 5 pgs.
Energous Corp., ISRWO , PCT/US2014/047963, dated Nov. 7, 2014, 13 pgs.
Energous Corp., IPRP , PCT/US2014/047963, dated Jan. 26, 2016, 10 pgs.
Energous Corp., ISRWO , PCT/US2014/054891, dated Dec. 18, 2014, 12 pgs.
Energous Corp., IPRP , PCT/US2014/054891, dated Mar. 15, 2016, 10 pgs.
Energous Corp., ISRWO , PCT/US2014/054953, dated Dec. 4, 2014, 7 pgs.
Energous Corp., IPRP , PCT/US2014/054953, dated Mar. 22, 2016, 5 pgs.
Energous Corp., ISRWO , PCT/US2015/067294, dated Mar. 29, 2016, 7 pgs.
Energous Corp., IPRP , PCT/US2015/067294, dated Jul. 4, 2017, 6 pgs.
Energous Corp., ISRWO , PCT/US2014/062672 dated Jan. 26, 2015, 11 pgs.
Energous Corp., IPRP , PCT/US2014/062672 dated May 10, 2016, 8 pgs.
Energous Corp., ISRWO , PCT/US2014/044810 dated Oct. 21, 2014, 12 pgs.
Energous Corp., IPRP , PCT/US2014/044810, dated Jan. 5, 2016, 10 pgs.
Energous Corp., ISRWO , PCT/US2015/067271, dated Mar. 11, 2016, 6 pgs.
Energous Corp., IPRP , PCT/US2015/067271, dated Jul. 4, 2017, 5 pgs.
Energous Corp., ISRWO , PCT/US2014/040648, dated Oct. 10, 2014, 11 pgs.
Energous Corp., IPRP , PCT/US2014/040648, dated Dec. 8, 2015, 8 pgs.
Energous Corp., ISRWO , PCT/US2014/049673, dated Nov. 18, 2014, 10 pgs.
Energous Corp., IPRP , PCT/US2014/049673, dated Feb. 9, 2016, 6 pgs.
Energous Corp., ISRWO , PCT/US2014/068282, dated Mar. 19, 2015, 13 pgs.
Energous Corp., IPRP, PCT/US2014/068282, dated Jun. 7, 2016, 10 pgs.
Energous Corp., ISRWO, PCT/US2014/068586, dated Mar. 20, 2015, 11 pgs.
Energous Corp., IPRP, PCT/US2014/068586, dated Jun. 14, 2016, 8 pgs.
Energous Corp., ISRWO, PCT/US2016/068504, dated Mar. 30, 2017, 8 pgs.

(56) **References Cited**

OTHER PUBLICATIONS

Energous Corp., ISRWO, PCT/US2016/068495, dated Mar. 30, 2017, 9 pgs.
Energous Corp., ISRWO, PCT/US2015/067287, dated Feb. 2, 2016, 8 pgs.
Energous Corp., IPRP, PCT/US2015/067287, dated Jul. 4, 2017, 6 pgs.
Energous Corp., ISRWO, PCT/US2016/068551, dated Mar. 17, 2017, 8 pgs.
Energous Corp., ISRWO, PCT/US2016/068498, dated May 17, 2017, 8 pgs.
Energous Corp., ISRWO, PCT/US2016/068993, dated Mar. 13, 2017, 12 pgs.
Energous Corp., ISRWO, PCT/US2016/068565, dated Mar. 8, 2017, 11 pgs.
Energous Corp., ISRWO, PCT/US2016/068987, dated May 8, 2017, 10 pgs.
Energous Corp., ISRWO, PCT/US2016/069316 , dated Mar. 16, 2017, 15 pgs.
Supplementary European Search Report, EP Patent Application No. EP14818136-5, dated Jul. 21, 2016, 9 pgs.
European Search Report, EP Patent Application No. EP16189052.0, dated Jan. 31, 2017, 11 pgs.
European Search Report, EP Patent Application No. EP16189319-3, dated Feb. 1, 2017, 9 pgs.
European Search Report, EP Patent Application No. EP14822971, dated Feb. 1, 2017, 9 pgs.
European Search Report, EP Patent Application No. EP16189987, dated Feb. 1, 2017, 8 pgs.
European Search Report, EP Patent Application No. 16196205.5, dated Mar. 28, 2017, 7 pgs.
European Search Report, EP Patent Application No. 16189300, dated Feb. 28, 2017, 4 pgs.
European Search Report, EP Patent Application No. 16189988.5, dated Mar. 1, 2017, 4 pgs.
European Search Report, EP Patent Application No. 16189982.5, dated Jan. 27, 2017, 9 pgs.
European Search Report, EP Patent Application No. 16189974, dated Mar. 2, 2017, 5 pgs.
European Search Report, EP Patent Application No. 16193743, dated Feb. 2, 2017, 5 pgs.
European Search Report, EP Patent Application No. 14868901.1, dated Jul. 7, 2017, 5 pgs.
L.H. Hsieh et al. Development of a Retrodirective Wireless Microwave Power Transmission System, IEEE, 2003 pp. 393-396.
B.D. Van Veen et al., Beamforming: A Versatile Approach to Spatial Filtering, IEEE, ASSP Magazine, Apr. 1988, pp. 4-24.
Leabman, Adaptive Band-partitioning for Interference Cancellation in Communication System, Thesis Massachusetts Institute of Technology, Feb. 1997, pp. 1-70.
Panda, SIW based Slot Array Antenna and Power Management Circuit for Wireless Energy Harvesting Applications, IEEE APSURSI, Jul. 2012, 2 pgs.
Singh, Wireless Power Transfer Using Metamaterial Bonded Microstrip Antenna for Smart Grid WSN: In Fourth International Conference on Advances in Computing and Communications (ICACC), Aug. 27-29, 2014, Abstract 299.
T. Gill et al. "A System for Change Detection and Human Recognition in Voxel Space using the Microsoft Kinect Sensor," 2011 IEEE Applied Imagery Pattern Recognition Workshop. 8 pgs.
J. Han et al. Enhanced Computer Vision with Microsoft Kinect Sensor: A Review, IEEE Transactions on Cybernetics vol. 43, No. 5. pp. 1318-1334.
Zhai, "A Practical wireless charging system based on ultra-wideband retro-reflective beamforming" 2010 IEEE Antennas and Propagation Society International Symposium, Toronto, ON 2010, pp. 1-4.
Mao: BeamStar: An Edge-Based Approach to Routing in Wireless Sensors Networks, IEEE Transactions on Mobile Computing, IEEE Service Center, Los Alamitos, CA US, vol. 6, No. 11, Nov. 1, 2007, 13 pgs.
Smolders—Institute of Electrical 1-15 and Electronics Engineers: "Broadband microstrip array antennas" Digest of the Antennas and Propagation Society International Symposium. Seattle, WA Jun. 19-24, 1994. Abstract 3 pgs.
Paolo Nenzi et al; "U-Helix: On-chip short conical antenna", 2013 7th European Conference on Antennas and Propagation (EUCAP), ISBN:978-1-4673-2187-7, IEEE, Apr. 8, 2013, 5 pgs.
Adamiuk G et al; "Compact, Dual-Polarized UWB-Antanna, Embedded in a Dielectric" IEEE Transactions on Antenna and Propagation, IEEE Service Center, Piscataway, NJ, US vol. 56, No. 2, ISSN: 0018-926X, abstract; Figure 1, Feb. 1, 2010, 8 pgs.
Mascarenas et al.; "Experimental Studies of Using Wireless Energy Transmission for Powering Embedded Sensor Nodes." Nov. 28, 2009, Journal of Sound and Vibration, pp. 2421-2433.

