Conclusion

Any inquiry concerning this communication should be directed to the Examiner at the below-listed number. The Examiner can normally be reached on Mon-Thu and Sat from 9:00am-5:00pm.

The Examiner's SPE is Drew Dunn and he can be reached at 571.272.2312. The fax number for the organization where this application is assigned is 571.273.8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866.217.9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800.786.9199 (IN USA OR CANADA) or 571.272.1000.

/Edward H Tso/
EDWARD H TSO
Primary Examiner, AU 2859
571.272.2087

Notice of References Cited	Application/Control No. 13/536,767	Applicant(s)/Patent Under Reexamination FISCHER ET AL.	
	Examiner EDWARD TSO	Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,986,127	07-2011	Fischer et al.	320/111
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

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

PATENT
Customer No. 93377
Attorney Docket No. 11298.0188-08

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	
Daniel M. FISCHER et al.	)	Parent Group Art Unit: 2858
	)	
Application No.: Unknown	)	Parent Examiner: Edward H. Tso
(Continuation of Appln. No. 13/175,509)	)	
	)	
Filed: June 28, 2012	)	
	)	Confirmation No.: Unknown
For: MULTIFUNCTIONAL CHARGER	)	
SYSTEM AND METHOD	)	

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

Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), Applicants bring to the attention of the Examiner the listed documents on the attached listing. This Information Disclosure Statement is being filed concurrently with the continuation application.

Copies of the listed documents are not attached since they were submitted in the parent case (Application No. 13/175,509).

Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

documents as prior art against any claim in the application and Applicants determine that the cited documents do not constitute "prior art" under United States law, Applicants reserve the right to present to the U.S. Patent and Trademark Office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: June 28, 2012

By: /Yi Yu/
Yi Yu
Reg. No. 69,397
(571) 203-2700

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	Unknown
	Filing Date	June 28, 2012
	First Named Inventor	Daniel M. Fischer
	Art Unit	Unknown
	Examiner Name	Unknown
	Attorney Docket Number	11298.0188-08000

U.S. PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	3775659		1973-11-27	Carlsen, II	
	2	4433251		1984-02-21	Banks et al.	
	3	4510431		1985-04-09	Winkler	
	4	5173855		1992-12-22	Nielsen et al.	
	5	5229649		1993-07-20	Nielsen et al.	
	6	5272475		1993-12-21	Eaton et al.	
	7	5444378		1995-08-22	Rogers	
	8	5631503		1997-05-20	Cioffi	
	9	5638540		1997-06-10	Aldous	
	10	5651057		1997-07-22	Blood et al.	
	11	5769877		1998-06-23	Barreras, Sr.	
	12	5850113		1998-12-15	Weimer et al.	
	13	5939860		1999-08-17	William	
	14	6006088		1999-12-21	Couse	
	15	6104162		2000-08-15	Sanisbury et al.	
	16	6104759		2000-08-15	Carkner et al.	
	17	6130518		2000-10-10	Gabehart et al.	
	18	6138242		2000-10-24	Massman et al.	
	19	6184652		2001-02-06	Yang	
	20	6211649		2001-04-03	Matsuda	
	21	6252375		2001-06-26	Richter et al.	
	22	6255800		2001-07-03	Bork	
	23	6283789		2001-09-04	Tsai	
	24	6357011		2002-03-12	Gilbert	
	25	6397696		2002-06-04	Ogami	
	26	6663420		2003-12-16	Xiao	
	27	6668296		2003-12-23	Dougherty et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

FISI00001812

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	Unknown
	Filing Date	June 28, 2012
	First Named Inventor	Daniel M. Fischer
	Art Unit	Unknown
	Examiner Name	Unknown
	Attorney Docket Number	11298.0188-08000

	28	6738856		2004-05-18	Milley et al.	
	29	7159132		2007-01-02	Takahashi et al.	
	30	7170259		2007-01-30	Veselic	
	31	7340627		2008-03-04	Harvey	
	32	7629767		2009-12-08	Kang	
	33	7631111		2009-12-08	Monks et al.	
	34	7698490		2010-04-13	Terrell, II	
	35	7737657		2010-06-15	Fischer, et al.	
	36	7812565		2010-10-12	Bayne et al.	
	37	7884570		2011-02-08	Purdy et al.	
	38	7986127		2011-07-26	Fischer et al.	
	39	7834586		2010-02-26	Fischer et al.	

U.S. PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	2001/0003205		2001-06-07	Gilbert	
	2	2003/0034898		2003-02-20	Shamoon et al.	
	3	2004/0063464		2004-04-01	Akam et al.	
	4	2004/0251878		2004-12-16	Veselic	
	5	2005/0269883		2005-12-08	Drader et al.	
	6	2006/0181241		2006-08-17	Veselic	
	7	2007/0108938		2007-05-17	Veselic	
	8	2009/0128091		2009-05-21	Purdy et al.	
	9	2009/0130874		2009-05-21	Englund	
	10	2010/0052620		2010-03-04	Wong	
	11	2010/0060233		2010-03-11	Kung et al.	
	12	2010/0201308		2010-08-12	Lindholm	
	13	2004/0251878		2004-12-16	Veselic	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	Unknown
	Filing Date	June 28, 2012
	First Named Inventor	Daniel M. Fischer
	Art Unit	Unknown
	Examiner Name	Unknown
	Attorney Docket Number	11298.0188-08000

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number	Country Code[2]i	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	0684680	EP		1995-11-29	Nokia Mobile Phones Ltd.		☐
	2	1198049	EP		2002-04-17	Sony International (Eur.)		
	3	2001/01330	WO		2001-01-04	Cross Match Technologies, Inc.		
	4	2005063355	JP		2005-03-10	Matsushita Electric Inc. Co. Ltd.		
	5	2517333	CA		2002-09-01	Research in Motion Ltd.		

NON-PATENT LITERATURE DOCUMENTS

Examiner Initial*	Cite No	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Canadian Office Action for Canadian Application No. 2,374,344 dated March 12, 2004 (3 pages)	☐
	2	Charging Big Supercaps, Portable Design, p. 26, March 1997	
	3	Electric Double-Layer Capacitors, Vol. 2, October 25, 1996, (Japan, Tokin Corp., Cat. No. EC-200E)	
	4	Supercapacitor: User's Manual, Vol. 2, Japan, Tokin Corporation, January 1997 (47 pages)	
	5	U.S. Office Action for U.S. Application 10/087,629 dated September 7, 2004 (6 pages)	
	6	U.S. Office Action for U.S. Application 11/175,885 dated April 4, 2006 (5 pages)	
	7	U.S. Office Action for U.S. Application 11/175,885 dated October 20, 2005 (8 pages)	
	8	U.S. Office Action for U.S. Application 11/749,680 dated September 25, 2007 (9 pages)	
	9	U.S. Office Action for U.S. Application 12/174,204 dated August 5, 2010 (11 pages)	
	10	U.S. Office Action for U.S. Application 12/268,297 dated August 18, 2009 (9 pages)	
	11	U.S. Office Action for U.S. Application 12/905,934 dated November 29, 2010 (11 pages)	
	12	U.S. Office Action for U.S. Application No. 11/175,885 dated August 24, 2006 (6 pages)	
	13	U.S. Office Action for U.S. Application No. 12/714,204 dated August 5, 2010 (11 pages)	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	Unknown
	Filing Date	June 28, 2012
	First Named Inventor	Daniel M. Fischer
	Art Unit	Unknown
	Examiner Name	Unknown
	Attorney Docket Number	11298.0188-08000

	14	U.S. Office Action for US. Application 11/175,885 dated August 24, 2006 (6 pages)	
	15	U.S. Office Action for US. Application 13/175,487dated December 12, 2011 (10 pages)	

EXAMINER SIGNATURE

Examiner Signature	/Edward Tso/	Date Considered	05/19/2013

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Document at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ET/

Index of Claims	Application/Control No. 13536767	Applicant(s)/Patent Under Reexamination FISCHER ET AL.
	Examiner EDWARD TSO	Art Unit 2859

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

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

CLAIM		DATE								
Final	Original	05/19/2013								
-	1	-								
-	2	-								
-	3	-								
-	4	-								
-	5	-								
-	6	-								
-	7	-								
-	8	-								
-	9	-								
-	10	-								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								
	21	✓								
	22	✓								
	23	✓								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								

Search Notes	Application/Control No. 13536767	Applicant(s)/Patent Under Reexamination FISCHER ET AL.
	Examiner EDWARD TSO	Art Unit 2859

CPC- SEARCHED

Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
320	107, 111, 114, 140		

SEARCH NOTES

Search Notes	Date	Examiner
text search	5/2013	et
class/subclass search	5/2013	et
inventor search	5/2013	et
foreign ipc search	5/2013	et
DP considered against related patents	5/2013	et

INTERFERENCE SEARCH

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/536,767	06/28/2012	Daniel M. FISCHER	11298.0188-08000

CONFIRMATION NO. 5104

PUBLICATION NOTICE

OC000000057755166

93377
RIM/FINNEGAN
901 New York Avenue NW
Washington, DC 20001

Title: MULTIFUNCTIONAL CHARGER SYSTEM AND METHOD

Publication No. US-2012-0293113-A1
Publication Date: 11/22/2012

NOTICE OF PUBLICATION OF APPLICATION

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

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/536,767	06/28/2012	2859	1250	11298.0188-08000	18	2

CONFIRMATION NO. 5104

UPDATED FILING RECEIPT

OC000000055989729

93377
RIM/FINNEGAN
901 New York Avenue NW
Washington, DC 20001

Date Mailed: 08/17/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Daniel M. FISCHER, Waterloo, CANADA;
Dan G. Radut, Waterloo, CANADA;
Michael F. Habicher, Toronto, CANADA;
Quang A. Luong, Missisauga, CANADA;
Jonathan T. Malton, Kitchener, CANADA;

Assignment For Published Patent Application

Research In Motion Limited, Waterloo, CANADA

Power of Attorney: The patent practitioners associated with Customer Number 93377

Domestic Priority data as claimed by applicant

This application is a CON of 13/175,509 07/01/2011 PAT 8232766
which is a CON of 12/905,934 10/15/2010 PAT 7986127
which is a CON of 12/714,204 02/26/2010 PAT 7834586
which is a CON of 12/268,297 11/10/2008 PAT 7737657
which is a CON of 11/749,680 05/16/2007 PAT 7453233
which is a CON of 11/175,885 07/06/2005 PAT 7239111
which is a CON of 10/087,629 03/01/2002 PAT 6936936
which claims benefit of 60/273,021 03/01/2001
and claims benefit of 60/330,486 10/23/2001

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 07/18/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/536,767**

Projected Publication Date: 11/22/2012

Non-Publication Request: No

Early Publication Request: No
Title

MULTIFUNCTIONAL CHARGER SYSTEM AND METHOD

Preliminary Class

320

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

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

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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

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

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

NOT GRANTED

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/536,767

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE($)	FEE($)		RATE($)	FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	18 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
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* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
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In re Application of:	)
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Daniel M. FISCHER et al.	) Group Art Unit: 2859
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Application No.: 13/536,767	) Examiner: Unknown
	)
Filed: June 28, 2012	)
	) Confirmation No.: 5104
For: MULTIFUNCTIONAL CHARGER SYSTEM AND METHOD	)
	)

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

Sir:

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

In response to the communication of July 20, 2012, Applicants submit a substitute specification incorporating the changes requested in the preliminary amendment accompanying the filing of the application. A marked-up version showing changes in accordance with 37 C.F.R. § 1.125(c) has been provided, as well as a clean version without markings. The substitute specification contains no new matter. Additionally, Applicants submit replacement drawings for Figures 1-4.

