US009712866B2

(12) **United States Patent**
Lasser

(10) **Patent No.: US 9,712,866 B2**
(45) **Date of Patent: Jul. 18, 2017**

(54) **CANCELLING TV AUDIO DISTURBANCE BY SET-TOP BOXES IN CONFERENCES**

(71) Applicant: **COMIGO LTD.**, Yarkona (IL)

(72) Inventor: **Menahem Lasser**, Kohav-Yair (IL)

(73) Assignee: **COMIGO LTD.**, Yarkona (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/044,023**

(22) Filed: **Feb. 15, 2016**

(65) **Prior Publication Data**

US 2016/0309119 A1 Oct. 20, 2016

Related U.S. Application Data

(60) Provisional application No. 62/148,354, filed on Apr. 16, 2015.

(51) **Int. Cl.**

H04N 7/15	(2006.01)
H04N 21/439	(2011.01)
H04N 21/4788	(2011.01)
H04N 21/422	(2011.01)
H04N 7/14	(2006.01)

(52) **U.S. Cl.**

CPC ***H04N 21/439*** (2013.01); ***H04N 7/147*** (2013.01); ***H04N 21/42203*** (2013.01); ***H04N 21/4788*** (2013.01)

(58) **Field of Classification Search**

CPC H04N 7/147; H04N 7/17318; H04N 21/4126; H04N 21/4203; H04N 21/4204; H04N 21/439; H04N 21/4396; H04N 21/4788; H04N 21/47

USPC 349/14.01–14.16; 725/110, 123, 131, 725/139, 151

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,305,307	A	4/1994	Chu
5,661,813	A	8/1997	Shimauchi et al.
5,706,344	A	1/1998	Finn
5,761,318	A	6/1998	Shimauchi et al.
5,796,819	A	8/1998	Romesburg
5,933,495	A	8/1999	Oh
5,937,060	A	8/1999	Oh
6,246,760	B1	6/2001	Makino et al.
6,473,409	B1	10/2002	Malvar
6,553,122	B1	4/2003	Shimauchi et al.
6,556,682	B1	4/2003	Gilloire et al.
6,597,787	B1	7/2003	Lindgren et al.
6,694,020	B1	2/2004	Benesty
6,925,176	B2	8/2005	Myllyla et al.
6,928,161	B1	8/2005	Graumann
6,961,422	B2	11/2005	Boland
6,968,064	B1	11/2005	Ning

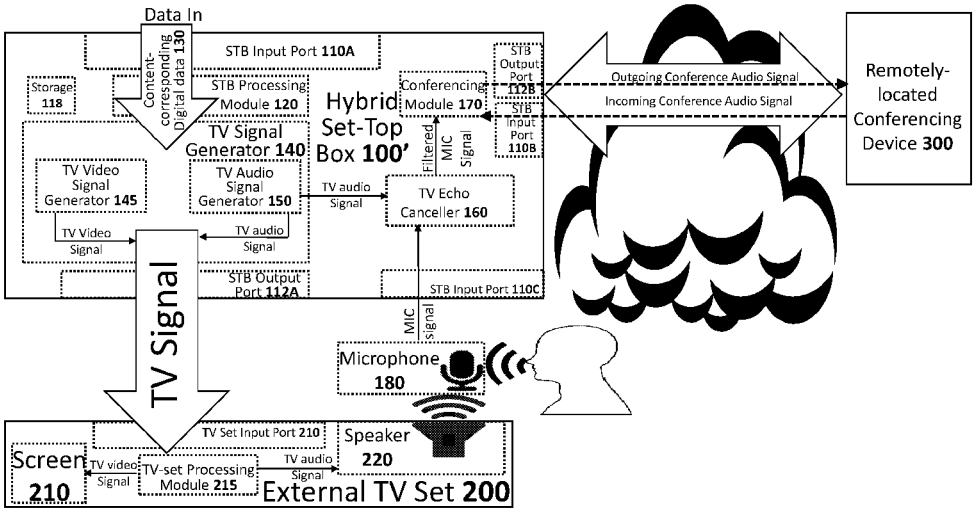
(Continued)

Primary Examiner — Melur Ramakrishnaiah
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Embodiments of the present invention relate to a Set-Top Box (STB) that in addition to outputting a TV signal to an external TV set also supports conferencing between different users located at different locations. When a user is engaged in a conferencing session he may at the same time also view and listen to a TV program on the TV set. The STB of the present disclosure is able to cancel audio disturbances in the outgoing audio signal of the session that might be caused by the TV audio signal played by the TV speaker penetrating the session as a result of being received by the video conferencing microphone.

13 Claims, 6 Drawing Sheets



US009549316B2

(12) **United States Patent**
Ben-Harosh et al.