* cited by examiner

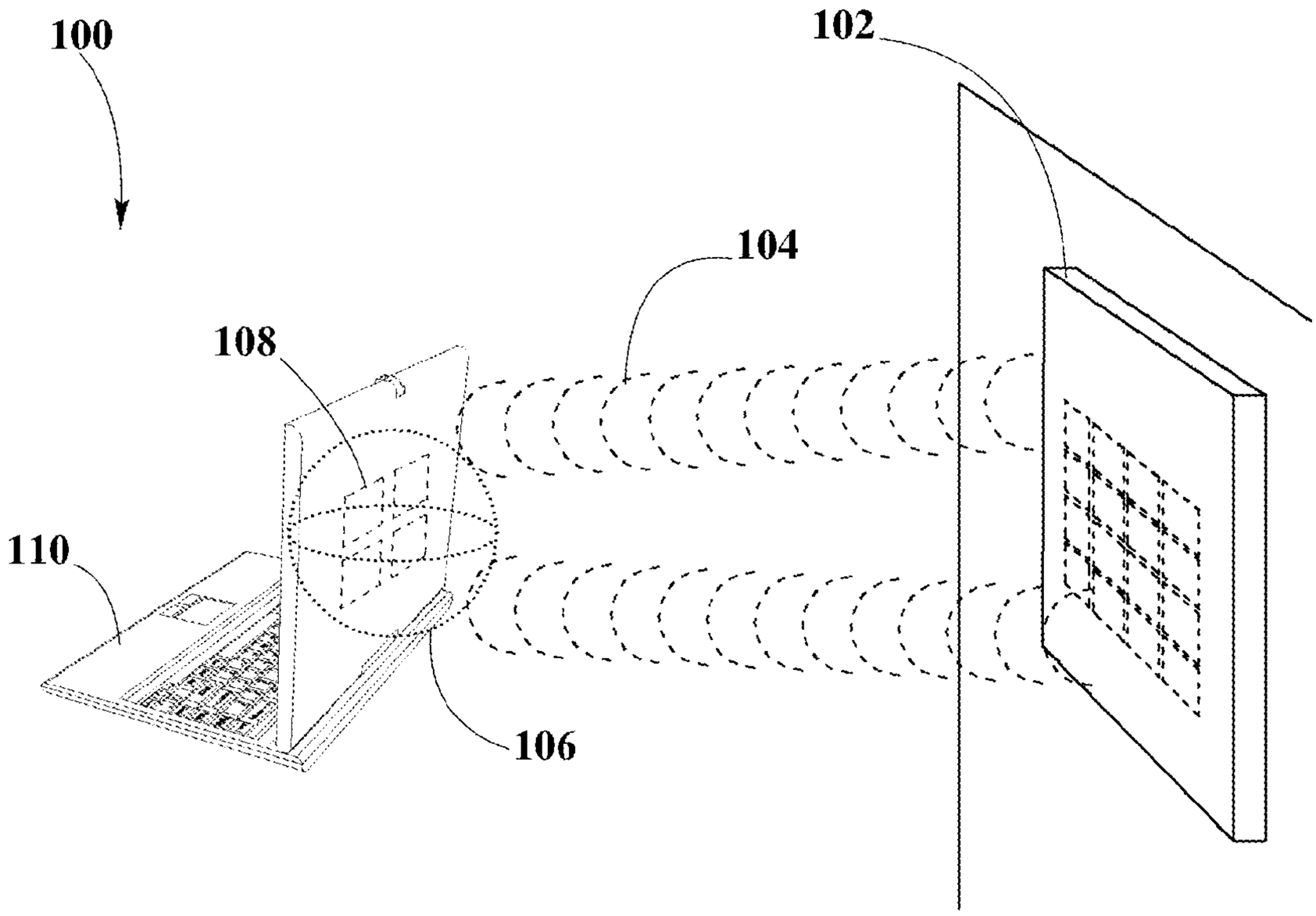


FIG. 1

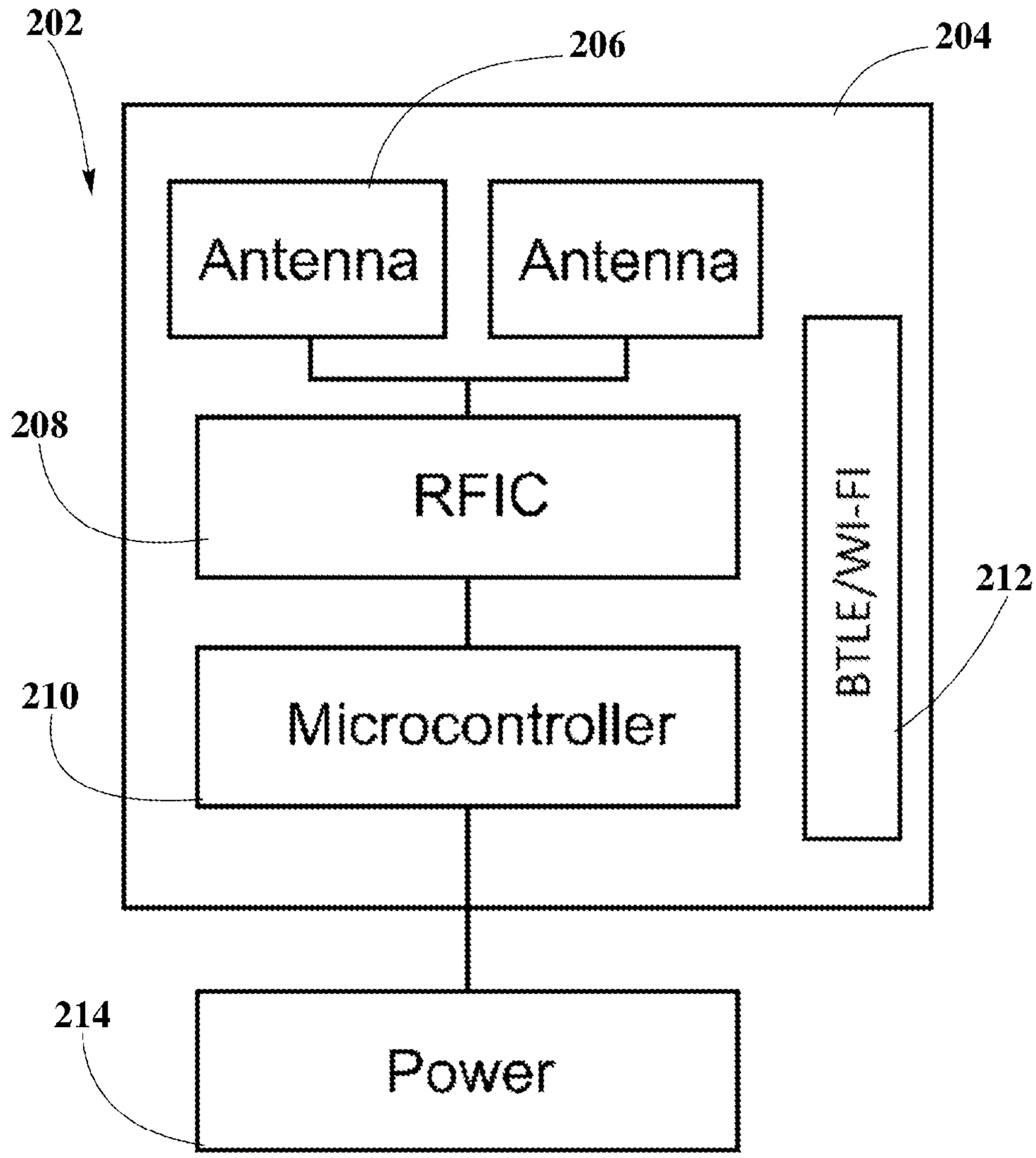

202
206
204
Antenna
Antenna
208
RFIC
BTLE/WI-FI
212
210
Microcontroller
214
Power