Applicants note that the original drawings submitted with this application are fully in compliance with 37 CFR 1.84 and have been accepted for U.S. Application No. 13/175,509 without any objection. A copy of the Notice To File Corrected Application Papers is not attached since this response is being filed electronically (EFS-Web).

Please associate the enclosed submission of replacement drawings and substitute specification with the application, grant any extensions of time required to enter this response, and charge any required fees to Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: August 10, 2012

By: /Yi Yu/
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Marked-up Substitute Specification

MULTIFUNCTIONAL CHARGER SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation application of U.S. Patent Application No. 13/175,509, filed July 1, 2011, now U.S. Patent No. 8,232,766, issued on July 31, 2012, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/905,934, filed October 15, 2010, now U.S. Patent No. 7,986,127, issued on July 26, 2011, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/714,204, filed February 26, 2010, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/268,297, filed November 10, 2008, now U.S. Patent No. 7,737,657 issued on June 15, 2010, by Daniel M. Fischer, et al. and entitled "System and Method for Charging a Battery in a Mobile Device," which is a continuation of U.S. Patent Application No. 11/749,680, filed May 16, 2007, now U.S. Patent No. 7,453,233 issued on November 18, 2008, by Daniel M. Fischer, et al. and entitled "Adapter System and Method for Powering a Device," which is a continuation of U.S. Patent Application No. 11/175,885, filed on July 6, 2005, now U.S. Patent No. 7,239,111 issued on July 3, 2007, by Daniel M. Fischer, et al. and entitled "Universal Serial Bus Adapter for a Mobile Device," which is a continuation of U.S. Patent Application No. 10/087,629, filed March 1, 2002, now U.S. Patent No. 6,936,936 issued on August 30, 2006, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which claims priority from U.S. Provisional Application no. 60/273,021, filed March 1, 2001, by Daniel

M. Fischer, et al. and entitled "System and Method for Adapting a USB to Provide Power for Charging a Mobile Device" and U.S. Provisional Application No. 60/330,486, filed October 23, 2001, by Daniel M. Fischer, et al. and entitled "multifunctional Charger System and Method." Each of the above patent applications is hereby incorporated herein by reference in its entirety for all purposes.

BACKGROUND

[0002] This invention relates generally to power adapters. More particularly, the invention relates to power adapters for use with mobile devices.

[0003] Providing an external source of power to a mobile device, such as a personal digital assistant[[s]] ("PDA"), mobile communication device, cellular phone, wireless two-way e-mail communication device, and others, requires design considerations with respect to both the mobile device and the power source. With regard to the mobile device, most mobile devices provide a distinct power interface for receiving power from a power source, for instance to recharge a battery, and a separate data interface for communicating. For example, many mobile devices presently use USB (Universal Serial Bus) interfaces for communicating and use a separate power interface, such as a barrel connector, for receiving power.

[0004] It is desirable, however, to have a combined power and data interface. The mobile devices that do have combined power and data interfaces typically use non-standard and sometimes proprietary interfaces. Consequently, combined interfaces for

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a particular manufacturer's mobile device may not be compatible with combined interfaces for mobile devices provided by other manufacturers.

[0005] Although the USB interface can be used as a power interface, the USB is typically not used for that purpose by mobile devices. In accordance with the USB specification, typical USB power source devices, such as hubs and hosts, require that a USB device participate in a host-initiated process called enumeration in order to be compliant with the current USB specification in drawing power from the USB interface. Although a mobile device could be adapted to participate in enumeration when drawing power over the USB interface, it would be preferable in many situations, such as when a host would not be available, as often happens during normal use of a mobile device, to be able to utilize alternate power sources such as conventional AC outlets and DC car sockets that are not capable of participating in enumeration to supply power to the mobile device via a USB interface.

SUMMARY

[0006] An adapter for providing a source of power to a mobile device through an industry standard port is provided. In accordance with one aspect of the invention, the adapter comprises a plug unit, a power converter, a primary connector, and an identification subsystem. The plug unit is operative to couple the adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

[0007] In accordance with another aspect, a USB adapter for providing a source of power to a mobile device through a USB port is provided. The USB adapter comprises a plug unit, a power converter, a primary USB connector, and an identification subsystem. The plug unit is operative to couple the USB adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary USB connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

[0008] Another aspect provides a USB adapter for providing a source of power to a mobile device through a USB port. The USB adapter comprises a plug unit, a power converter, a primary USB connector, and an auxiliary USB adapter. The plug unit is operative to couple the USB adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary USB connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The auxiliary USB connector has data lines that are electrically coupled to the data lines of the primary USB connector.

[0009] Yet another aspect provides a method for providing energy to a mobile device using a USB adapter that comprises a plug unit, a primary USB connector, a power converter electrically coupled between the plug unit and the primary USB connector, and an identification subsystem electrically coupled to the primary USB connector. The method comprising the steps of coupling the USB connector to the mobile device, coupling the plug unit to a power socket, outputting a power requirement to the mobile device via the power converter and the USB connector, and providing an identification signal to the mobile device, via the identification subsystem and the USB connector, that is operative to inform the mobile device that the USB adapter is not limited by the power limits imposed by the USB specification.

[0010] In accordance with another aspect, a powering system for a mobile device having a USB connector is provided. The powering system comprises a power distribution subsystem in the mobile device that is operable to receive energy through the USB connector and to distribute the energy to at least one component in the mobile device and a USB adapter that is operative to couple to the USB connector. The USB adapter comprises a plug unit for coupling to a power socket and that is operable to receive energy from the power socket, a power converter electrically coupled to the plug unit for regulating the received energy and for providing a power requirement to the power distribution subsystem, and an identification subsystem that is operable to transmit an identification signal that is operative to identify the USB adapter as not being limited by the power limits imposed by the USB specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In order that the invention identified in the claims may be more clearly understood, preferred embodiments thereof will be described in detail by way of example, with reference to the accompanying drawings, in which:

[0012] Fig. 1 is a schematic diagram of an exemplary mobile device which has an industry standard interface;

[0013] Fig. 2 is a schematic diagram of a first embodiment of a USB adapter that is coupled to an exemplary mobile device;

[0014] Fig. 3 is a flow chart illustrating an exemplary use of a USB adapter with a mobile device; and

[0015] Fig. 4 is a schematic diagram of an additional exemplary embodiment of a USB adapter that is coupled to both an exemplary mobile device and an external battery.

DETAILED DESCRIPTION

Exemplary Mobile Device

[0016] Turning now to the drawing figures, shown in Fig. 1 is a schematic diagram of an exemplary mobile communication device 10 which has an industry standard interface. The mobile communication device 10 is preferably a two-way communication device having at least voice or data communication capabilities. Preferably, the mobile device 10 is also capable of communicating over the Internet, for example, via a radio frequency ("RF") link. Examples of types of devices that could be classified as a mobile device 10 include a data messaging device, a two-way pager, a cellular telephone with data messaging capabilities, a wireless Internet appliance, a data communication device (with or without telephony capabilities), a personal digital assistant[[s]] ("PDA"), a wireless two-way e-mail communication device, and others.

[0017] The exemplary mobile device 10 comprises a microprocessor 12, a communication subsystem 14, input/output ("I/O") devices 16, an industry standard interface 18 which in this example is a USB port, and a power subsystem 20. The microprocessor 12 controls the overall operation of the mobile device 10. The communication subsystem 14 provides the mobile device 10 with the ability to communicate wirelessly with external devices such as other mobile devices and other computers. The I/O devices 16 provide the mobile device 10 with input/output capabilities for use with a device user. The USB port 18 provides the mobile device 10 with a serial port for linking directly with other computers and/or a means for receiving power from an external power source. The power subsystem 20 provides the mobile device 10 with a local power source.

[0018] The exemplary communication subsystem 14 comprises components such as a receiver 22, a transmitter 24, antenna elements 26 and 28, local oscillators (LOs) 30, and a processing module such as a digital signal processor (DSP) 32. The particular design of the communication subsystem 14 and the components used therein can vary. It would be apparent to one of ordinary skill in the art to design an appropriate communication subsystem using conventional methods and components to operate over a communication network 34 based on the parameters necessary to operate over that communication network. For example, a mobile device 10 geographically located in North America may include a communication subsystem 14 designed to operate within the Mobitex™ mobile communication system or DataTAC™ mobile communication system, whereas a mobile device 10 intended for use in Europe may incorporate a General Packet Radio Service (GPRS) communication subsystem 14.

[0019] Network access requirements will also vary depending upon the type of network 34. For example, in the Mobitex and DataTAC networks, mobile devices 10 are registered on the network using a unique personal identification number or PIN associated with each device. In GPRS networks however, network access is associated with a subscriber or user of a mobile device 10. A GPRS device therefore requires a subscriber identity module (not shown), commonly referred to as a SIM card, in order to operate on a GPRS network. Without a SIM card, a GPRS device will not be fully functional. Local or non-network communication functions (if any) may be operable, but the mobile device 10 will be unable to carry out any functions involving communications over the network 34.

[0020] When required, after the network registration or activation procedures have been completed, a mobile device 10 may send and receive communication signals over the network 34. Signals received by the receiver antenna 26 through a communication network 34 are input to the receiver 22, which may perform such common receiver functions as signal amplification, frequency down conversion, filtering, channel selection and the like, and in the exemplary system shown in Fig. 1, analog to digital conversion. Analog to digital conversion of a received signal allows more complex communication functions such as demodulation and decoding to be performed in a DSP 32. Similarly, signals to be transmitted are processed, including modulation and encoding for example, by the DSP 32 and input to the transmitter 24 for digital to analog conversion, frequency up conversion, filtering, amplification and transmission over the communication network 34 via the transmitter antenna 28.