(10) **Patent No.: US 9,549,316 B2**
(45) **Date of Patent: Jan. 17, 2017**

(54) **HOST DEVICE COUPLED TO A MOBILE PHONE AND METHOD OF OPERATING THE SAME**

(71) Applicant: **MCE-SYS LTD.**, Tel Aviv (IL)

(72) Inventors: **Almog Ben-Harosh**, Pardes Hanna (IL); **Erez Manor**, Herzlia (IL)

(73) Assignee: **MCE-SYS Ltd.**, Tel Aviv (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/774,136**

(22) PCT Filed: **Mar. 14, 2014**

(86) PCT No.: **PCT/IB2014/059809**
§ 371 (c)(1),
(2) Date: **Sep. 10, 2015**

(87) PCT Pub. No.: **WO2014/141180**
PCT Pub. Date: **Sep. 18, 2014**

(65) **Prior Publication Data**

US 2016/0044498 A1 Feb. 11, 2016

Related U.S. Application Data

(60) Provisional application No. 61/786,053, filed on Mar. 14, 2013.

(51) **Int. Cl.**
H04W 24/00 (2009.01)
H04W 8/22 (2009.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04W 8/22*** (2013.01); ***H04L 63/0428*** (2013.01); ***H04W 88/06*** (2013.01)

(58) **Field of Classification Search**
CPC H04W 8/245; H04W 24/00; H04W 24/02; H04W 24/06; H04W 24/08; H04W 88/02; H04W 16/18
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,396,465 B2 3/2013 Danford et al.
2006/0223486 A1* 10/2006 Ruff H04M 1/24 455/343.1
(Continued)

FOREIGN PATENT DOCUMENTS

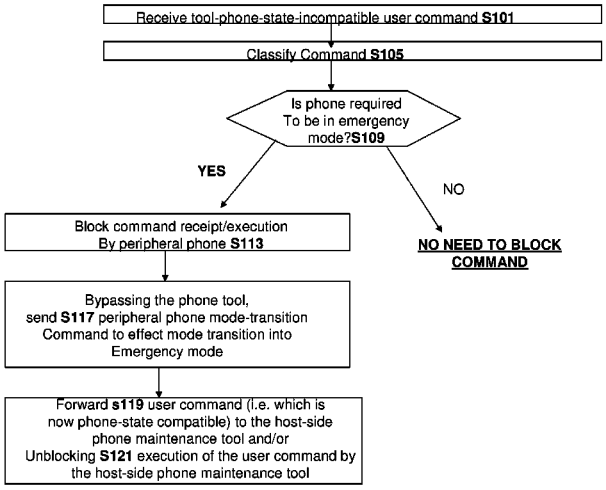
WO WO2012073126 A1 6/2012

Primary Examiner — Temica M Beamer
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Some embodiments relate to a host-side surrogate tool configured to service mobile phones from a host device that is coupled to one or more peripheral cell phones. The presently-disclosed host-side surrogate tool executes on the host device concurrently with one or more software components of a vendor-compliant phone maintenance tool. In some embodiments, the concurrently-executing host-side surrogate tool may cause the vendor-compliant phone maintenance tool to provide functionality for which it was not intended. In some embodiments, it may be said that the host-side surrogate tool provides a 'semi-virtual' environment under which host-side vendor-compliant phone maintenance tool operates. Related methods, devices and systems are disclosed herein.

6 Claims, 14 Drawing Sheets



US009514065B2

(12) **United States Patent**
Ben-Harosh

(10) **Patent No.: US 9,514,065 B2**
(45) **Date of Patent: Dec. 6, 2016**

(54) **HOST DEVICE COUPLED TO A USB PERIPHERAL AND METHOD OF OPERATING THE SAME**

(75) Inventor: **Almog Ben-Harosh**, Pardes Hanna (IL)

(73) Assignee: **MCE-SYS LTD.**, Tel Aviv (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/990,041**

(22) PCT Filed: **Aug. 2, 2011**

(86) PCT No.: **PCT/IB2011/053440**

§ 371 (c)(1),
(2), (4) Date: **May 29, 2013**

(87) PCT Pub. No.: **WO2012/073126**

PCT Pub. Date: **Jun. 7, 2012**

(65) **Prior Publication Data**

US 2014/0019651 A1 Jan. 16, 2014

Related U.S. Application Data

(60) Provisional application No. 61/417,460, filed on Nov. 29, 2010, provisional application No. 61/439,394, (Continued)

(51) **Int. Cl.**
G06F 13/12 (2006.01)
G06F 13/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06F 13/102*** (2013.01); ***G06F 9/4413*** (2013.01); ***G06F 13/385*** (2013.01); ***G06F 13/387*** (2013.01)

(58) **Field of Classification Search**
CPC .. G06F 9/4413; G06F 9/4415; G06F 41/0809; G06F 13/102; G06F 13/385; G06F 13/387
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,082,598 B1 7/2006 Le et al.
2004/0073912 A1* 4/2004 Meza 719/321
(Continued)