FIG. 2

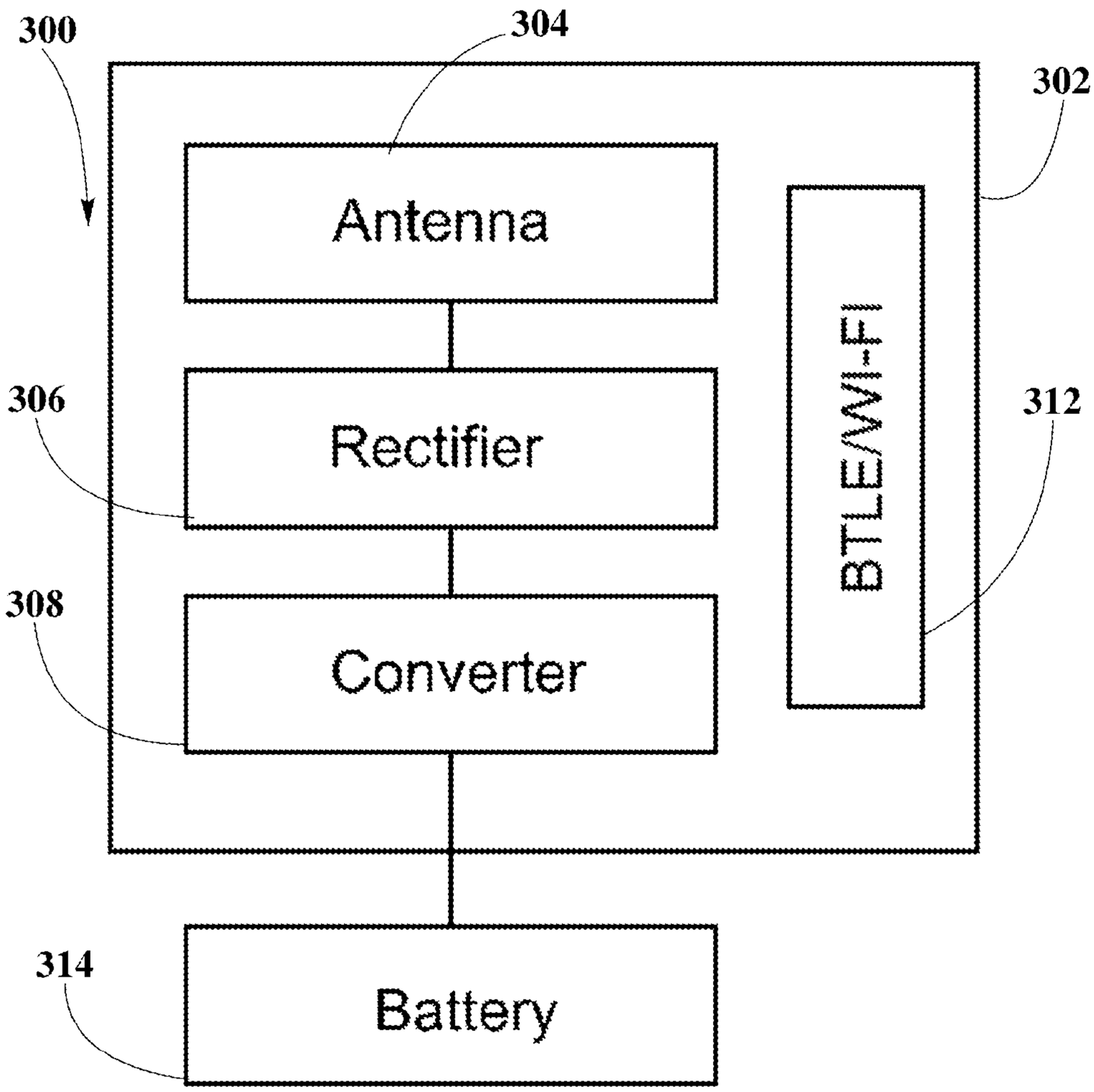

300
304
302
Antenna
306
Rectifier
312
BTLE/MI-FI
308
Converter
314
Battery

FIG. 3

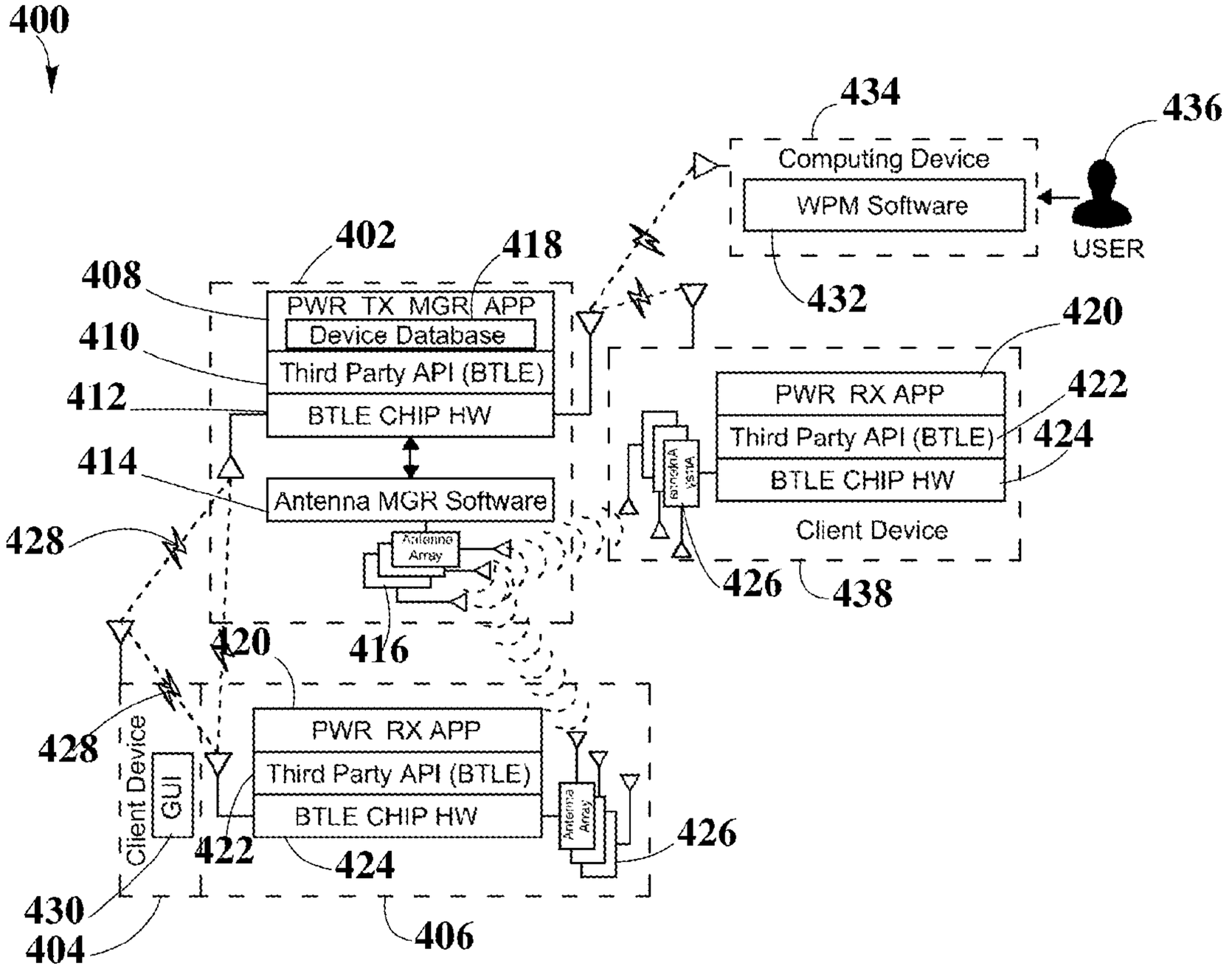

400
434
436
Computing Device
WPM Software
USER
432
402
418
408
410
412
414
PWR TX MGR APP
Device Database
Third Party API (BTLE)
BTLE CHIP HW
Antenna MGR Software
Antenna Array
420
PWR RX APP
422
424
Third Party API (BTLE)
BTLE CHIP HW
Antenna Array
Client Device
426
438
428
416
420
PWR RX APP
Third Party API (BTLE)
BTLE CHIP HW
Client Device
GUI
422
424
426
428
430
404
406