[0021] Also, in the exemplary communication subsystem 14, the DSP 32 processes communication signals and also provides for receiver and transmitter control. For example, the gains applied to communication signals in the receiver 22 and transmitter 24 may be adaptively controlled through automatic gain control algorithms implemented in the DSP 32.

[0022] In implementing its control function, the microprocessor 12 in the exemplary mobile device 10 executes an operating system. The operating system software used by the microprocessor 12 is preferably stored in a persistent store such as flash memory 36, or alternatively read only memory (ROM) or similar storage element. The microprocessor 12 may also enable the execution of specific device applications, which preferably are also stored in a persistent store. The operating system, specific device applications, or parts thereof, may also be temporarily loaded into a volatile store such as in RAM 38.

[0023] A predetermined set of applications which control basic device operations, including at least data and voice communication applications for example, will normally be installed on the mobile device 10 during manufacture. One such application loaded on the mobile device 10 could be a personal information manager (PIM) application. The PIM application preferably is an application for organizing and managing user inputted data items such as e-mail, calendar events, voice mails, appointments, and task items. The PIM data items may be stored in the RAM 38 and/or the flash memory 36.

[0024] The PIM application preferably has the ability to send and receive data items, via the wireless network 34. The PIM data items are preferably seamlessly integrated, synchronized and updated, via the wireless network 34, with corresponding data items stored or associated with a host computer system (not shown) used by the device user. The synchronization of PIM data items is a process by which the PIM data items on the mobile device 10 and the PIM data items on the host computer system can be made to mirror each other.

[0025] There are several possible mechanisms for loading applications onto the mobile device 10. For example, applications may be loaded onto the mobile device 10 through the wireless network 34, an auxiliary I/O subsystem 40, the serial port 18, a short-range communications subsystem 42, such as an infrared ("IR") communication system, or any other suitable subsystem 44. When loading the applications onto the mobile device 10, the device user may install the applications in the RAM 38, the flash memory 36, or preferably a non-volatile store (not shown) such as ROM for execution by the microprocessor 12. The available application installation mechanisms can increase the utility of the mobile device 10 by providing the device user with a way of upgrading the mobile device 10 with additional and/or enhanced on-device functions, communication-related functions, or both. For example, a secure communication application may be loaded onto the mobile device 10 that allows for electronic commerce functions or other financial transactions to be performed using the mobile device 10.

[0026] The I/O devices 16 may be used to display and/or compose data communication messages. In one mode of operation, a signal received by the mobile device 10, such as a text message or web page download, will be received and processed by the communication subsystem 14, forwarded to the microprocessor 12, which will preferably further process the received signal, and provide the processed signal to one or more of the I/O devices 16 such as a display 46. Alternatively, a received signal such as a voice signal can be provided to a speaker 48, or alternatively to an auxiliary I/O device 40. In another mode of operation a device user may compose a data item such as an e-mail message using a keyboard 50 in cooperation with the display 46 and possibly an auxiliary I/O device 40. Alternatively, a device user may compose a voice message via a microphone 52. The composed data item may then be transmitted over a communication network 34 using the communication subsystem 14.

[0027] A short-range communications subsystem 42 may be provided in the mobile device 10 to allow the mobile device 10 to communicate with other systems or devices, which need not necessarily be similar to device 10. For example, the short-range communications subsystem 42 may include an infrared device and associated circuitry and components or a Bluetooth™ communication module to allow the device 10 to communicate with similarly-enabled systems and devices.

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[0028] The USB port 18 provides the mobile device 10 with a serial port for linking directly with other computers to exchange data and/or to receive power. The USB port 18 also provides the mobile device 10 with a means for receiving power from an external power source. For example, in a personal digital assistant (PDA)-type communication device, the USB port 18 could be used to allow the mobile device 10 to synchronize data with a user's desktop computer (not shown). The USB port 18 could also enable a user to set parameters in the mobile device 10 such as preferences through the use of an external device or software application. In addition the USB port 18 may also be used to provide a means for downloading information or software to the mobile device 10 without using the wireless communication network 34. The USB port 18 can provide a direct and thus reliable and trusted connection that may for example be used to load an encryption key onto the mobile device 10 thereby enabling secure device communication.

[0029] Coupled to the USB port 18 is a USB connector 54. The USB connector 54 is the physical component that couples the USE port 18 to the outside world. In the exemplary mobile device 10, the USB connector 54 is used to transmit and receive data from an external data/power source 56, receive power from the external data/power source 56, direct the transmitted/received data from/to the USB port 18, and direct the received power to the power subsystem 20.

[0030] The exemplary power subsystem 20 comprises a charging and power distribution subsystem 58 and a battery 60. The charging and power distribution subsystem 58 performs many functions. It may be used to transfer energy to the battery 60 from the external data/power source 56 to charge the battery 60 and also to distribute power to the many ~~power requiring~~ power-requiring components within the mobile device 10. The charging subsystem 58 may be capable of determining the presence of a batter 60 and/or a power circuit coupled to the mobile device 10, such as an AC adapter, USB connection, or car adapter, which alternatively can act as power sources 56 to provide power for the mobile device 10 and to charge the battery 60. Additionally, the charging subsystem 58 may have the ability to determine if a power source 56 is coupled to the mobile device 10 and, in the absence of such a coupling, cause the mobile device 10 to be powered by the battery 60.

[0031] The power distributed by the charging and power distribution subsystem 58 may be derived from energy stored in the battery 60 and/or energy received from the external data/power source 56. When the battery 60 is depleted, the charging and power distribution subsystem 58 transfers energy from the power source 56 to recharge the battery 60. Optionally, the charging and power distribution subsystem 58 may also transfer energy from the power source 56 to other components in the mobile device 10 to power the mobile device 10 when the battery 60 has been depleted and is recharging. When the data/power source 56 is not connected to the mobile device 10, power for the device 10 is derived from the battery 60.

Exemplary USB Adapter

[0032] Fig. 2 is a schematic diagram of a first embodiment of an adapter 100 that can be used to couple the mobile device 10 of fig. 1 to the data/power source 56 of fig. 1. In this example the adapter 100 is a USB adapter 100 that comprises a primary USB connector 102, a power converter 104, a plug unit 106, and an identification subsystem 108. The power converter is a known element in the art and typically includes at least one of the following components: switching converter, transformer, DC source, voltage regulator, linear regulator and rectifier. In the embodiment shown in fig. 2, the USB adapter 100 is shown coupling a mobile device 10 to one of one or more types of power sockets 110N, 110D, 110B, and [[100]] 110. Also shown in fig. 2 is an optional auxiliary USB connector 112 that can be used to couple the mobile device 10 to a data source (not shown) such as a personal computer.

[0033] In the embodiment shown in fig. 2, the primary USB connector 102 is configured to mate with the USB connector 54 of the mobile device 10. The USB adapter 100 is operable to provide power to the mobile device 10 through the Vbus and Gnd power pins in the USB connectors 54 and 102. The USB adapter 100 also optionally provides a communication path for data across the D+ and D- data pins in the USB connectors 54 and 102.

[0034] The plug unit 106 is preferably a conventional plug unit that can be used to couple with a conventional power socket to receive power therefrom. For example, the plug unit 106 can be a ~~two prong~~ two-prong or ~~three prong~~ three-prong plug of the type used in North America that can couple to a North American AC power socket 110N that provides 115 VAC. In the embodiment shown in figure 2, the plug unit 106 can accept one or more types of plug adapters 114N, 114B, 114D, and 114 that are configured to couple to the plug unit 106 and are further configured to directly mate with one or more types of power sockets 110N, 110D, 110B, and [[100]] 110. The plug unit 106 can be configured to receive energy from a power socket 110N, 110D, 110B, or [[100]] 110, either directly or through the use of a plug adapter, and is operative to transfer the received energy to the power converter 104.

[0035] The power converter 104 is operative to receive energy from a power socket 110N, 110D, 110B, or [[100]] 110 and to convert that received energy to a form that can be used by the mobile device 10. For example, the power converter 104 can be of conventional construction such as a switching power converter that converts 115 VAC to 5 VDC. Also, the power converter 104 could comprise a D.C. regulator circuit that converts a D.C. input to a D.C. output. The power converter 104 could also be adapted to accept a wide range of input energy levels and frequencies. Alternatively, the power converter 104 could be adapted to accept a limited range of input energy levels and frequencies, wherein the plug adapters are operable to convert the possible input energy levels and frequencies to a range that the power converter 104 can accommodate. The power converter 104 provides its energy output to the mobile device 10 via the Vbus and Gnd pins of the primary USB connector 102.

[0036] Through the use of a variety of different types of plug adapters, the USB adapter 100 can be adapted to receive energy from various types of power sockets 110N, 110D, 110B, or [[100]] 110. For example, using the appropriate plug adapter 114, 114B, 114D, and 114N, the USB adapter 100 can receive energy from a power socket such as [[an]] a 115 VAC North American power socket 110N, or a 12 VDC automobile power socket, or an air power socket, or others.

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[0037] For example, in North America, a type "N" power socket is commonly available. The plug adapter 114N can be releasably attached to the plug unit 106 thereby allowing any North American power socket 114N to be used as a power source. When traveling to a locale which does not have the North American power socket 114N, an alternate plug adapter such as adapters 114, 114B, or 114D may be selected by the user, according to the power socket 110D, 110B, or [[100]] 110 available at the locale. The plug adapter 114, 114B, or 114D may then be releasably attached to plug unit 106 in place of the plug adapter 114N, thereby allowing the USB power adapter 100 to connect to a local power supply via the local power ~~socket .~~ socket. Various other plug adapters are envisioned that can be configured to operate with alternate power sources such as for instance car sockets.

[0038] The power distribution and charging subsystem 58 of the mobile device 10 can selectively use the power provided on the Vbus and Gnd lines of the USB connector 54 to provide power to the mobile device 10, charge the battery 60, or both. A more detailed discussion of how the charging function of mobile device 10 can be implemented is described in United States Provisional Application No. 60/273021 filed on March 1st, 2001 and entitled "System and Method for Adapting a USB to Provide Power for Charging a Mobile Device" which has been incorporated herein by reference.

[0039] Typically when a mobile device 10 receives power over the USB from a USB host, it is required to draw power in accordance with the USB specification. The USB specification specifies a process for transferring energy across the USB called enumeration and limits the electrical current that can flow across the USB.

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[0040] The USB adapter 100 contributes to a system wherein a device 10 that follows the USB specification when coupled to a typical USB host via its USB port can be informed that the USB adapter 100 has been coupled to the device 10 and that the device 10 can now draw power without regard to the USB specification and the USB specification imposed limits.