OTHER PUBLICATIONS

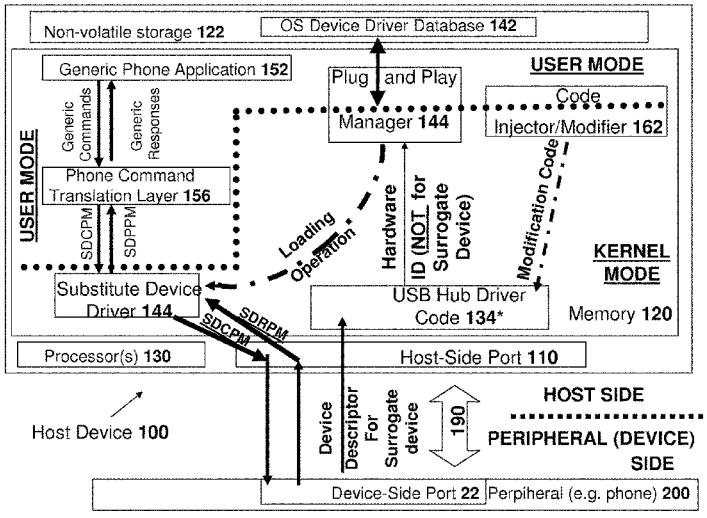
EP Communication for EP 11844416 dated Feb. 10, 2015.
(Continued)

Primary Examiner — Ernest Unelus
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Embodiments of the present invention relate to methods and apparatus for operating a host device (e.g. a 'plug-and-play' host device) coupled to a peripheral device (e.g. a mobile phone). In some embodiments, the host device may analyzed peripheral device-descriptive data (e.g. including but not limited to USB endpoint data) and determine information about the peripheral device in accordance with the results of the analysis. Operations that may be carried out by the host device in accordance with results of the analysis include but are not limited to protocol selection, retrieval of cell phone data, and determining software or hardware resource(s) of the peripheral device. In some embodiments, it is possible to actively suppress natural OS behavior whereby a device driver(s) specified by the peripheral device (e.g. in a hardware identifier) is loaded by the host device. For example, it is possible to load a surrogate driver instead. In one example, the hardware identifier is intercepted and not forwarded to a plug-and-play manager executing on the host device.

31 Claims, 39 Drawing Sheets



US008781158B1

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

(10) **Patent No.: US 8,781,158 B1**
(45) **Date of Patent: Jul. 15, 2014**

(54) **UVB-VISIBLE CHANNEL APPARATUS AND METHOD FOR VIEWING A SCENE COMPRISING TERRESTRIAL CORONA RADIATION**

(71) Applicant: **Ofil, Ltd.**, Nes Ziona (IL)

(72) Inventors: **Eran Frisch**, Neve Daniel (IL); **Odelya Koslovsky**, Jerusalem (IL); **Reuel Haavrahami**, Beit Shemesh (IL)

(73) Assignee: **Ofil, Ltd.**, Nes Ziona (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/151,885**

(22) Filed: **Jan. 10, 2014**

(51) **Int. Cl.**

G06K 9/00	(2006.01)
G06K 9/62	(2006.01)
G06K 9/36	(2006.01)
G01J 3/50	(2006.01)
G06K 7/10	(2006.01)
G02B 5/22	(2006.01)
G02B 27/28	(2006.01)

(52) **U.S. Cl.**
CPC ***G02B 27/28*** (2013.01)
USPC **382/100**; 382/224; 382/284; 250/226; 359/350; 359/885

(58) **Field of Classification Search**
USPC 382/100, 224, 284; 250/226; 359/350, 359/885
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,748,471	A *	7/1973	Ross et al.	250/333
4,731,881	A	3/1988	Geller	
4,752,824	A	6/1988	Moore	
4,835,391	A	5/1989	Hartemann et al.	
5,001,348	A *	3/1991	Dirscherl et al.	250/372

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2211490	1/1998
CN	101726693	6/2010

(Continued)

OTHER PUBLICATIONS

Lindner, M.; Elstein, S.; Lindner, P.; Topaz, J. M.; Phillips, A.J., "Daylight corona discharge imager," High Voltage Engineering, 1999. Eleventh International Symposium on (Conf. Publ. No. 467) , vol. 4, no., pp. 349,352 vol. 4, 1999.*

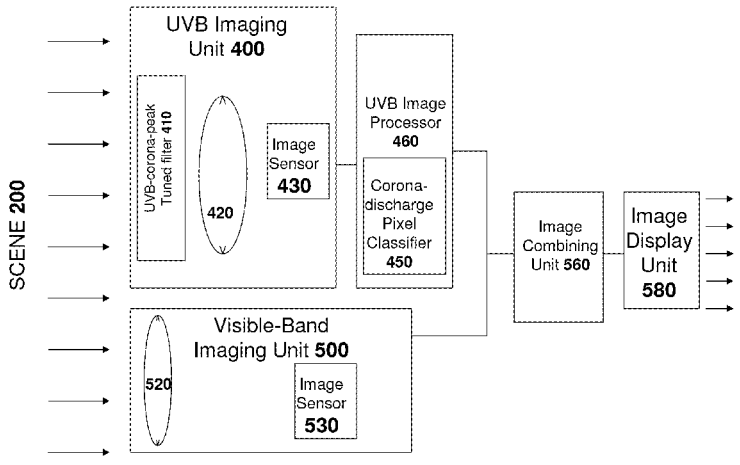
(Continued)

Primary Examiner — Utpal Shah
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

A UVB-visible hybrid system and method for visualizing a scene comprising one of more terrestrial corona discharge(s) and one or more objects is disclosed. On the UVB channel, an object-devoid UVB image of at least a portion of the scene is generated using UVB light which passes though a corona-peak tuned optical filter configured to filter out sufficient non-terrestrial-corona light so that the generated UVB image is object-devoid. The object-devoid UVB image is analyzed to classify pixels thereof as corona-discharge pixels or non-corona-discharge pixels. When a derivative of the object-devoid UVB image superposed with a visible-band image of the scene is displayed on a display device, the pixels classified as corona-discharge are displayed at increased visibility, while the pixels classified as corona-discharge are displayed at decreased visibility. In some embodiments, the optical filter has an average optical density over the [290 nm, 700 nm] spectrum of at least 4.