FIG. 4

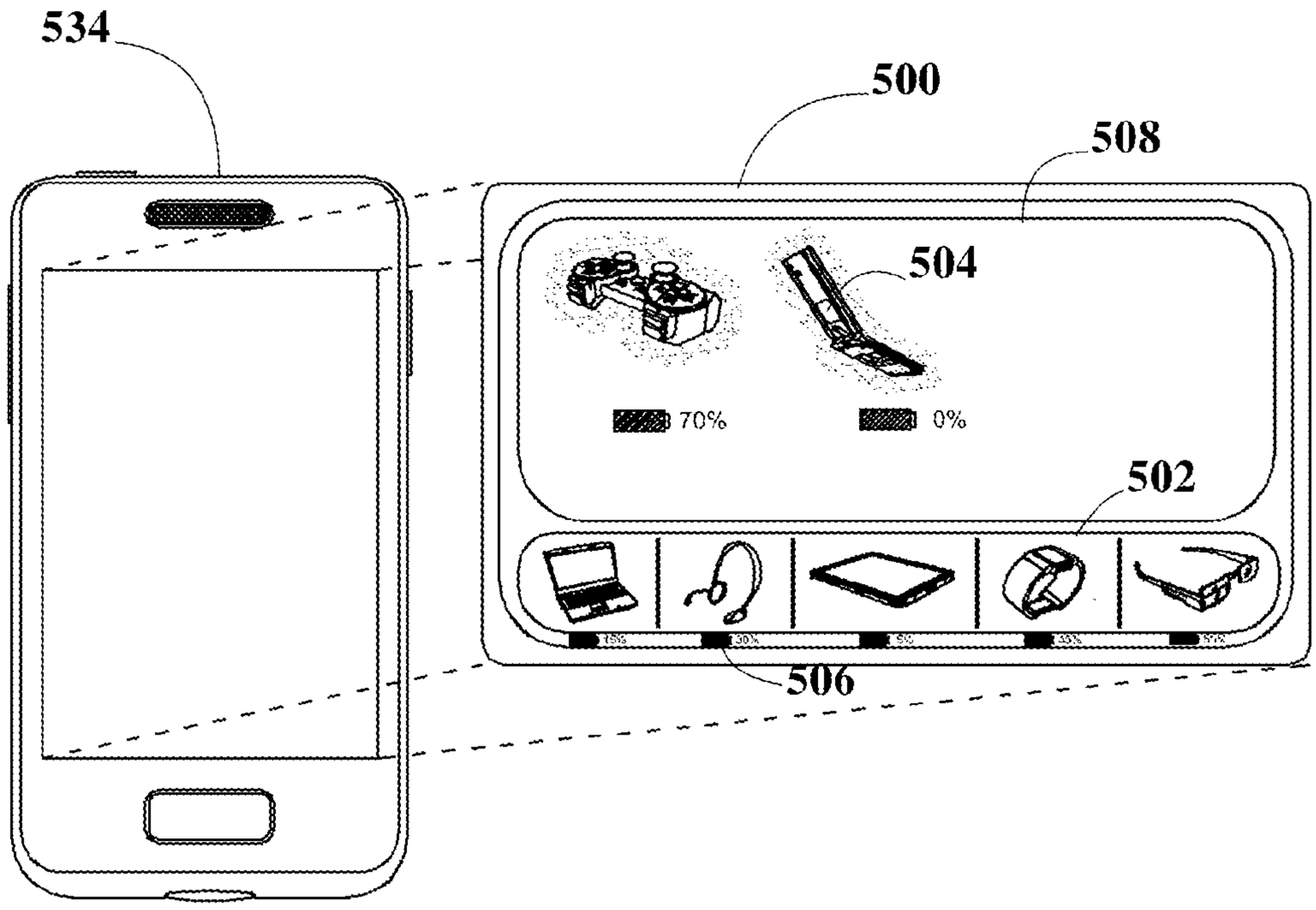


FIG. 5

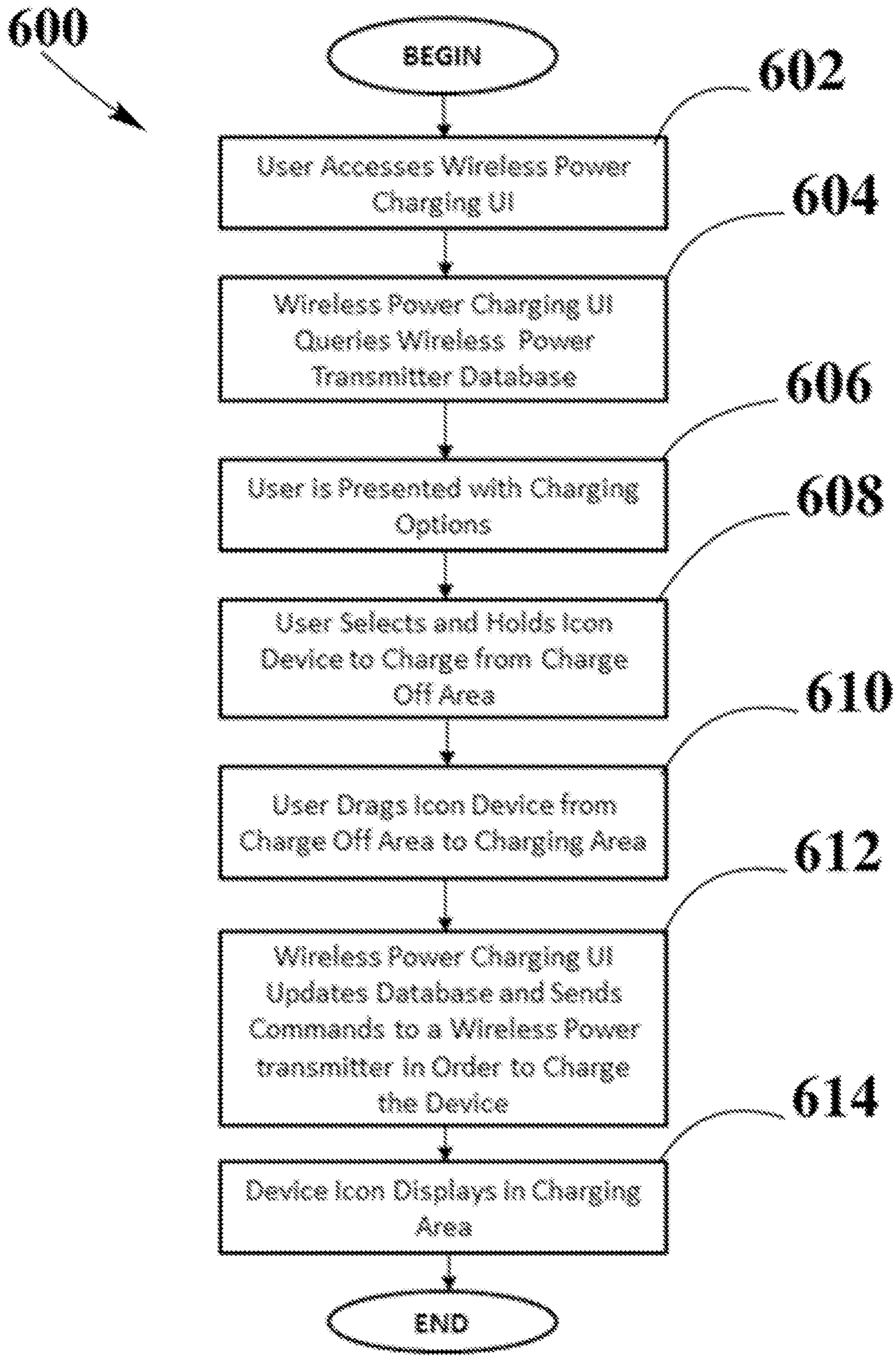

600
BEGIN
602
User Accesses Wireless Power Charging UI
604
Wireless Power Charging UI Queries Wireless Power Transmitter Database
606
User is Presented with Charging Options
608
User Selects and Holds Icon Device to Charge from Charge Off Area
610
User Drags Icon Device from Charge Off Area to Charging Area
612
Wireless Power Charging UI Updates Database and Sends Commands to a Wireless Power transmitter in Order to Charge the Device
614
Device Icon Displays In Charging Area
END