[0041] The identification subsystem 108 provides an identification signal to the mobile device 10 that the power source is not a USB limited source. The identification signal could be the communication of a single voltage on one or more of the USB data lines, different voltages on the two data lines, a series of pulses or voltage level changes, or other types of electrical signals. The identification subsystem 108 that generates the identification signal could have multiple types of configurations. In one embodiment, the identification subsystem 108 comprises a hard-wired connection of a single voltage level to both data lines. In another embodiment, the identification subsystem 108 comprises a USB controller that is operable to communicate an identification signal to the mobile device 10. Additional embodiments are contemplated. The identification subsystem 108 may optionally be configured to have the capability of electrically connecting or disconnecting the power output from the power converter 104 from the USB connector 102 and/or to connect or disconnect any data inputs from the USB adapter 100 to the USB connector 102.

[0042] In addition to providing power to the mobile device 10 over the primary USB connector 102, the USB adapter 100 may optionally be equipped with an auxiliary USB connector 112 that allows the USB adapter 100 to create a communication path between the mobile device 10 and some other device capable of communicating over the USB such as a personal computer, another mobile device or some other type of device.

[0043] The USB adapter 100 preferably provides a communication path between the D+ and D- pins of the Primary USB connector 102 and the D+ and D- pins of the auxiliary USB connector 112. In the embodiment shown, the communication path also traverses the identification subsystem 108. Alternatively, the communication path could bypass the identification subsystem 108. The USB adapter 100 can thus act as a ~~pass-through~~ pass-through device for communication between a USB hub or host and a mobile device 10.

[0044] Optionally, the USB adapter 100 could also transfer energy from the power converter 104 to the auxiliary USB connector 112 thereby providing a device coupled to the auxiliary USB connector 112 with power. In this arrangement, the identification subsystem 108 could also provide an identification signal to the device coupled to the auxiliary USB connector 112 to inform that device that the power source is not a USB limited source.

Exemplary Illustration Of The Use of A USB Adapter With A Mobile Device

[0045] When a USB adapter 100 is connected to a mobile device 10, the identification subsystem 108 of the USB adapter 100 preferably provides an identification signal to the mobile device 10 to notify the mobile device 10 that the device 10 is connected to a power source that is not subject to the power limits imposed by the USB specification.

Preferably, the mobile device 10 is programmed to recognize the identification signal and therefore recognizes that an identification signal has been transmitted by the USB adapter 100. After recognizing a valid identification signal, the mobile device 10[[,]] draws power through the USB adapter 100 without waiting for enumeration or charge negotiation.

[0046] The detection of the identification signal may be accomplished using a variety of methods. For example, the microprocessor 12 may detect the identification signal by detecting the presence of an abnormal data line condition at the USB port 18. The detection may also be accomplished through the use of other device subsystems 44 in the mobile device 10. The preferred identification signal results from the application of voltage signals greater than 2 volts to both the D+ and D- lines in the USB connector 54. The preferred method of identification is described below in greater detail with reference to Fig. 3.

[0047] At step 210, the mobile device 10 detects the presence of a voltage on the Vbus line of the USB connector 54 via the USB port 18. At step 220, the mobile device checks the state of the D+ and D- lines of USB connector 54. In the example shown in the drawings, the D+ and D- lines are compared to a 2V reference. Also, in this example, the identification subsystem 108 of the USB adapter 100 may have applied a logic high signal, such as +5V reference, to both the D+ and D- lines to identify the attached device as a USB adapter 100. If the voltages on both the D+ and D- lines of the USB connector are greater than 2 Volts (step 220), then the mobile device 10 determines that the device connected to the USB connector 54 is not a typical USB host or hub and that a USB adapter 100 has been detected (step 230). The mobile device 10 can then charge the battery or otherwise use power provided via the Vbus and Gnd line sin the USB connector 54 (step 260) without waiting for enumeration.

[0048] If, however, after the mobile device 10 detects the presence of a voltage on the Vbus line of the USB connector 54 and determines that the voltages on both the D+ and D- lines of the USB connector 54 are not greater than 2 Volts (step 220), then the mobile device 10 determines that a USB host or hub has been detected (step 240). A typical USB host or hub weakly holds its D+ and D- lines at zero volts when it is not connected to another device. The mobile device 10 can then signal the USB host or hub to initiate the enumeration process (step 250) and can charge the battery or otherwise use power provided via the Vbus and Gnd lines in the USB connector 54 (step 260) in accordance with the power limits imposed by the USB specification. The enumeration process is typically initiated after the mobile device 10 applies approximately zero volts to the D-line and approximately 5 volts to the D+ line to inform the host of the mobile device's 10 presence and communication speed.

[0049] Therefore, when a USB adapter 100 is coupled to the mobile device 10 and has been identified as a USB adapter 100, the mobile device 10 can forego the enumeration process and charge negotiation process and immediately draw energy from the USB power adapter 100 at a desired rate, for instance at 5 unit loads, i.e. 500mA. While the mobile device 10 charges its battery using the USB adapter 100, the mobile device 10 can disable its typical USB functions. If, however, the mobile device 10 detects that a USB host or hub is coupled to the mobile device 10, the mobile device 10 can apply a voltage to the D+ line to indicate to the USB host or hub that the mobile device 10 is coupled thereto and await enumeration and USB charge negotiation.

[0050] If the USB adapter 100[[,]] is coupled to the mobile device 10, and the mobile device 10 does not identify the USB adapter 100 through communications with the identification module 108, the mobile device 10 may stop drawing energy from the Vbus and Gnd lines of the USB connector 54. This may occur, for example, if the mobile device 10 is not programmed to identify the USB adapter 100. The mobile device 10 may mistakenly identify the USB adapter 100 as a typical USB host or hub and await enumeration before drawing substantial energy. To guard against this, the USB adapter 100 can optionally be adapted to function with mobile devices that are not programmed to recognize the USB adapter 100.

[0051] In that scenario, the USB adapter 100 can be adapted to provide energy to a mobile device by using the knowledge that the mobile device will draw energy from a connected device for a period of time before it stops drawing energy due to lack of enumeration. The USB adapter 100 can optionally provide power for charging a battery 60 in a mobile device by periodically switching the voltages on the Vbus and Gnd lines between on and off states. When the USB adapter 100 is coupled to the mobile device, the identification subsystem 108 can apply an on-voltage (5 V for example) between the Vbus and Gnd lines. The mobile device will draw energy while awaiting enumeration. After a period of time, the identification subsystem 108 can apply an off-voltage (0 volts) between the Vbus and Gnd lines thereby fooling the mobile device into determining that the unidentified USB device has been disconnected from the mobile device. The identification subsystem 108 can then reapply an on-voltage between the Vbus and Gnd lines. The mobile device will draw energy again while awaiting enumeration. This cycle can be repeated to periodically apply energy to the mobile device, for example, to recharge the battery 60 of the mobile device.

Additional Exemplary Embodiments of USB Adapters

[0052] Shown in [[fig.]] Fig. 4 is a schematic diagram of an additional exemplary embodiment of a USB adapter 300 that is coupled to a mobile device 10. The exemplary USB adapter 300 comprises a USB connector 302, a power converter 304, a plug unit 306, and an identification subsystem 308. The USB connector 302, plug unit 306, and identification subsystem 308[[,]] preferably correspond to the USB connector 102, plug unit 106, and identification subsystem 108 which were described earlier with respect to the first embodiment. Similar to the first embodiment, the additional embodiment may optionally be equipped with various plug adapters 314N, 314D, 314B, and 314 that preferably are releasably attachable to plug unit 306 so that the appropriate plug adapter 314N, 314D, 314B, or 314 can be selected by a user to allow the USB adapter 300 to couple to and receive energy from an available power socket 310N, 310D, 310B, or 310. The exemplary USB power converter 300 further comprises a charging subsystem 316 and battery receptacle 318 for coupling the USB adapter 300 to an external battery 320 that may be optionally coupled thereto.

[0053] The battery receptacle 318 provides a location for releasably coupling an external battery 320 thereto so that the external battery can be charged via the USB adapter 300. This provides the USB adapter 300 with a mechanism for charging, for example, a mobile device's primary or spare battery when the battery has been separated from or is not coupled to the mobile device 10.

[0054] To accommodate this functionality, the power converter 304 is capable of providing the proper voltage levels for the USB connector 302 and also capable of providing necessary voltage and current levels to drive a battery charging subsystem 316. The power converter 304 is preferably a dual power converter that may be constructed using conventional or non-conventional architectures. With respect to the portion of the power converter 304 that provides energy to the USB connector 302, that portion is preferably similar in construction and function to the power converter 104 of the first embodiment.

[0055] Preferably, the charging subsystem 316 performs in a substantially similar manner to charging subsystem 58 of the mobile device 10. But, for efficiency and simplicity of design, certain aspects of the dual power converter 304 and the charging subsystem 316 may be combined, as both are local to the USB adapter 300.

[0056] Other alternative embodiments of the USB adapter may include various combinations of components described above with respect to the first and additional embodiments. Another embodiment of the USB adapter may include a second or more auxiliary USB connectors. A USB adapter having one or more auxiliary USB connectors may optionally be configured such that one or more of the auxiliary USB connectors may have power from the USB adapter's power converter made available to it so that multiple USB devices may draw power simultaneously. Preferably, a USB adapter having multiple auxiliary USB connectors will be configured such that the data lines in the auxiliary connectors can, on a selective basis, be electrically connected to or disconnected from the data lines in the primary USB connector. This allows a mobile device connected to the primary USB connector to receive energy from the adapter regardless of whether a USB host or hub is connected to an auxiliary USB connector. It is also contemplated that a USB adapter may be embodied in a USB host or hub.

Conclusion

[0057] The embodiments described herein are examples of structures, systems or methods having elements corresponding to the elements of the invention recited in the claims. This written description may enable those skilled in the art to make and use embodiments having alternative elements that likewise correspond to the elements of the invention recited in the claims. The intended scope of the invention thus includes other structures, systems or methods that do not differ from the literal language of the claims, and further includes other structures, systems or methods with insubstantial differences from the literal language of the claims. Although the embodiments have been described with reference to the USB interface, it is contemplated that the invention could be applicable to devices and systems that use other standard interfaces such as the IEEE 1394 interface.