15 Claims, 16 Drawing Sheets



US008708907B2

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

(10) **Patent No.: US 8,708,907 B2**
(45) **Date of Patent: Apr. 29, 2014**

(54) **METHOD AND APPARATUS FOR DETERMINING ONE OR MORE BLOOD PARAMETERS FROM ANALOG ELECTRICAL SIGNALS**

(75) Inventors: **Ilya Fine**, Rehovot (IL); **Alexander Kaminsky**, Rehovot (IL)

(73) Assignee: **Elfi-Tech**, Rehovot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 416 days.

(21) Appl. No.: **12/774,056**

(22) Filed: **May 5, 2010**

(65) **Prior Publication Data**

US 2010/0286497 A1 Nov. 11, 2010

Related U.S. Application Data

(60) Provisional application No. 61/175,981, filed on May 6, 2009.

(51) **Int. Cl.**

A61B 5/02	(2006.01)
A61B 5/14551	(2006.01)
A61B 5/145	(2006.01)
A61B 8/06	(2006.01)
A61B 8/12	(2006.01)
A61B 5/026	(2006.01)

(52) **U.S. Cl.**

USPC **600/369**; 600/301; 600/323; 600/324; 600/336; 600/364; 600/368; 600/465; 600/467; 600/468; 600/504

(58) **Field of Classification Search**

CPC A61B 5/026; A61B 5/0261; A61B 5/1455
USPC 600/368, 369, 301, 323, 324, 336, 364, 600/465, 467, 468, 504
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,476,875	A *	10/1984	Nilsson et al.	600/479
5,219,962	A	6/1993	McDaniel et al.	
5,284,149	A *	2/1994	Dhadwal et al.	600/476
5,598,841	A *	2/1997	Taniji et al.	600/342

(Continued)

FOREIGN PATENT DOCUMENTS

WO	WO2007113804	10/2007
WO	WO2007144880	12/2007
WO	WO2008053474	5/2008

OTHER PUBLICATIONS

PCT Search report of PCT/US10/56282.

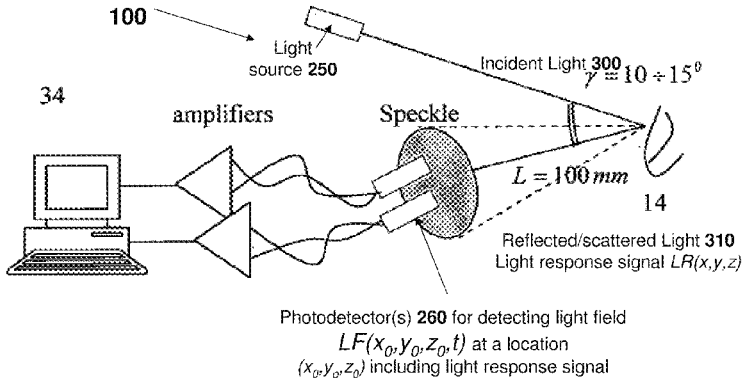
(Continued)

Primary Examiner — Jacqueline Cheng
Assistant Examiner — Puya Agahi
(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

Embodiments of the present invention relate to a system and method for in vivo measurement of blood parameters by processing analog electrical signals from a plurality of photodetectors. In some embodiments, it is possible to determine one or more blood parameters according to (i) a first electrical signal from a first detector and (ii) a second electrical signal from a second photodetector. A difference analog electrical signal is generated, indicative of a difference between the light response signal at the first location and light response signal at the second location, is generated. One or more blood parameters may be detected according to the difference analog electrical signal.

12 Claims, 14 Drawing Sheets



$$LF(x0,y0,z0,t) = LF^{SLOWLY\_FLUCTUATING}(x0,y0,z0,t) + LF^{RAPIDLY\_FLUCTUATING}(x0,y0,z0,t) = LF^{SLOWLY\_FLUCTUATING}(x0,y0,z0,t) + [LF^{REGULAR}((x0,y0,z0,t) + LF^{STOCHASTIC}(x0,y0,z0,t)]$$

US008554961B2

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

(10) **Patent No.: US 8,554,961 B2**
(45) **Date of Patent: *Oct. 8, 2013**

(54) **APPARATUS, METHODS, AND COMPUTER-CODE FOR HANDLING AN IMPENDING DECOUPLING BETWEEN A PERIPHERAL DEVICE AND A HOST DEVICE**

(75) Inventors: **Yehuda Hahn**, Ofra (IL); **Mordechai Teicher**, Hod Hasharon (IL); **Itzhak Pomerantz**, Kfar Saba (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/204,586**

(22) Filed: **Aug. 5, 2011**

(65) **Prior Publication Data**

US 2011/0296061 A1 Dec. 1, 2011

Related U.S. Application Data

(63) Continuation of application No. 11/798,424, filed on May 14, 2007, now Pat. No. 7,996,579.