FIG 6

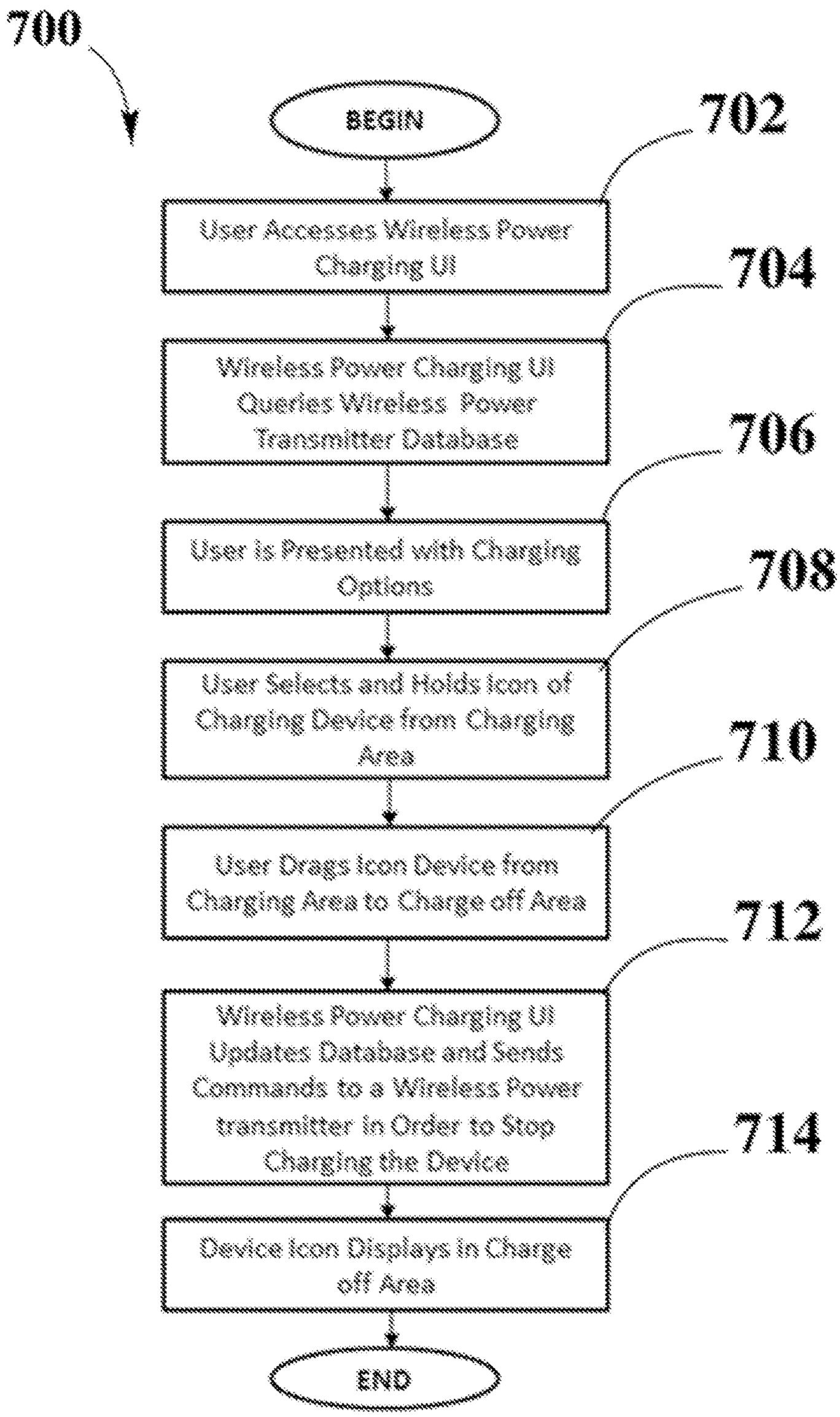

700
BEGIN
702
User Accesses Wireless Power Charging UI
704
Wireless Power Charging UI Queries Wireless Power Transmitter Database
706
User is Presented with Charging Options
708
User Selects and Holds Icon of Charging Device from Charging Area
710
User Drags Icon Device from Charging Area to Charge off Area
712
Wireless Power Charging UI Updates Database and Sends Commands to a Wireless Power transmitter in Order to Stop Charging the Device
714
Device Icon Displays in Charge off Area
END

FIG 7

SYSTEM AND METHOD FOR MANUALLY SELECTING AND DESELECTING DEVICES TO CHARGE IN A WIRELESS POWER NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

The present disclosure is related to U.S. patent application Ser. No. 13/891,399 entitled Receivers For Wireless Power Transmission, filed May 10, 2013, U.S. patent application Ser. No. 13/891,430 entitled Methodology For Pocket-Forming, filed May 10, 2013, and U.S. patent application Ser. No. 13/891,445 entitled Transmitters For Wireless Power Transmission, filed May 10, 2013, each of which are incorporated by reference in their entirety herein.

N/A

BACKGROUND

Field of the Disclosure

The present disclosure relates in general to wireless power transmission, and more specifically to a system software for enabling a user to select and deselect devices to charge in a wireless power transmission network.

Background Information

Electronic devices such as laptop computers, smartphones, portable gaming devices, tablets and so forth may require power for performing their intended functions. This may require having to charge electronic equipment at least once a day, or in high-demand electronic devices more than once a day. Such an activity may be tedious and may represent a burden to users. For example, a user may be required to carry chargers in case his electronic equipment is lacking power. In addition, users have to find available power sources to connect to. Lastly, users must plugin to a wall power socket or other power supply to be able to charge his or her electronic device.

An approach to mitigate this issue may include using RF waves through suitable power transmission techniques such as pocket-forming. This approach may provide wireless power transmission while eliminating the use of wires or pads for charging devices. In addition, electronic equipment may require less components as typical wall chargers may not be required.

In some cases, even batteries may be eliminated as a device may fully be powered wirelessly. This approach may enable the creation of wireless power networks similar in structure to regular wireless local area networks (WLAN) where a wireless access point is used to provide internet or intranet access to different devices. An access point or wireless transmitter may provide wireless power charging to different receiver devices.

Electric energy is an important and expensive resource. At times improper handling of electric energy may lead to waste of the valuable resource, in other cases too much electrical current may damage certain devices. It may also be beneficial in some cases to allow power sources to prioritize certain devices over others. Thus, a need exists for selecting and deselecting devices to charge in a wireless power network.

SUMMARY

Disclosed is a system and method for managing a wireless power network. The wireless power network may include wireless power transmitters with an embedded wireless power management application. This power transmitter manager application may include a device database where information about receiver devices may be stored.

The wireless power network may include a plurality of client devices with wireless power receivers built in as part of the device or adapted externally. Wireless power receivers may include a power receiver application configured to communicate with the power transmitter manager application in a wireless power transmitter. Communication between wireless power transmitters and wireless power receivers may be achieved using standard network communication protocols such as, Bluetooth, Bluetooth Low Energy, WIFI or the like.

The wireless power network may further include a wireless power application. The wireless power manager may be a software application, which may be hosted in a computing device, which may be either a local or cloud-based physical or virtual server, or a mobile or hand-held or wearable computing device such as a smart phone, tablet, notebook, laptop or the like. The wireless power manager application may communicate with a power transmitter manager application to update information in the wireless power manager's database at the transmitter, such as: statuses, power schedules, setting priorities, authentication credentials, present charge and tracking states, and the like. Wireless power manager may include a GUI which may be used by a user to perform management tasks in the wireless power transmission network. The GUI may be a local application interface on the computer running the wireless power management application software, or the GUI may be one or more web pages hosted by said computer.

The wireless power manager may include a software GUI for automatically or manually selecting and deselecting one or more devices to be charged in the wireless power network. The software GUI may include a charge off area, displaying icons of all devices that are currently not being charged in the wireless power network. The software module may additionally include a charging area displaying devices in the wireless power network that are receiving charge. The software GUI may additionally include an automatic charge area displaying icons of devices that have charging enabled or disabled automatically. A user may select a device icon from either the charge off area or automatic charge area and drag it to the charging area in order to enable the device to receive charge in the wireless power network. A user may also select icon devices from the either the charging area or the automatic charge area and drag them to the charge off area in order to disable the device from receiving charge. A user may also drag a device icon from either charge-off area or charging area to the automatic-charge area of the view screen, to command the wireless power transmitter to automatically make the decision to enable or disable charging the device based on status criteria, such as, but not limited to, time, physical location or hot spot, by user name, or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure can be better understood by referring to the following figures. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the disclosure. In the figures, reference numerals designate corresponding parts throughout the different views.

FIG. **1** illustrates a wireless power transmission example situation using pocket-forming.

FIG. **2** illustrates a component level embodiment for a transmitter, according to an embodiment.

FIG. **3** illustrates a component level embodiment for a receiver, according to an embodiment.

FIG. **4** illustrates an exemplary embodiment of a wireless power network including a transmitter an wireless receivers.

FIG. **5** is an exemplary embodiment of a Wireless Power Manager Graphic User Interface (GUI).

FIG. **6** is a flowchart of a process to manually enable power charging of a device in a wireless power network.

FIG. **7** is a flowchart of a process for disabling a device from charging in a wireless power network.

DETAILED DESCRIPTION

The present disclosure is here described in detail with reference to embodiments illustrated in the drawings, which form a part here. Other embodiments may be used and/or other changes may be made without departing from the spirit or scope of the present disclosure. The illustrative embodiments described in the detailed description are not meant to be limiting of the subject matter presented here.

Definitions

As used here, the following terms may have the following definitions:

"Pocket-forming" may refer to generating two or more RF waves which converge in 3-d space, forming controlled constructive and destructive interference patterns.

"Pockets of energy" may refer to areas or regions of space where energy or power may accumulate in the form of constructive interference patterns of RF waves.

"Null-space" may refer to areas or regions of space where pockets of energy do not form because of destructive interference patterns of RF waves.

"Transmitter" may refer to a device, including a chip which may generate two or more RF signals, at least one RF signal being phase shifted and gain adjusted with respect to other RF signals, substantially all of which pass through one or more RF antenna such that focused RF signals are directed to a target.

"Receiver" may refer to a device including at least one antenna element, at least one rectifying circuit and at least one power converter, which may utilize pockets of energy for powering, or charging an electronic device.

"Adaptive pocket-forming" may refer to dynamically adjusting pocket-forming to regulate power on one or more targeted receivers.

"Scheduling records" may refer to records stored in a database that contain information related to charging schedules and priorities of different receivers or devices.

"Power" sometimes is a colloquial reference to electrical energy, in the sense of "power transmission lines" which technically transmit energy, since "power" is the *rate* at which electric energy is transferred by an electric circuit. Thus, "wireless power transmission" within the context of this claim refers technically to mean "wireless energy transmission," and "wireless power system" also means "wireless energy system."

"BTLE" or "BLE": Bluetooth Low Energy communication hardware and/or software.

"Charge" in the context of this invention, refers to when a wireless power receiver converts RF energy, being received by its antenna, into electrical energy that is transmitted through an electrical circuit connection from said power receiver to an electrically connected client device using said electrical energy to charge the battery of the client device, if it has a battery, or to simply power the client device.