Marked-up Substitute Specification

ABSTRACT OF THE DISCLOSURE

An adapter for providing a source of power to a mobile device through an industry standard port is provided. In accordance with one aspect of the invention, the adapter comprises a plug unit, a power converter, a primary connector, and an identification subsystem. The plug unit is operative to couple the adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

Clean Version - Substitute Specification

MULTIFUNCTIONAL CHARGER SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation application of U.S. Patent Application No. 13/175,509, filed July 1, 2011, now U.S. Patent No. 8,232,766, issued on July 31, 2012, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/905,934, filed October 15, 2010, now U.S. Patent No. 7,986,127, issued on July 26, 2011, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/714,204, filed February 26, 2010, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which is a continuation of U.S. Patent Application No. 12/268,297, filed November 10, 2008, now U.S. Patent No. 7,737,657 issued on June 15, 2010, by Daniel M. Fischer, et al. and entitled "System and Method for Charging a Battery in a Mobile Device," which is a continuation of U.S. Patent Application No. 11/749,680, filed May 16, 2007, now U.S. Patent No. 7,453,233 issued on November 18, 2008, by Daniel M. Fischer, et al. and entitled "Adapter System and Method for Powering a Device," which is a continuation of U.S. Patent Application No. 11/175,885, filed on July 6, 2005, now U.S. Patent No. 7,239,111 issued on July 3, 2007, by Daniel M. Fischer, et al. and entitled "Universal Serial Bus Adapter for a Mobile Device," which is a continuation of U.S. Patent Application No. 10/087,629, filed March 1, 2002, now U.S. Patent No. 6,936,936 issued on August 30, 2006, by Daniel M. Fischer, et al. and entitled "Multifunctional Charger System and Method," which claims priority from U.S. Provisional Application no. 60/273,021, filed March 1, 2001, by Daniel

M. Fischer, et al. and entitled "System and Method for Adapting a USB to Provide Power for Charging a Mobile Device" and U.S. Provisional Application No. 60/330,486, filed October 23, 2001, by Daniel M. Fischer, et al. and entitled "multifunctional Charger System and Method." Each of the above patent applications is hereby incorporated herein by reference in its entirety for all purposes.

BACKGROUND

[0002] This invention relates generally to power adapters. More particularly, the invention relates to power adapters for use with mobile devices.

[0003] Providing an external source of power to a mobile device, such as a personal digital assistant ("PDA"), mobile communication device, cellular phone, wireless two-way e-mail communication device, and others, requires design considerations with respect to both the mobile device and the power source. With regard to the mobile device, most mobile devices provide a distinct power interface for receiving power from a power source, for instance to recharge a battery, and a separate data interface for communicating. For example, many mobile devices presently use USB (Universal Serial Bus) interfaces for communicating and use a separate power interface, such as a barrel connector, for receiving power.

[0004] It is desirable, however, to have a combined power and data interface. The mobile devices that do have combined power and data interfaces typically use non-standard and sometimes proprietary interfaces. Consequently, combined interfaces for a particular manufacturer's mobile device may not be compatible with combined interfaces for mobile devices provided by other manufacturers.

[0005] Although the USB interface can be used as a power interface, the USB is typically not used for that purpose by mobile devices. In accordance with the USB specification, typical USB power source devices, such as hubs and hosts, require that a USB device participate in a host-initiated process called enumeration in order to be compliant with the current USB specification in drawing power from the USB interface. Although a mobile device could be adapted to participate in enumeration when drawing power over the USB interface, it would be preferable in many situations, such as when a host would not be available, as often happens during normal use of a mobile device, to be able to utilize alternate power sources such as conventional AC outlets and DC car sockets that are not capable of participating in enumeration to supply power to the mobile device via a USB interface.

SUMMARY

[0006] An adapter for providing a source of power to a mobile device through an industry standard port is provided. In accordance with one aspect of the invention, the adapter comprises a plug unit, a power converter, a primary connector, and an identification subsystem. The plug unit is operative to couple the adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary

connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

[0007] In accordance with another aspect, a USB adapter for providing a source of power to a mobile device through a USB port is provided. The USB adapter comprises a plug unit, a power converter, a primary USB connector, and an identification subsystem. The plug unit is operative to couple the USB adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary USB connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

[0008] Another aspect provides a USB adapter for providing a source of power to a mobile device through a USB port. The USB adapter comprises a plug unit, a power converter, a primary USB connector, and an auxiliary USB adapter. The plug unit is operative to couple the USB adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary USB connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The auxiliary USB connector has data lines that are electrically coupled to the data lines of the primary USB connector.

[0009] Yet another aspect provides a method for providing energy to a mobile device using a USB adapter that comprises a plug unit, a primary USB connector, a power converter electrically coupled between the plug unit and the primary USB connector, and an identification subsystem electrically coupled to the primary USB connector. The method comprising the steps of coupling the USB connector to the mobile device, coupling the plug unit to a power socket, outputting a power requirement to the mobile device via the power converter and the USB connector, and providing an identification signal to the mobile device, via the identification subsystem and the USB connector, that is operative to inform the mobile device that the USB adapter is not limited by the power limits imposed by the USB specification.

[0010] In accordance with another aspect, a powering system for a mobile device having a USB connector is provided. The powering system comprises a power distribution subsystem in the mobile device that is operable to receive energy through the USB connector and to distribute the energy to at least one component in the mobile device and a USB adapter that is operative to couple to the USB connector. The USB adapter comprises a plug unit for coupling to a power socket and that is operable to receive energy from the power socket, a power converter electrically coupled to the plug unit for regulating the received energy and for providing a power requirement to the power distribution subsystem, and an identification subsystem that is operable to transmit an identification signal that is operative to identify the USB adapter as not being limited by the power limits imposed by the USB specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In order that the invention identified in the claims may be more clearly understood, preferred embodiments thereof will be described in detail by way of example, with reference to the accompanying drawings, in which:

[0012] Fig. 1 is a schematic diagram of an exemplary mobile device which has an industry standard interface;

[0013] Fig. 2 is a schematic diagram of a first embodiment of a USB adapter that is coupled to an exemplary mobile device;

[0014] Fig. 3 is a flow chart illustrating an exemplary use of a USB adapter with a mobile device; and

[0015] Fig. 4 is a schematic diagram of an additional exemplary embodiment of a USB adapter that is coupled to both an exemplary mobile device and an external battery.

DETAILED DESCRIPTION

Exemplary Mobile Device

[0016] Turning now to the drawing figures, shown in Fig. 1 is a schematic diagram of an exemplary mobile communication device 10 which has an industry standard interface. The mobile communication device 10 is preferably a two-way communication device having at least voice or data communication capabilities. Preferably, the mobile device 10 is also capable of communicating over the Internet, for example, via a radio frequency ("RF") link. Examples of types of devices that could be classified as a mobile device 10 include a data messaging device, a two-way pager, a cellular telephone with data messaging capabilities, a wireless Internet appliance, a data communication device (with or without telephony capabilities), a personal digital assistant ("PDA"), a wireless two-way e-mail communication device, and others.

[0017] The exemplary mobile device 10 comprises a microprocessor 12, a communication subsystem 14, input/output ("I/O") devices 16, an industry standard interface 18 which in this example is a USB port, and a power subsystem 20. The microprocessor 12 controls the overall operation of the mobile device 10. The communication subsystem 14 provides the mobile device 10 with the ability to communicate wirelessly with external devices such as other mobile devices and other computers. The I/O devices 16 provide the mobile device 10 with input/output capabilities for use with a device user. The USB port 18 provides the mobile device 10 with a serial port for linking directly with other computers and/or a means for receiving power from an external power source. The power subsystem 20 provides the mobile device 10 with a local power source.

[0018] The exemplary communication subsystem 14 comprises components such as a receiver 22, a transmitter 24, antenna elements 26 and 28, local oscillators (LOs) 30, and a processing module such as a digital signal processor (DSP) 32. The particular design of the communication subsystem 14 and the components used therein can vary. It would be apparent to one of ordinary skill in the art to design an appropriate communication subsystem using conventional methods and components to operate over a communication network 34 based on the parameters necessary to operate over that communication network. For example, a mobile device 10 geographically located in North America may include a communication subsystem 14 designed to operate within the Mobitex™ mobile communication system or DataTAC™ mobile communication system, whereas a mobile device 10 intended for use in Europe may incorporate a General Packet Radio Service (GPRS) communication subsystem 14.

[0019] Network access requirements will also vary depending upon the type of network 34. For example, in the Mobitex and DataTAC networks, mobile devices 10 are registered on the network using a unique personal identification number or PIN associated with each device. In GPRS networks however, network access is associated with a subscriber or user of a mobile device 10. A GPRS device therefore requires a subscriber identity module (not shown), commonly referred to as a SIM card, in order to operate on a GPRS network. Without a SIM card, a GPRS device will not be fully functional. Local or non-network communication functions (if any) may be operable, but the mobile device 10 will be unable to carry out any functions involving communications over the network 34.

[0020] When required, after the network registration or activation procedures have been completed, a mobile device 10 may send and receive communication signals over the network 34. Signals received by the receiver antenna 26 through a communication network 34 are input to the receiver 22, which may perform such common receiver functions as signal amplification, frequency down conversion, filtering, channel selection and the like, and in the exemplary system shown in Fig. 1, analog to digital conversion. Analog to digital conversion of a received signal allows more complex communication functions such as demodulation and decoding to be performed in a DSP 32. Similarly, signals to be transmitted are processed, including modulation and encoding for example, by the DSP 32 and input to the transmitter 24 for digital to analog conversion, frequency up conversion, filtering, amplification and transmission over the communication network 34 via the transmitter antenna 28.

[0021] Also, in the exemplary communication subsystem 14, the DSP 32 processes communication signals and also provides for receiver and transmitter control. For example, the gains applied to communication signals in the receiver 22 and transmitter 24 may be adaptively controlled through automatic gain control algorithms implemented in the DSP 32.

[0022] In implementing its control function, the microprocessor 12 in the exemplary mobile device 10 executes an operating system. The operating system software used by the microprocessor 12 is preferably stored in a persistent store such as flash memory 36, or alternatively read only memory (ROM) or similar storage element. The microprocessor 12 may also enable the execution of specific device applications, which preferably are also stored in a persistent store. The operating system, specific device applications, or parts thereof, may also be temporarily loaded into a volatile store such as in RAM 38.

[0023] A predetermined set of applications which control basic device operations, including at least data and voice communication applications for example, will normally be installed on the mobile device 10 during manufacture. One such application loaded on the mobile device 10 could be a personal information manager (PIM) application. The PIM application preferably is an application for organizing and managing user inputted data items such as e-mail, calendar events, voice mails, appointments, and task items. The PIM data items may be stored in the RAM 38 and/or the flash memory 36.