(60) Provisional application No. 60/747,195, filed on May 14, 2006.

(51) **Int. Cl.**

G06F 13/00	(2006.01)
G06F 12/00	(2006.01)
G06F 15/00	(2006.01)

(52) **U.S. Cl.**

USPC **710/15**; 710/16; 710/17; 710/18; 710/19; 710/64; 710/302; 710/304; 710/72; 711/115; 711/135; 702/188

(58) **Field of Classification Search**

USPC 710/15–19, 62, 64, 72, 302; 702/188; 711/115, 135

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,564,024	A	10/1996	Pemberton
5,664,119	A	9/1997	Jeffries et al.
5,758,101	A	5/1998	Pemberton
5,768,541	A	6/1998	Pan-Ratzlaff
6,005,769	A	12/1999	Cho
6,098,127	A	8/2000	Kwang
6,134,615	A	10/2000	Chari et al.
6,138,194	A	10/2000	Klein et al.

(Continued)

OTHER PUBLICATIONS

Non-Final Office Action dated Nov. 26, 2008, U.S. Appl. No. 11/798,424, filed May 14, 2007.

Response to Office Action dated Mar. 26, 2009, U.S. Appl. No. 11/798,424, filed May 14, 2007.

(Continued)

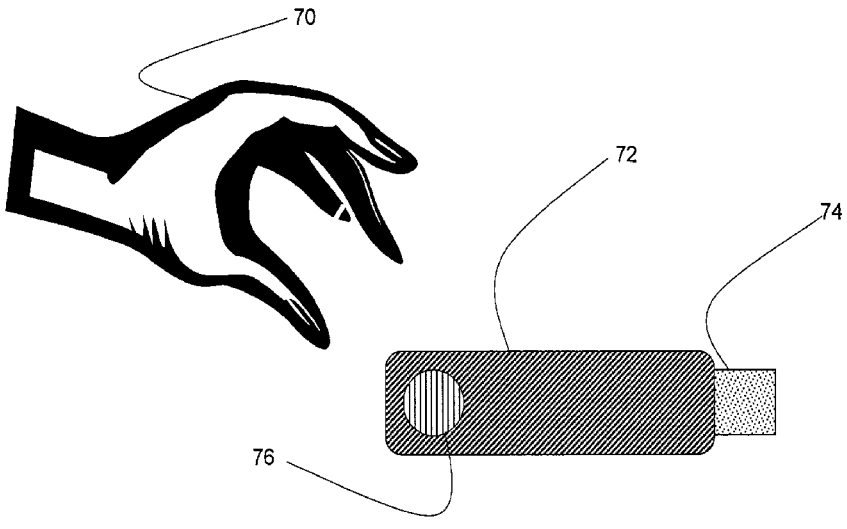
Primary Examiner — Tammara Peyton

(74) *Attorney, Agent, or Firm* — Vierra Magen Marcus LLP

(57) **ABSTRACT**

Apparatus, methods and computer-code are disclosed where an impending decoupling between a peripheral device and a host is detected. In some embodiments, in response to the detected impending disconnection, a user alert signal is generated. In some embodiments, an 'onboard detector' that is associated with housing of the peripheral device and operative to detect the impending disconnection is provided. In some embodiments, the user alert signal is generated in accordance with inter-device data flow between the host and the peripheral device. Exemplary peripheral devices include but are not limited to transient storage devices such as a USB flash drives (UFD).

13 Claims, 12 Drawing Sheets



US008464134B2

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

(10) **Patent No.: US 8,464,134 B2**
(45) **Date of Patent: Jun. 11, 2013**

(54) **METHOD AND APPARATUS FOR ERROR CORRECTION ACCORDING TO ERASE COUNTS OF A SOLID-STATE MEMORY**

(75) Inventors: **Idan Alrod**, Herzliya (IL); **Eran Sharon**, Rishon Lezion (IL); **Menahem Lasser**, Kochav Yair (IL)

(73) Assignee: **SanDisk IL Ltd**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 694 days.

(21) Appl. No.: **12/436,155**

(22) Filed: **May 6, 2009**

(65) **Prior Publication Data**

US 2009/0319859 A1 Dec. 24, 2009

Related U.S. Application Data

(60) Provisional application No. 61/075,065, filed on Jun. 24, 2008.

(51) **Int. Cl.**
G06F 11/00 (2006.01)

(52) **U.S. Cl.**
USPC **714/773**

(58) **Field of Classification Search**
USPC 714/773, 752
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,341,339	A	8/1994	Wells	
5,388,083	A	2/1995	Assar et al.	
5,568,423	A	10/1996	Jou et al.	
5,712,819	A	1/1998	Harari	
5,963,480	A	10/1999	Harari	
6,166,650	A *	12/2000	Bruwer	340/5.26
6,230,233	B1	5/2001	Lofgren et al.	
6,570,790	B1	5/2003	Harari	
6,831,865	B2	12/2004	Chang et al.	
7,900,125	B1 *	3/2011	Liu et al.	714/799
2004/0083333	A1 *	4/2004	Chang et al.	711/103
2005/0281113	A1 *	12/2005	Yada et al.	365/222
2008/0022189	A1 *	1/2008	Vityaev et al.	714/770

(Continued)

FOREIGN PATENT DOCUMENTS

WO	WO2007/132457	11/2007
WO	WO2008/053472	5/2008
WO	WO2008/068747	6/2008

OTHER PUBLICATIONS

U.S. Appl. No. 11/642,708, filed Jun. 2008, Alrod; Idan ; et al.