Description of the Drawings

Reference will now be made to the exemplary embodiments illustrated in the drawings, and specific language will be used here to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Alterations and further modifications of the inventive features illustrated here, and additional applications of the principles of the inventions as illustrated here, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention.

Wireless Power Transmission System Including Disclosed Concepts:

Methods disclosed here may be part of a wireless power transmission system including two or more wireless power transmitters, one or more wireless power receivers, one or more optional system management servers, and one or more optional mobile or hand-held computers, smart phones, or the like, that run the system management GUI app. This app may be made available at, downloaded, and installed from a public software app store or digital application distribution platform, such as Apple's iTunes, Google's Play Store, Amazon's Appstore, and the like.

The power transmitters and management servers may all communicate with each other through a distributed system database, and may also communicate present status and any status change to a remote information service that may be located in the Internet cloud.

One or more wireless power transmitters may automatically transmit power to any single wireless power receiver that is close enough for it to establish a communication connection with, using a suitable communication technology, including Bluetooth Low Energy or the like. Said receiver may then power or charge an electrically connected client device, such as mobile device, toy, remote control, lighting device, and the like. A single wireless power transmitter may also power multiple wireless power receivers simultaneously.

Alternately, the system can be configured by the system management GUI to automatically only transmit power to specific wireless power receivers depending on specific system criteria or conditions, such as the time or hour of the day for automatic time-based scheduled power transmission, power receiver physical location, owner of client device, or other any other suitable conditions and/or criteria.

The wireless power receiver is connected electrically to a client device, such a mobile phone, portable light, TV remote control, or any device that would otherwise require a battery or connection to wall power. In one or more embodiments, devices requiring batteries can have traditional batteries replaced by wireless power receiver batteries. The wireless power receiver then receives energy transmitted from the power transmitter, into receiver's antenna, rectifies, conditions, and sends the resulting electrical energy, through an electrical relay switch, to the electrically connected client device to power it or charge it.

A wireless power transmitter can transmit power to a wireless power receiver, which, in response, can power or charge its associated client device while device is in use or in motion anywhere within the power transmission range of the wireless power transmitter. The wireless power transmitter can power multiple devices at the same time.

The wireless power transmitter establishes a real-time communication connection with each receiver for the pur-

pose of receiving feedback in real-time (such as 100 samples per second). This feedback from each receiver includes the measurement of energy presently being received, which is used by the transmitter to control the direction of the transmitter's antenna array so that it stays aimed at the receiver, even if the receiver moves to a different physical 3-D location or is in 3-D motion that changes its physical 3-D location.

Multiple wireless power transmitters can power a given, single receiver, in order to substantially increase power to it.

When a transmitter is done transmitting power to a receiver, it may communicate to the receiver that power transmission has ended, and disconnect communication. The wireless power transmitter may then examine its copy of the distributed system database to determine which, if any, receivers in power range it should next transmit power to.

FIG. **1** illustrates wireless power transmission **100** using pocket-forming. A transmitter **102** may transmit controlled Radio Frequency (RF) waves **104** which may converge in 3-d space. These RF waves may be controlled through phase and/or relative amplitude adjustments to form constructive and destructive interference patterns (pocket-forming). Pockets of energy **106** may form at constructive interference patterns and can be 3-Dimensional in shape whereas null-spaces may be generated at destructive interference patterns. A receiver **108** may then utilize pockets of energy produced by pocket-forming for charging or powering an electronic device, for example a laptop computer **110** and thus effectively providing wireless power transmission **100**. In some embodiments, there can be multiple transmitters **102** and/or multiple receivers **108** for powering various electronic devices, for example smartphones, tablets, music players, toys and others at the same time. In other embodiments, adaptive pocket-forming may be used to regulate power on electronic devices.

FIG. **2** illustrates a component level embodiment for a transmitter **202** which may be utilized to provide wireless power transmission **100** as described in FIG. **1**. Transmitter **202** may include a housing **204** where at least two or more power transmitter antenna elements **206**, at least one RF integrated circuit (RFIC **208**), at least one digital signal processor (DSP) or micro-controller **210**, and one optional communications component **212** may be included. Housing **204** can be made of any suitable material which may allow for signal or wave transmission and/or reception, for example plastic or hard rubber. Antenna elements **206** may include suitable antenna types for operating in frequency bands such as 900 MHz, 2.5 GHz or 5.8 GHz as these frequency bands conform to Federal Communications Commission (FCC) regulations part **18** (Industrial, Scientific and Medical equipment). Antenna elements **206** may include vertical or horizontal polarization, right hand or left hand polarization, elliptical polarization, or other suitable polarizations as well as suitable polarization combinations. Suitable antenna types may include, for example, patch antennas with heights from about ⅛ inches to about 6 inch and widths from about ⅛ inches to about 6 inch. Other antenna elements **206** types can be used, for example meta-materials, dipole antennas among others. RFIC **208** may include a proprietary chip for adjusting phases and/or relative magnitudes of RF signals which may serve as inputs for antenna elements **206** for controlling pocket-forming. These RF signals may be produced using an external power supply **214** and a local oscillator chip (not shown) using a suitable piezoelectric material. Micro-controller **210** may then process information sent by a receiver through its own antenna elements for determining optimum times and locations for pocket-forming. In some embodiments, the foregoing may be achieved through communications component **212**. Communications component **212** may be based on standard wireless communication protocols which may include Bluetooth, Wi-Fi or ZigBee. In addition, communications component **212** may be used to transfer other information such as an identifier for the device or user, battery level, location or other such information. Other communications component **212** which may be used include radar, infrared cameras or sound devices for sonic triangulation for determining the device's position.

Multiple transmitter **202** units may be placed together in the same area to deliver more power to individual power receivers or to power more receivers at the same time, said power receivers being within power reception range of all the power transmitters **202**.

FIG. **3** illustrates a component level embodiment for a receiver **300** which can be used for powering or charging an electronic device as exemplified in wireless power transmission **100**. Receiver **300** may include a housing **302** where at least one antenna element **304**, one rectifier **306**, one power converter **308** and an optional communications component **312** may be included. Housing **302** can be made of any suitable material which may allow for signal or wave transmission and/or reception, for example plastic or hard rubber. Housing **302** may be an external hardware that may be added to different electronic equipment, for example in the form of cases, or can be embedded within electronic equipment as well. Antenna element **304** may include suitable antenna types for operating in frequency bands similar to the bands described for transmitter **202** from FIG. **2**. Antenna element **304** may include vertical or horizontal polarization, right hand or left hand polarization, elliptical polarization, or other suitable polarizations as well as suitable polarization combinations. Using multiple polarizations can be beneficial in devices where there may not be a preferred orientation during usage or whose orientation may vary continuously through time, for example a smartphone or portable gaming system. On the contrary, for devices with well-defined orientations, for example a two-handed video game controller, there might be a preferred polarization for antennas which may dictate a ratio for the number of antennas of a given polarization. Suitable antenna types may include patch antennas with heights from about ⅛ inches to about 6 inch and widths from about ⅛ inches to about 6 inch. Patch antennas may have the advantage that polarization may depend on connectivity, i.e. depending on which side the patch is fed, the polarization may change. This may further prove advantageous as a receiver, such as receiver **300**, may dynamically modify its antenna polarization to optimize wireless power transmission. Rectifier **306** may include diodes or resistors, inductors or capacitors to rectify the alternating current (AC) voltage generated by antenna element **304** to direct current (DC) voltage. Rectifier **306** may be placed as close as is technically possible to antenna element **304** to minimize losses. After rectifying AC voltage, DC voltage may be regulated using power converter **308**. Power converter **308** can be a DC-DC converter which may help provide a constant voltage output, regardless of input, to an electronic device, or as in this embodiment to a battery **314**. Typical voltage outputs can be from about 5 volts to about 10 volts. Lastly, communications component **312**, similar to that of transmitter **202** from FIG. **2**, may be included in receiver **300** to communicate with a transmitter **202** or to other electronic equipment.

FIG. **4** shows an exemplary embodiment of a wireless power network **400** in which one or more embodiments of

the present disclosure may operate. Wireless power network **400** may include communication between wireless power transmitter **402** and one or more wireless powered receivers. Wireless powered receivers may include a client device **404** with an adaptable paired receiver **406** that may enable wireless power transmission to the client device **404**. In another embodiment, a client device **438** may include a wireless power receiver **406** built in as part of the hardware of the device. Client device **404** may be any device which uses an energy power source, such as, laptop computers, stationary computers, mobile phones, tablets, mobile gaming devices, televisions, radios and/or any set of appliances that may require or benefit from an electrical power source.