[0024] The PIM application preferably has the ability to send and receive data items, via the wireless network 34. The PIM data items are preferably seamlessly integrated, synchronized and updated, via the wireless network 34, with corresponding data items stored or associated with a host computer system (not shown) used by the device user. The synchronization of PIM data items is a process by which the PIM data items on the mobile device 10 and the PIM data items on the host computer system can be made to mirror each other.

[0025] There are several possible mechanisms for loading applications onto the mobile device 10. For example, applications may be loaded onto the mobile device 10 through the wireless network 34, an auxiliary I/O subsystem 40, the serial port 18, a short-range communications subsystem 42, such as an infrared ("IR") communication system, or any other suitable subsystem 44. When loading the applications onto the mobile device 10, the device user may install the applications in the RAM 38, the flash memory 36, or preferably a non-volatile store (not shown) such as ROM for execution by the microprocessor 12. The available application installation mechanisms can increase the utility of the mobile device 10 by providing the device user with a way of upgrading the mobile device 10 with additional and/or enhanced on-device functions, communication-related functions, or both. For example, a secure communication application may be loaded onto the mobile device 10 that allows for electronic commerce functions or other financial transactions to be performed using the mobile device 10.

[0026] The I/O devices 16 may be used to display and/or compose data communication messages. In one mode of operation, a signal received by the mobile device 10, such as a text message or web page download, will be received and processed by the communication subsystem 14, forwarded to the microprocessor 12, which will preferably further process the received signal, and provide the processed signal to one or more of the I/O devices 16 such as a display 46. Alternatively, a received signal such as a voice signal can be provided to a speaker 48, or alternatively to an auxiliary I/O device 40. In another mode of operation a device user may compose a data item such as an e-mail message using a keyboard 50 in cooperation with the display 46 and possibly an auxiliary I/O device 40. Alternatively, a device user may compose a voice message via a microphone 52. The composed data item may then be transmitted over a communication network 34 using the communication subsystem 14.

[0027] A short-range communications subsystem 42 may be provided in the mobile device 10 to allow the mobile device 10 to communicate with other systems or devices, which need not necessarily be similar to device 10. For example, the short-range communications subsystem 42 may include an infrared device and associated circuitry and components or a Bluetooth™ communication module to allow the device 10 to communicate with similarly-enabled systems and devices.

[0028] The USB port 18 provides the mobile device 10 with a serial port for linking directly with other computers to exchange data and/or to receive power. The USB port 18 also provides the mobile device 10 with a means for receiving power from an external power source. For example, in a personal digital assistant (PDA)-type communication device, the USB port 18 could be used to allow the mobile device 10 to synchronize data with a user's desktop computer (not shown). The USB port 18 could also enable a user to set parameters in the mobile device 10 such as preferences through the use of an external device or software application. In addition the USB port 18 may also be used to provide a means for downloading information or software to the mobile device 10 without using the wireless communication network 34. The USB port 18 can provide a direct and thus reliable and trusted connection that may for example be used to load an encryption key onto the mobile device 10 thereby enabling secure device communication.

[0029] Coupled to the USB port 18 is a USB connector 54. The USB connector 54 is the physical component that couples the USE port 18 to the outside world. In the exemplary mobile device 10, the USB connector 54 is used to transmit and receive data from an external data/power source 56, receive power from the external data/power source 56, direct the transmitted/received data from/to the USB port 18, and direct the received power to the power subsystem 20.

[0030] The exemplary power subsystem 20 comprises a charging and power distribution subsystem 58 and a battery 60. The charging and power distribution subsystem 58 performs many functions. It may be used to transfer energy to the battery 60 from the external data/power source 56 to charge the battery 60 and also to distribute power to the many power-requiring components within the mobile device 10. The charging subsystem 58 may be capable of determining the presence of a batter 60 and/or a power circuit coupled to the mobile device 10, such as an AC adapter, USB connection, or car adapter, which alternatively can act as power sources 56 to provide power for the mobile device 10 and to charge the battery 60. Additionally, the charging subsystem 58 may have the ability to determine if a power source 56 is coupled to the mobile device 10 and, in the absence of such a coupling, cause the mobile device 10 to be powered by the battery 60.

[0031] The power distributed by the charging and power distribution subsystem 58 may be derived from energy stored in the battery 60 and/or energy received from the external data/power source 56. When the battery 60 is depleted, the charging and power distribution subsystem 58 transfers energy from the power source 56 to recharge the battery 60. Optionally, the charging and power distribution subsystem 58 may also transfer energy from the power source 56 to other components in the mobile device 10 to power the mobile device 10 when the battery 60 has been depleted and is recharging. When the data/power source 56 is not connected to the mobile device 10, power for the device 10 is derived from the battery 60.

Exemplary USB Adapter

[0032] Fig. 2 is a schematic diagram of a first embodiment of an adapter 100 that can be used to couple the mobile device 10 of fig. 1 to the data/power source 56 of fig. 1. In this example the adapter 100 is a USB adapter 100 that comprises a primary USB connector 102, a power converter 104, a plug unit 106, and an identification subsystem 108. The power converter is a known element in the art and typically includes at least one of the following components: switching converter, transformer, DC source, voltage regulator, linear regulator and rectifier. In the embodiment shown in fig. 2, the USB adapter 100 is shown coupling a mobile device 10 to one of one or more types of power sockets 110N, 110D, 110B, and 110. Also shown in fig. 2 is an optional auxiliary USB connector 112 that can be used to couple the mobile device 10 to a data source (not shown) such as a personal computer.

[0033] In the embodiment shown in fig. 2, the primary USB connector 102 is configured to mate with the USB connector 54 of the mobile device 10. The USB adapter 100 is operable to provide power to the mobile device 10 through the Vbus and Gnd power pins in the USB connectors 54 and 102. The USB adapter 100 also optionally provides a communication path for data across the D+ and D- data pins in the USB connectors 54 and 102.

[0034] The plug unit 106 is preferably a conventional plug unit that can be used to couple with a conventional power socket to receive power therefrom. For example, the plug unit 106 can be a two-prong or three-prong plug of the type used in North America that can couple to a North American AC power socket 110N that provides 115 VAC. In the embodiment shown in figure 2, the plug unit 106 can accept one or more types of plug adapters 114N, 114B, 114D, and 114 that are configured to couple to the plug unit 106 and are further configured to directly mate with one or more types of power sockets

110N, 110D, 110B, and 110. The plug unit 106 can be configured to receive energy from a power socket 110N, 110D, 110B, or 110, either directly or through the use of a plug adapter, and is operative to transfer the received energy to the power converter 104.

[0035] The power converter 104 is operative to receive energy from a power socket 110N, 110D, 110B, or 110 and to convert that received energy to a form that can be used by the mobile device 10. For example, the power converter 104 can be of conventional construction such as a switching power converter that converts 115 VAC to 5 VDC. Also, the power converter 104 could comprise a D.C. regulator circuit that converts a D.C. input to a D.C. output. The power converter 104 could also be adapted to accept a wide range of input energy levels and frequencies. Alternatively, the power converter 104 could be adapted to accept a limited range of input energy levels and frequencies, wherein the plug adapters are operable to convert the possible input energy levels and frequencies to a range that the power converter 104 can accommodate. The power converter 104 provides its energy output to the mobile device 10 via the Vbus and Gnd pins of the primary USB connector 102.

[0036] Through the use of a variety of different types of plug adapters, the USB adapter 100 can be adapted to receive energy from various types of power sockets 110N, 110D, 110B, or 110. For example, using the appropriate plug adapter 114, 114B, 114D, and 114N, the USB adapter 100 can receive energy from a power socket such as a 115 VAC North American power socket 110N, or a 12 VDC automobile power socket, or an air power socket, or others.

[0037] For example, in North America, a type "N" power socket is commonly available. The plug adapter 114N can be releasably attached to the plug unit 106 thereby allowing any North American power socket 114N to be used as a power source. When traveling to a locale which does not have the North American power socket 114N, an alternate plug adapter such as adapters 114, 114B, or 114D may be selected by the user, according to the power socket 110D, 110B, or 110 available at the locale. The plug adapter 114, 114B, or 114D may then be releasably attached to plug unit 106 in place of the plug adapter 114N, thereby allowing the USB power adapter 100 to connect to a local power supply via the local power socket. Various other plug adapters are envisioned that can be configured to operate with alternate power sources such as for instance car sockets.

[0038] The power distribution and charging subsystem 58 of the mobile device 10 can selectively use the power provided on the Vbus and Gnd lines of the USB connector 54 to provide power to the mobile device 10, charge the battery 60, or both. A more detailed discussion of how the charging function of mobile device 10 can be implemented is described in United States Provisional Application No. 60/273021 filed on March 1st, 2001 and entitled "System and Method for Adapting a USB to Provide Power for Charging a Mobile Device" which has been incorporated herein by reference.

[0039] Typically when a mobile device 10 receives power over the USB from a USB host, it is required to draw power in accordance with the USB specification. The USB specification specifies a process for transferring energy across the USB called enumeration and limits the electrical current that can flow across the USB.

Clean Version - Substitute Specification

[0040] The USB adapter 100 contributes to a system wherein a device 10 that follows the USB specification when coupled to a typical USB host via its USB port can be informed that the USB adapter 100 has been coupled to the device 10 and that the device 10 can now draw power without regard to the USB specification and the USB specification imposed limits.

[0041] The identification subsystem 108 provides an identification signal to the mobile device 10 that the power source is not a USB limited source. The identification signal could be the communication of a single voltage on one or more of the USB data lines, different voltages on the two data lines, a series of pulses or voltage level changes, or other types of electrical signals. The identification subsystem 108 that generates the identification signal could have multiple types of configurations. In one embodiment, the identification subsystem 108 comprises a hard-wired connection of a single voltage level to both data lines. In another embodiment, the identification subsystem 108 comprises a USB controller that is operable to communicate an identification signal to the mobile device 10. Additional embodiments are contemplated. The identification subsystem 108 may optionally be configured to have the capability of electrically connecting or disconnecting the power output from the power converter 104 from the USB connector 102 and/or to connect or disconnect any data inputs from the USB adapter 100 to the USB connector 102.

[0042] In addition to providing power to the mobile device 10 over the primary USB connector 102, the USB adapter 100 may optionally be equipped with an auxiliary USB connector 112 that allows the USB adapter 100 to create a communication path between the mobile device 10 and some other device capable of communicating over the USB such as a personal computer, another mobile device or some other type of device.

[0043] The USB adapter 100 preferably provides a communication path between the D+ and D- pins of the Primary USB connector 102 and the D+ and D- pins of the auxiliary USB connector 112. In the embodiment shown, the communication path also traverses the identification subsystem 108. Alternatively, the communication path could bypass the identification subsystem 108. The USB adapter 100 can thus act as a pass-through device for communication between a USB hub or host and a mobile device 10.