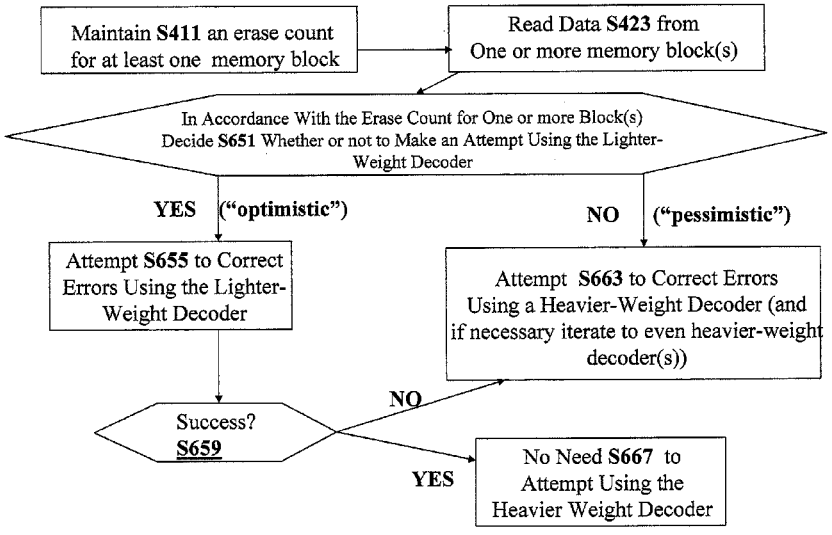
(Continued)

Primary Examiner — Scott Baderman
Assistant Examiner — Yair Leibovich
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP

(57) **ABSTRACT**

Embodiments of the present invention relate to methods and devices where an erase count is maintained for at least one block of solid state memory. Errors are corrected in data read from the solid state memory in accordance with the associated erase count of the memory block. In some embodiments, one or more of the following error-correction operations may be effected according to the associated erase count of a memory block from which the data is read: (i) a decoder and/or decoder mode is selected; (ii) a decision to attempt correcting errors using a lighter-weight weight decoder (mode) and/or heavier weight decoder (mode) and/or faster decoder (mode) and/or slower decoder (mode) is made; (iii) a mode transition and/or error correction attempt resource budget is determined; (iv) a number of soft bits is determined; and (v) a decoding bus width size is selected.

15 Claims, 14 Drawing Sheets



US008407399B2

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

(10) **Patent No.: US 8,407,399 B2**
(45) **Date of Patent: Mar. 26, 2013**

(54) **METHOD AND APPARATUS FOR ENFORCING A FLASH MEMORY CACHING POLICY**

(75) Inventors: **Menahem Lasser**, Kochav Yair (IL); **Itshak Afriat**, Tel-Mond (IL); **Opher Lieber**, Kfar Saba (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 677 days.

(21) Appl. No.: **12/260,135**

(22) Filed: **Oct. 29, 2008**

(65) **Prior Publication Data**

US 2010/0106890 A1 Apr. 29, 2010

(51) **Int. Cl.**
G06F 12/08 (2006.01)

(52) **U.S. Cl.** **711/103**; 711/113; 711/118; 711/138; 711/170; 711/173

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,930,167	A *	7/1999	Lee et al.	365/185.03
2006/0168390	A1	7/2006	Speier et al.	711/5
2007/0061502	A1	3/2007	Lasser et al.	711/103
2008/0016283	A1	1/2008	Madter	711/138
2008/0189478	A1 *	8/2008	Chae et al.	711/103
2008/0209112	A1 *	8/2008	Yu et al.	711/103
2008/0209114	A1 *	8/2008	Chow et al.	711/103
2009/0089482	A1	4/2009	Traister	711/103