In one embodiment, wireless power transmitter **402** may include a microprocessor that integrates a power transmitter manager app **408** (PWR TX MGR APP) as embedded software, and a third party application programming interface **410** (Third Party API) for a Bluetooth Low Energy chip **412** (BTLE CHIP HW). Bluetooth Low Energy chip **412** may enable communication between wireless power transmitter **402** and wireless power receivers **406**. Wireless power transmitter **402** may also include an antenna manager software **414** (Antenna MGR Software) to control an RF antenna array **416** that may be used to form controlled RF waves which may converge in 3-D space and create pockets of energy around wireless powered receivers. In some embodiments, Bluetooth Low Energy chip **412** may also be of other types of wireless communication protocols such as WiFi or the like.

Power transmitter manager app **408** may call third party application programming interface **410** for running a plurality of functions such as start a connection, end a connection, and send data among others. Third party application programming interface **410** may command Bluetooth Low Energy chip **412** according to the functions called by power transmitter manager app **408**.

Power transmitter manager app **408** may also include a database **418**, which may store relevant information from client devices **404**, and receivers **406** such as, identification for a client device or power receiver, measured hardware values such as antenna voltage for a power receiver **406**, status, configuration, location, signal strength and/or any relevant information from a client device **404** or receiver **406**.

Third party application programming interface **410** at the same time may call power transmitter manager app **408** through a callback function which may be registered in the power transmitter manager app **408** at boot time. Third party application programming interface **410** may have a timer callback that may callback at the rate of ten times a second, and may send callbacks every time a connection begins, a connection ends, a connection is attempted, or a message is received.

Wireless power receiver **406** may include a power receiver app **420** (PWR RX APP), a third party application programming interface **422** (Third party API) for a Bluetooth Low Energy chip **424** (BTLE CHIP HW), and a RF antenna array **426** which may be used to receive and utilize the pockets of energy sent from wireless power transmitter **402**.

Power receiver app **420** may call third party application programming interface **422** for running a plurality of functions such as start a connection, end the connection, and send data among others. Third party application programming interface **422** may have a timer callback that may callback at the rate of ten times a second and may send callbacks every time a connection begins, a connection ends, a connection is attempted, or message is received.

Client device **404** may be paired to an adaptable paired receiver **406** via a BTLE connection **428**. A graphical user interface (GUI **430**) may be used to manage the wireless power network from a client device **404**. GUI **430** may be a software module that may be downloaded from any suitable application store and may run on any suitable operating system such as iOS and Android, among others. Client device **404** may also communicate with wireless power transmitter **402** via a BTLE connection **428** to send important data such as client device identification, as well as battery level information, geographic location data, manual charge commands, power schedule configuration, or other information that may be of use for the wireless power transmitter **402**, and to receive information such as configuration, or data for the generation of reports to the user, among others. Client device **404** may also communicate with wireless power receiver **406** in via BTLE connection **428** to receive information such has hardware measurement values, voltage at receiver antennas, power receiver's unique identification, and the like. The GUI and wireless power receiver **406** integrated as part of the hardware within client device **438** may provide the same operation methods and functions as a separate adaptable paired receiver **406**.

A wireless power manager **432** software may be used in order to manage wireless power network **400**. Wireless power manager **432** may be a software module hosted in memory and executed by a processor inside a computing device **434**. The wireless power manager **432** may include a GUI, app, host a GUI web page, or support a GUI app on a mobile or hand-held device, from where a user **436** may see options and statuses, as well as execute commands to manage the wireless power network **400**. The computing device **434** may be connected to the wireless power transmitter **402** through standard communication protocols which may include Bluetooth, Wi-Fi or ZigBee. Power transmitter manager app **408** may exchange information with wireless power manager **432** in order to control access from client devices, and control power transmission to power receiver of said client devices **404**. Functions controlled by the wireless power manager **432** may include, monitoring entire system, reporting all system activity and status, scheduling power transmission for individual devices, priorities between different client devices, access credentials for each client, physical location, broadcasting messages, and/or any functions required to manage the wireless power network **400**.

Multiple wireless power transmitter **402** units may be placed together in the same area to deliver more power to individual power receivers or to power more receivers at the same time, said power receivers being within power reception range of all said power transmitters **402**.

FIG. **5** is an exemplary embodiment of a wireless power charging UI **500**. Wireless power charging UI **500** may be a software module hosted in memory and executed by a processor in a computing device **534**. Wireless power charging UI **500** may be included as part of a wireless power manager application in order to select and deselect one or more wireless power devices to charge or power in a wireless power network.

Wireless power charging UI **500** may include a charge off area **502** which may display device icons that represent the different client devices **504** that are not to have power transmitted to them in a wireless power network. If the device, represented by a given icon, contains a battery then its icon, or a sub-icon near the device icon may also additionally include a charge level **506** icon which may

serve as an indication of battery present charge or state and/or how much energy charge the client devices **504** battery, if any, possess at the moment.

Wireless power charging UI **500** may also include a charging area **508** which may display icons that represent the different client devices **504** that are receiving power from a wireless power transmitter in a wireless power network. Each icon may also include a charge level **506** icon which may serve as an indication of battery present charge state and/or how much energy charge the client device's **504** battery, if any, possess at the moment. A client device **504** in the charging area **508** may also include additional indicators to show a device is charging. For example and without limitation, a client device **504** icon may be surrounded by a flashing or pulsating halo when the device is receiving power; in another example the charge level **506** icon may be flashing; In yet another example; the client device **504** may include transparent overlapped text such as a message reading "Charging".

User may drag and drop a client device **504** from the charge off area **502** into the charging area **508** in order to begin charging a device. A user may also select a client device **504** from the charging area **508** and drag and drop it into the charge off area **502** in order to stop charging the device. The user may perform this actions using known in the art UI navigation tools such as, a mouse click or touch screen for example.

FIG. **6** is a flowchart describing a process **600** by which a user may charge a device in a wireless power network. The process may begin when a user accesses, logs on to, or begins to use the wireless power charging UI (block **602**). The wireless power charging UI may be a software module hosted in memory and executed by a processor in a suitable computing device, such as, a laptop computer, smartphone and the like. The wireless power charging UI may be a software module implemented as part of the wireless power manager application (described in FIG. **4**) used to manage a wireless power network. The wireless power charging software may then query (block **604**) a database stored in a wireless power transmitter in order to extract records of all wireless power receivers in the wireless power network. The wireless power charging UI may also create a local copy of the database in the memory of the computing device hosting the wireless power charging UI. A copy of the database may be re-created and mirrored into each computing device in the wireless power network in order to create a distributed database environment and enable sharing all the information across all computing devices in the wireless power network. Extracted information may include for example records indicating status of each wireless power receiver in the wireless power network, their associated client devices, battery level and charge status, owner, and/or any associated information from the components in a wireless power network. The extracted information may then be presented (block **606**) and shown to the user in a wireless power charging UI such as the one described in FIG. **5**. From the wireless power charging UI the user may select and hold the icon for the device he may desire to charge from the charge off screen area of the wireless power charging UI (block **608**). At this point the icon for the device may change or become highlighted in order to indicate that the device has been selected, for example the image of the icon may become larger when a user selects the device from the charge off area. The user may then drag the icon device from the charge off area to the charging area (block **610**). The wireless power charging UI may then update the database and send commands to the wireless power transmitter (block **612**) in order to begin charging the device. The database in the wireless power transmitter may then be updated with any necessary information. The charging area of the wireless power charging UI may then display an icon indicating that the selected device is charging (block **614**). The icon from the corresponding device may then be removed from the charge off area of the wireless power charging UI.

FIG. **7** is a flowchart describing a process **700** by which a user may disable a device from charging in a wireless power network. The process may begin when a user accesses the wireless power charging UI (block **702**). The wireless power charging UI may be a software module hosted in memory and executed by a processor in a suitable computing device, such as, a laptop computer, smartphone and the like. The wireless power charging UI may be a software module implemented as part of the wireless power manager application (described in FIG. **4**) used to manage a wireless power network. The wireless power charging software may then query (block **704**) a database stored in a wireless power transmitter in order to extract records of all wireless power receivers in the wireless power network. Extracted information may include for example records indicating status of each wireless power receiver in the wireless power network, their associated devices, battery level and charge status, owner, and/or any associated information from the components in a wireless power network. The extracted information may then be presented (block **706**) and shown to the user in a wireless power charging UI such as the one described in FIG. **5**. From the wireless power charging UI the user may select and hold the icon for the device he may desire to charge off, from within the charging area of the wireless power charging UI (block **708**). At this point the icon for the device may change or be highlighted in order to indicate that the device has been selected, for example the image of the icon may become larger when a user selects the device from the charging area. The user may then drag and drop the icon device from the charging area to the charge off area(block **710**). The wireless power charging UI may then update the database and send commands to the wireless power transmitter (block **712**) to disable charging the device. The database in the wireless power transmitter may then be updated with any necessary information. The charge off area of the wireless power charging UI may then display an icon of the device indicating that the selected device is no longer being charged (block **714**). The icon of the corresponding device may then be removed from the charging area of the wireless power charging UI.