[0044] Optionally, the USB adapter 100 could also transfer energy from the power converter 104 to the auxiliary USB connector 112 thereby providing a device coupled to the auxiliary USB connector 112 with power. In this arrangement, the identification subsystem 108 could also provide an identification signal to the device coupled to the auxiliary USB connector 112 to inform that device that the power source is not a USB limited source.

<u>Exemplary Illustration Of The Use of A USB Adapter With A Mobile Device</u>

[0045] When a USB adapter 100 is connected to a mobile device 10, the identification subsystem 108 of the USB adapter 100 preferably provides an identification signal to the mobile device 10 to notify the mobile device 10 that the device 10 is connected to a power source that is not subject to the power limits imposed by the USB specification. Preferably, the mobile device 10 is programmed to recognize the identification signal and therefore recognizes that an identification signal has been transmitted by the USB adapter 100. After recognizing a valid identification signal, the mobile device 10 draws power through the USB adapter 100 without waiting for enumeration or charge negotiation.

[0046] The detection of the identification signal may be accomplished using a variety of methods. For example, the microprocessor 12 may detect the identification signal by detecting the presence of an abnormal data line condition at the USB port 18. The detection may also be accomplished through the use of other device subsystems 44 in the mobile device 10. The preferred identification signal results from the application of voltage signals greater than 2 volts to both the D+ and D- lines in the USB connector 54. The preferred method of identification is described below in greater detail with reference to Fig. 3.

[0047] At step 210, the mobile device 10 detects the presence of a voltage on the Vbus line of the USB connector 54 via the USB port 18. At step 220, the mobile device checks the state of the D+ and D- lines of USB connector 54. In the example shown in the drawings, the D+ and D- lines are compared to a 2V reference. Also, in this example, the identification subsystem 108 of the USB adapter 100 may have applied a logic high signal, such as +5V reference, to both the D+ and D- lines to identify the attached device as a USB adapter 100. If the voltages on both the D+ and D- lines of the USB connector are greater than 2 Volts (step 220), then the mobile device 10 determines that the device connected to the USB connector 54 is not a typical USB host or hub and that a USB adapter 100 has been detected (step 230). The mobile device

10 can then charge the battery or otherwise use power provided via the Vbus and Gnd line sin the USB connector 54 (step 260) without waiting for enumeration.

[0048] If, however, after the mobile device 10 detects the presence of a voltage on the Vbus line of the USB connector 54 and determines that the voltages on both the D+ and D- lines of the USB connector 54 are not greater than 2 Volts (step 220), then the mobile device 10 determines that a USB host or hub has been detected (step 240). A typical USB host or hub weakly holds its D+ and D- lines at zero volts when it is not connected to another device. The mobile device 10 can then signal the USB host or hub to initiate the enumeration process (step 250) and can charge the battery or otherwise use power provided via the Vbus and Gnd lines in the USB connector 54 (step 260) in accordance with the power limits imposed by the USB specification. The enumeration process is typically initiated after the mobile device 10 applies approximately zero volts to the D-line and approximately 5 volts to the D+ line to inform the host of the mobile device's 10 presence and communication speed.

[0049] Therefore, when a USB adapter 100 is coupled to the mobile device 10 and has been identified as a USB adapter 100, the mobile device 10 can forego the enumeration process and charge negotiation process and immediately draw energy from the USB power adapter 100 at a desired rate, for instance at 5 unit loads, i.e. 500mA. While the mobile device 10 charges its battery using the USB adapter 100, the mobile device 10 can disable its typical USB functions. If, however, the mobile device 10 detects that a USB host or hub is coupled to the mobile device 10, the mobile device 10 can apply a voltage to the D+ line to indicate to the USB host or hub that the mobile device 10 is coupled thereto and await enumeration and USB charge negotiation.

[0050] If the USB adapter 100 is coupled to the mobile device 10, and the mobile device 10 does not identify the USB adapter 100 through communications with the identification module 108, the mobile device 10 may stop drawing energy from the Vbus and Gnd lines of the USB connector 54. This may occur, for example, if the mobile device 10 is not programmed to identify the USB adapter 100. The mobile device 10 may mistakenly identify the USB adapter 100 as a typical USB host or hub and await enumeration before drawing substantial energy. To guard against this, the USB adapter 100 can optionally be adapted to function with mobile devices that are not programmed to recognize the USB adapter 100.

[0051] In that scenario, the USB adapter 100 can be adapted to provide energy to a mobile device by using the knowledge that the mobile device will draw energy from a connected device for a period of time before it stops drawing energy due to lack of enumeration. The USB adapter 100 can optionally provide power for charging a battery 60 in a mobile device by periodically switching the voltages on the Vbus and Gnd lines between on and off states. When the USB adapter 100 is coupled to the mobile device, the identification subsystem 108 can apply an on-voltage (5 V for example) between the Vbus and Gnd lines. The mobile device will draw energy while awaiting enumeration. After a period of time, the identification subsystem 108 can apply an off-voltage (0 volts) between the Vbus and Gnd lines thereby fooling the mobile device into determining that the unidentified USB device has been disconnected from the mobile device. The identification subsystem 108 can then reapply an on-voltage between the Vbus and Gnd lines. The mobile device will draw energy again while awaiting enumeration. This cycle can be repeated to periodically apply energy to the mobile device, for example, to recharge the battery 60 of the mobile device.

Additional Exemplary Embodiments of USB Adapters

[0052] Shown in Fig. 4 is a schematic diagram of an additional exemplary embodiment of a USB adapter 300 that is coupled to a mobile device 10. The exemplary USB adapter 300 comprises a USB connector 302, a power converter 304, a plug unit 306, and an identification subsystem 308. The USB connector 302, plug unit 306, and identification subsystem 308 preferably correspond to the USB connector 102, plug unit 106, and identification subsystem 108 which were described earlier with respect to the first embodiment. Similar to the first embodiment, the additional embodiment may optionally be equipped with various plug adapters 314N, 314D, 314B, and 314 that preferably are releasably attachable to plug unit 306 so that the appropriate plug adapter 314N, 314D, 314B, or 314 can be selected by a user to allow the USB adapter 300 to couple to and receive energy from an available power socket 310N, 310D, 310B, or 310. The exemplary USB power converter 300 further comprises a charging subsystem 316 and battery receptacle 318 for coupling the USB adapter 300 to an external battery 320 that may be optionally coupled thereto.

[0053] The battery receptacle 318 provides a location for releasably coupling an external battery 320 thereto so that the external battery can be charged via the USB adapter 300. This provides the USB adapter 300 with a mechanism for charging, for example, a mobile device's primary or spare battery when the battery has been separated from or is not coupled to the mobile device 10.

[0054] To accommodate this functionality, the power converter 304 is capable of providing the proper voltage levels for the USB connector 302 and also capable of providing necessary voltage and current levels to drive a battery charging subsystem 316. The power converter 304 is preferably a dual power converter that may be constructed using conventional or non-conventional architectures. With respect to the portion of the power converter 304 that provides energy to the USB connector 302, that portion is preferably similar in construction and function to the power converter 104 of the first embodiment.

[0055] Preferably, the charging subsystem 316 performs in a substantially similar manner to charging subsystem 58 of the mobile device 10. But, for efficiency and simplicity of design, certain aspects of the dual power converter 304 and the charging subsystem 316 may be combined, as both are local to the USB adapter 300.

[0056] Other alternative embodiments of the USB adapter may include various combinations of components described above with respect to the first and additional embodiments. Another embodiment of the USB adapter may include a second or more auxiliary USB connectors. A USB adapter having one or more auxiliary USB connectors may optionally be configured such that one or more of the auxiliary USB connectors may have power from the USB adapter's power converter made available to it so that multiple USB devices may draw power simultaneously. Preferably, a USB adapter having multiple auxiliary USB connectors will be configured such that the data lines in the auxiliary connectors can, on a selective basis, be electrically connected to or disconnected from the data lines in the primary USB connector. This allows a mobile device connected to the primary USB connector to receive energy from the adapter regardless of whether a USB host or hub is connected to an auxiliary USB connector. It is also contemplated that a USB adapter may be embodied in a USB host or hub.

Conclusion

[0057] The embodiments described herein are examples of structures, systems or methods having elements corresponding to the elements of the invention recited in the claims. This written description may enable those skilled in the art to make and use embodiments having alternative elements that likewise correspond to the elements of the invention recited in the claims. The intended scope of the invention thus includes other structures, systems or methods that do not differ from the literal language of the claims, and further includes other structures, systems or methods with insubstantial differences from the literal language of the claims. Although the embodiments have been described with reference to the USB interface, it is contemplated that the invention could be applicable to devices and systems that use other standard interfaces such as the IEEE 1394 interface.

Clean Version - Substitute Specification

ABSTRACT OF THE DISCLOSURE

An adapter for providing a source of power to a mobile device through an industry standard port is provided. In accordance with one aspect of the invention, the adapter comprises a plug unit, a power converter, a primary connector, and an identification subsystem. The plug unit is operative to couple the adapter to a power socket and operative to receive energy from the power socket. The power converter is electrically coupled to the plug unit and is operable to regulate the received energy from the power socket and to output a power requirement to the mobile device. The primary connector is electrically coupled to the power converter and is operative to couple to the mobile device and to deliver the outputted power requirement to the mobile device. The identification subsystem is electrically coupled to the primary connector and is operative to provide an identification signal.