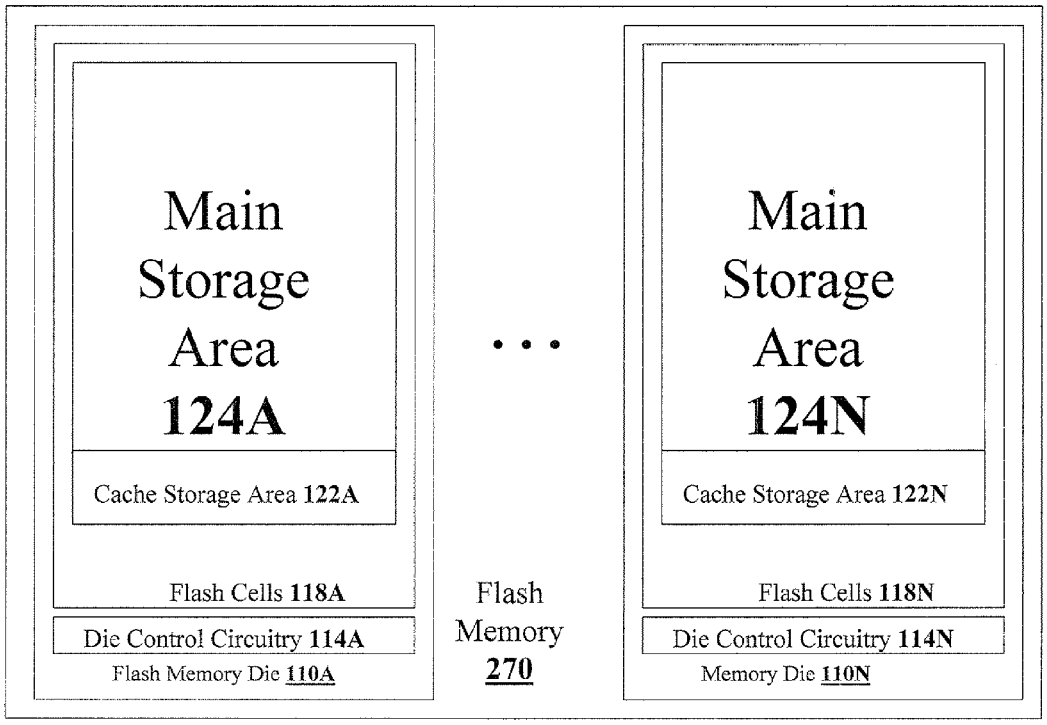
* cited by examiner

Primary Examiner — Jared Rutz
Assistant Examiner — Alan Otto
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP.

(57) **ABSTRACT**

Methods, apparatus and computer medium for enforcing one or more cache management policies are disclosed herein. In some embodiments, a flash memory of a storage device includes a plurality of flash memory dies each flash memory die including a respective cache storage area and a respective main storage area. A determination is made, for data that is received from an external host device to which main storage area the received data is addressed thereby specifying one of the plurality of flash memory dies as a target die for the received data. Whenever the received data is written into a cache storage area before being written into a main storage area, the received data is written into the cache storage area of the specified target die.

28 Claims, 20 Drawing Sheets



US008386868B2

(12) **United States Patent**
Lasser

(10) **Patent No.: US 8,386,868 B2**
(45) **Date of Patent: Feb. 26, 2013**

(54) **USING PROGRAMMING-TIME INFORMATION TO SUPPORT ERROR CORRECTION**

(75) Inventor: **Menahem Lasser**, Kochav Yair (IL)

(73) Assignee: **SanDisk IL, Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1351 days.

(21) Appl. No.: **12/103,784**

(22) Filed: **Apr. 16, 2008**

(65) **Prior Publication Data**

US 2009/0265598 A1 Oct. 22, 2009

(51) **Int. Cl.**
G06F 11/30 (2006.01)

(52) **U.S. Cl.** **714/746**; 714/718; 714/719; 714/758; 714/763; 713/187

(58) **Field of Classification Search** 714/763, 714/752, 718, 719; 713/187
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,553,536	B1 *	4/2003	Hassner et al.	714/780
6,751,766	B2	6/2004	Guterman et al.	
7,992,009	B2 *	8/2011	Seo	713/187
2003/0037299	A1	2/2003	Smith	714/763
2003/0217323	A1 *	11/2003	Guterman et al.	714/763
2004/0015771	A1 *	1/2004	Lasser et al.	714/763
2004/0030737	A1 *	2/2004	Hassner et al.	708/530
2004/0117562	A1 *	6/2004	Wu et al.	711/147
2005/0172179	A1 *	8/2005	Brandenberger et al.	714/718
2005/0185476	A1 *	8/2005	Tachikawa	365/189.05
2007/0283227	A1 *	12/2007	Sharon et al.	714/776
2008/0086677	A1	4/2008	Yang et al.	714/763
2009/0265598	A1 *	10/2009	Lasser	714/746
2009/0319843	A1 *	12/2009	Meir et al.	714/746
2009/0319859	A1 *	12/2009	Alrod et al.	714/752
2010/0115376	A1 *	5/2010	Shalvi et al.	714/763