The foregoing method descriptions and the process flow diagrams are provided merely as illustrative examples and are not intended to require or imply that the steps of the various embodiments must be performed in the order presented. As will be appreciated by one of skill in the art the steps in the foregoing embodiments may be performed in any order. Words such as "then," "next," etc. are not intended to limit the order of the steps; these words are simply used to guide the reader through the description of the methods. Although process flow diagrams may describe the operations as a sequential process, many of the operations can be performed in parallel or concurrently. In addition, the order of the operations may be re-arranged. A process may correspond to a method, a function, a procedure, a subroutine, a subprogram, etc. When a process corresponds to a function, its termination may correspond to a return of the function to the calling function or the main function.

The various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the

embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

Embodiments implemented in computer software may be implemented in software, firmware, middleware, microcode, hardware description languages, or any combination thereof. A code segment or machine-executable instructions may represent a procedure, a function, a subprogram, a program, a routine, a subroutine, a module, a software package, a class, or any combination of instructions, data structures, or program statements. A code segment may be coupled to another code segment or a hardware circuit by passing and/or receiving information, data, arguments, parameters, or memory contents. Information, arguments, parameters, data, etc. may be passed, forwarded, or transmitted via any suitable means including memory sharing, message passing, token passing, network transmission, etc.

The actual software code or specialized control hardware used to implement these systems and methods is not limiting of the invention. Thus, the operation and behavior of the systems and methods were described without reference to the specific software code being understood that software and control hardware can be designed to implement the systems and methods based on the description herein.

When implemented in software, the functions may be stored as one or more instructions or code on a non-transitory computer-readable or processor-readable storage medium. The steps of a method or algorithm disclosed herein may be embodied in a processor-executable software module which may reside on a computer-readable or processor-readable storage medium. A non-transitory computer-readable or processor-readable media includes both computer storage media and tangible storage media that facilitate transfer of a computer program from one place to another. A non-transitory processor-readable storage media may be any available media that may be accessed by a computer. By way of example, and not limitation, such non-transitory processor-readable media may comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other tangible storage medium that may be used to store desired program code in the form of instructions or data structures and that may be accessed by a computer or processor. Disk and disc, as used herein, include compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk, and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media. Additionally, the operations of a method or algorithm may reside as one or any combination or set of codes and/or instructions on a non-transitory processor-readable medium and/or computer-readable medium, which may be incorporated into a computer program product.

The preceding description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the following claims and the principles and novel features disclosed herein.

The invention claimed is:

1. A method of selectively charging one or more electronic devices in a wireless power network, the method comprising:

providing a wireless power network comprising a controlling electronic device that includes a display, at least one wireless power transmitter, and a plurality of electronic devices each having an associated wireless power receiver, wherein the controlling electronic device is distinct and separate from the at least one wireless power transmitter;

at the controlling electronic device:

receiving data comprising a charge status for each of the plurality of electronic devices;

displaying, on the display, representations of one or more electronic devices of the plurality of electronic devices;

detecting a user selection of one of the representations corresponding to a device selected to be charged; and

upon detecting the user selection, sending a command to the at least one wireless power transmitter to transmit radio frequency (RF) waves that constructively interfere with one another in proximity to a location of a wireless power receiver associated with the device selected to be charged.

2. The method of claim **1**, wherein:

displaying the representations of the one or more electronic devices comprises displaying the representations of the one or more electronic devices in a first region of the display; and

the method further comprises, at the controlling electronic device:

displaying, in a second region of the display that is adjacent to the first region of the display, representations of one or more additional electronic devices of the plurality of electronic devices.

3. The method of claim **2**, wherein:

each of the one or more additional electronic devices represented in the second region of the display is currently receiving RF waves from one or more wireless power transmitters included in the wireless power network; and

each of the one or more electronic devices represented in the first region of the display is currently not receiving RF waves.

4. The method of claim **3**, wherein detecting the user selection comprises:

ceasing to display the user selected representation corresponding to the device selected to be charged in the first region of the display; and

displaying the user selected representation in the second region of the display.

5. The method of claim **4**, wherein ceasing to display the user selected representation in the first region of the display and displaying the user selected representation in the second region of the display comprises animating movement of the user selected representation from the first region of the

display to the second region of the display in accordance with a detected movement of the user selected representation.

6. The method of claim **4**, further comprising, at the controlling electronic device:

detecting, in the second region of the display, an additional user selection of the user selected representation corresponding to the device selected to be charged; and

in response to detecting the additional user selection, sending another command to the at least one wireless power transmitter to cease transmitting the RF waves.

7. The method of claim **6**, wherein detecting the additional user selection comprises:

ceasing to display the user selected representation corresponding to the device selected to be charged in the second region of the display; and

displaying the user selected representation in the first region of the display.

8. The method of claim **1**, wherein:

the wireless power network further includes a plurality of wireless power transmitters, including the at least one wireless power transmitter;

the plurality of wireless power transmitters is assigned to a designated area; and

the wireless power receiver associated with the device selected to be charged is located within the designated area.

9. The method of claim **8**, wherein the wireless power receiver associated with the device selected to be charged is within a predefined transmission range of the at least one wireless power transmitter.

10. The method of claim **8**, wherein receiving the data comprises receiving the data from one or more of the plurality of wireless power transmitters.

11. The method of claim **1**, wherein each of the representations includes the charge status associated with the one or more electronic devices.

12. The method of claim **1**, further comprising, at the controlling electronic device:

after sending the command to the at least one wireless power transmitter, adding an indicator to the user selected representation corresponding to the device selected to be charged to indicate reception of the RF waves by the wireless power receiver associated with the device selected to be charged.

13. A wireless power system, comprising:

one or more wireless power transmitters;

a plurality of electronic devices each having an associated wireless power receiver; and

a controlling electronic device, which is distinct and separate from the one or more wireless power transmitters, having a display and configured to:

receive data comprising a charge status for each of the plurality of electronic devices;

display, on the display, representations of one or more electronic devices of the plurality of electronic devices;

detect a user selection of one of the representations corresponding to a device selected to be charged; and

upon detecting the user selection, send a command to at least one wireless power transmitter of the one or more wireless power transmitters,

wherein the least one wireless power transmitter is configured to, upon receiving the command from the controlling electronic device, transmit radio frequency (RF) waves that constructively interfere with one another in proximity to a location of a wireless power receiver associated with the device selected to be charged.

14. The wireless power system of claim **13**, wherein:

the representations of the one or more electronic devices are displayed in a first region of the display; and

the controlling electronic device is further configured to:

display, in a second region of the display that is adjacent to the first region of the display, representations of one or more additional electronic devices of the plurality of electronic devices.

15. The wireless power system of claim **14**, wherein:

each of the one or more additional electronic devices represented in the second region of the display is currently receiving RF waves from at least some of the one or more wireless power transmitters; and

each of the one or more electronic devices represented in the first region of the display is currently not receiving RF waves.

16. The wireless power system of claim **14**, wherein detecting the user selection comprises:

ceasing to display the user selected representation corresponding to the device selected to be charged in the first region of the display; and

displaying the user selected representation in the second region of the display.

17. The wireless power system of claim **16**, wherein ceasing to display the user selected representation in the first region of the display and displaying the user selected representation in the second region of the display comprises animating movement of the user selected representation from the first region of the display to the second region of the display in accordance with a detected movement of the user selected representation.

18. The wireless power system of claim **16**, wherein:

the controlling electronic device is further configured to:

detect, in the second region of the display, an additional user selection of the user selected representation corresponding to the device selected to be charged; and

upon detecting the additional user selection, send another command to the at least one wireless power transmitter to cease transmitting the RF waves; and

the least one wireless power transmitter is configured to, upon receiving the other command from the controlling electronic device, cease transmission of the RF waves.

19. The wireless power system of claim **18**, wherein detecting the additional user selection comprises:

ceasing to display the user selected representation corresponding to the device selected to be charged in the second region of the display; and

displaying the user selected representation in the first region of the display.

20. The wireless power system of claim **13**, wherein:

the one or more wireless power transmitters are assigned to a designated area; and

the wireless power receiver associated with the device selected to be charged is located within the designated area.

* * * * *