REPLACEMENT
DRAWING

1/4

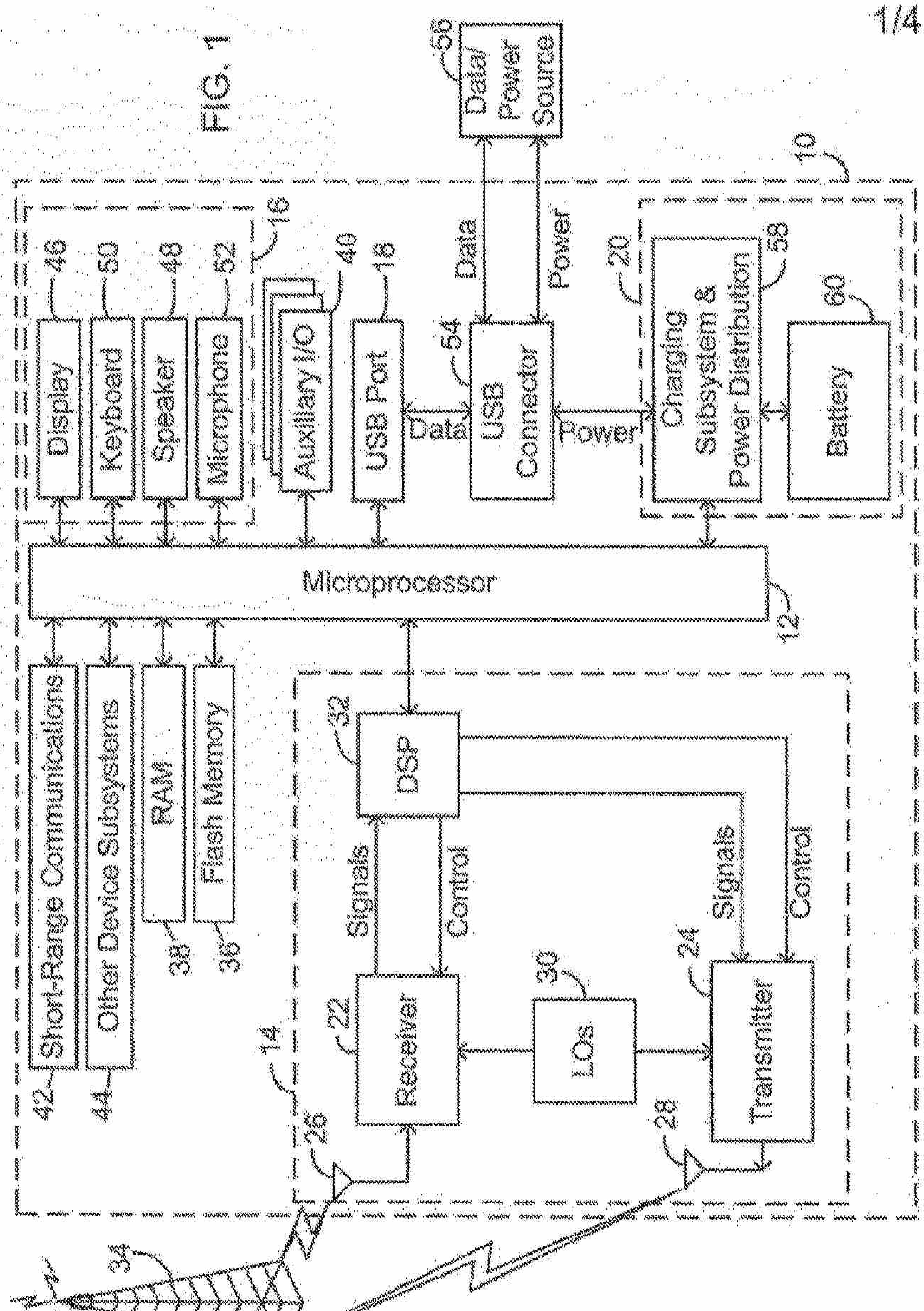

FIG. 1

FISI00001875

REPLACEMENT
DRAWING

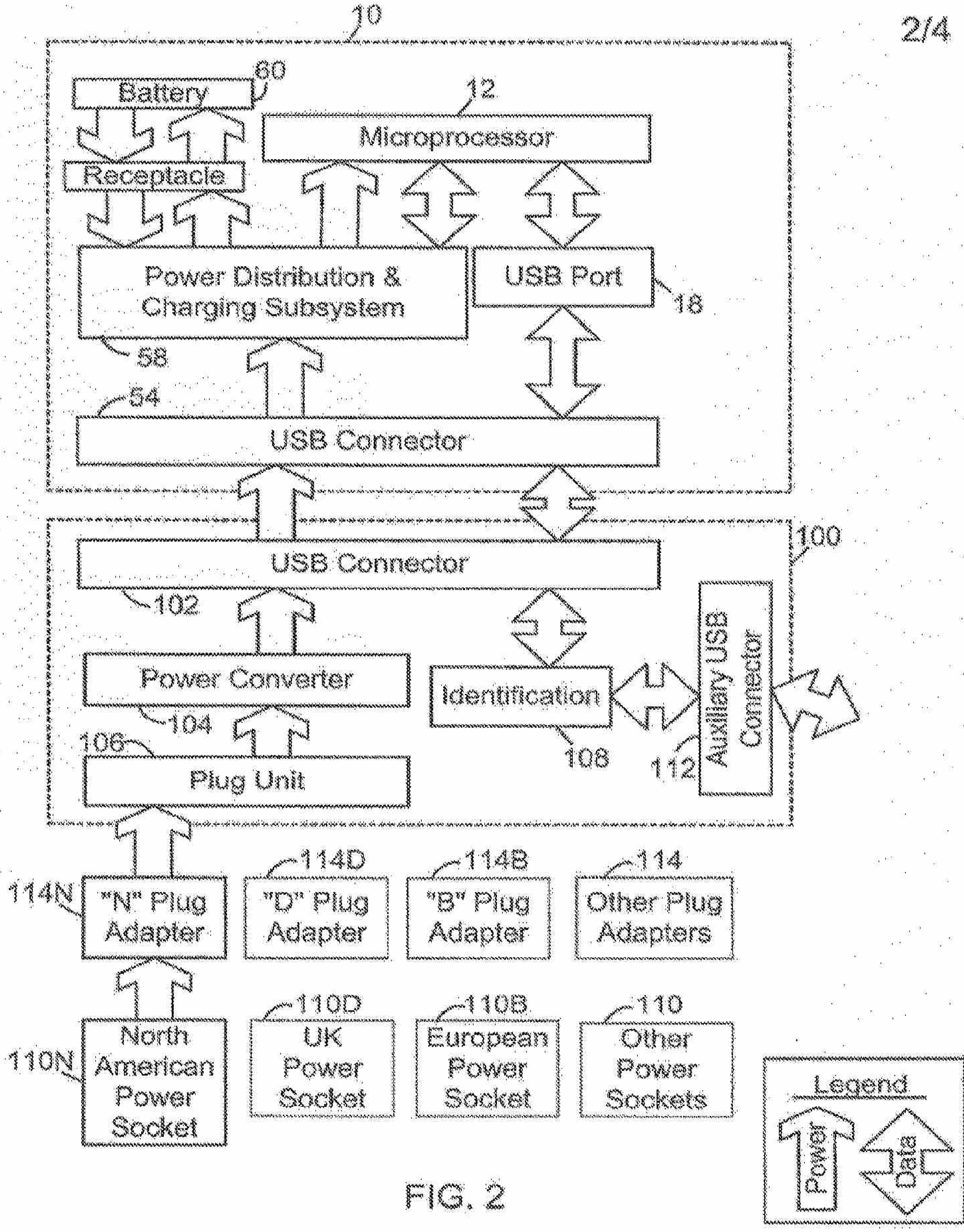

FIG. 2

FISI00001876

REPLACEMENT
DRAWING

3/4

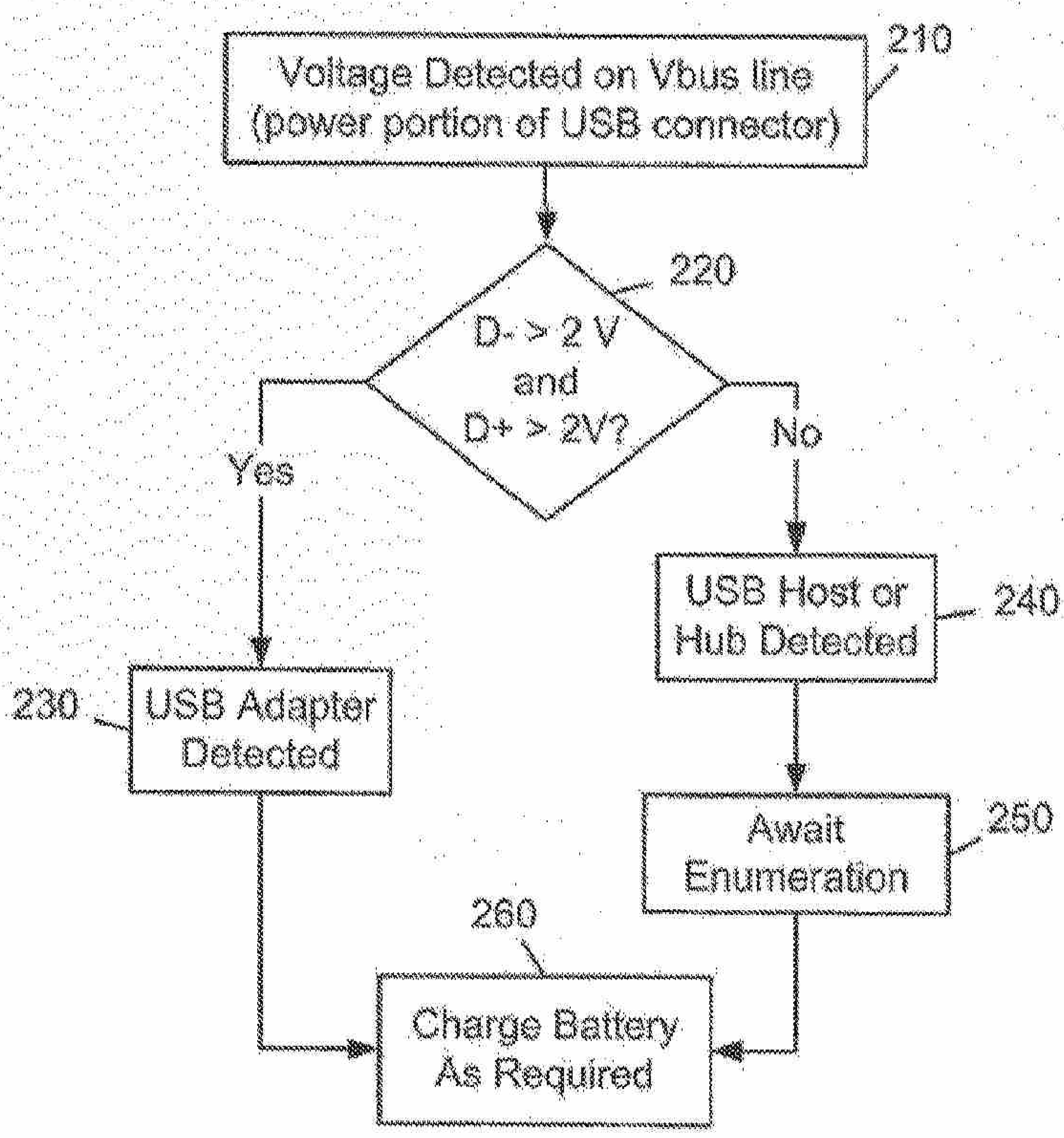

FIG. 3

FISI00001877