FOREIGN PATENT DOCUMENTS

WO	WO 2006/013529	A1	9/2006
WO	WO2007132457		11/2007
WO	WO2008053472		5/2008
WO	WO2008068747		6/2008

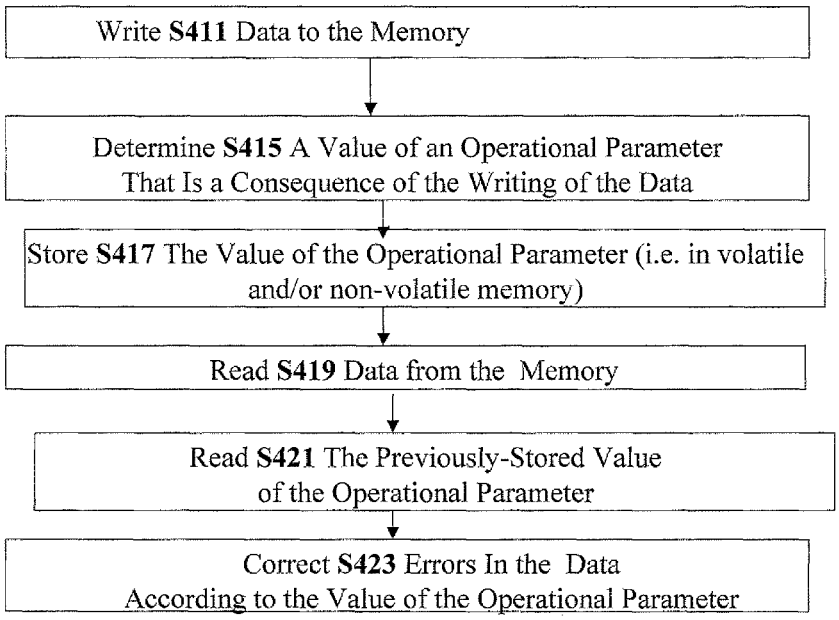
* cited by examiner

Primary Examiner — Scott Baderman
Assistant Examiner — Jeison C Arcos
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP

(57) **ABSTRACT**

Methods, apparatus and computer readable medium for handling error correction in a memory are disclosed. In some embodiments, first data is written to the memory, and a value (s) of an operational parameter(s) that is a consequence of the writing of the first data is determined. Second data is read from the memory, and the value(s) of the operational parameter(s) may be used when correcting errors in the second data. In some embodiments, the first data is the same as the second data. The presently-disclosed teachings are applicable to any kind of memory including (i) non-volatile memories such as flash memory, magnetic memory and optical storage and (ii) volatile memory such as SRAM or DRAM.

29 Claims, 25 Drawing Sheets



US008321757B2

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

(10) **Patent No.: US 8,321,757 B2**
(45) **Date of Patent: Nov. 27, 2012**

(54) **METHOD AND APPARATUS FOR ERROR CORRECTION**

(75) Inventors: **Avraham Meir**, Rishon Lezion (IL); **Menahem Lasser**, Kohav Yair (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1129 days.

(21) Appl. No.: **12/143,796**

(22) Filed: **Jun. 22, 2008**

(65) **Prior Publication Data**

US 2009/0319843 A1 Dec. 24, 2009

(51) **Int. Cl.**
G11C 29/00 (2006.01)

(52) **U.S. Cl.** **714/763**

(58) **Field of Classification Search** 714/763
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,146,592	A *	9/1992	Pfeiffer et al.	715/807
6,751,766	B2	6/2004	Guterman et al.	
7,567,464	B2 *	7/2009	Gendrier et al.	365/185.25
2002/0144196	A1 *	10/2002	Chen	714/718
2007/0277066	A1 *	11/2007	Gajapathy et al.	714/724
2008/0148115	A1	6/2008	Sokolov et al.	
2010/0115376	A1 *	5/2010	Shalvi et al.	714/763

FOREIGN PATENT DOCUMENTS

WO	WO2007132457	11/2007
WO	WO2008053472	5/2008
WO	WO2008068747	6/2008

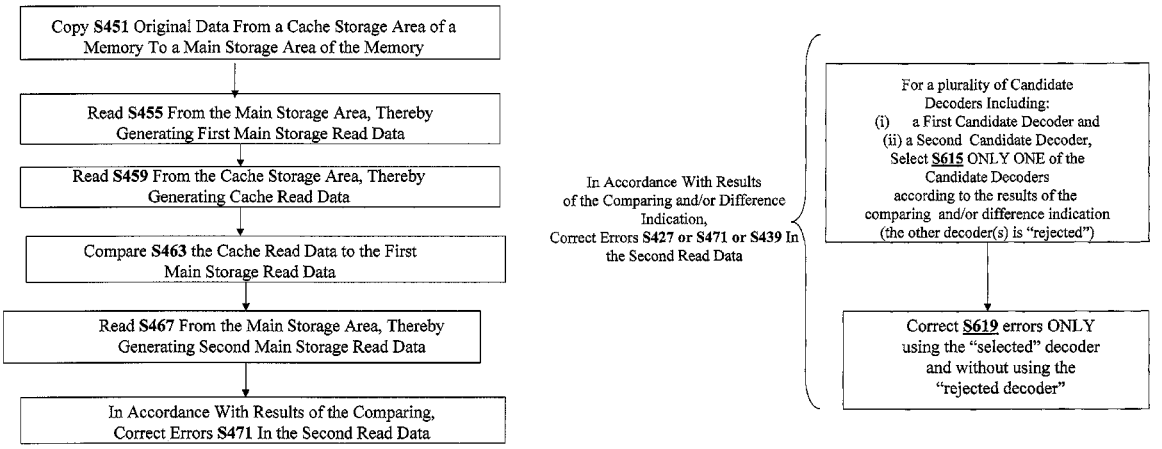
* cited by examiner

Primary Examiner — Guy Lamarre
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP.

(57) **ABSTRACT**

Methods, apparatus and computer readable medium for handling error correction in a memory are disclosed. In some embodiments, after an attempt is made to write original data to a 'target' memory, data is read back from the target memory in a 'first read operation', thereby generating first read data. After the first read operation, the first read data is compared to the original data and/or an indication of a difference between the original data and the first data is determined. The information obtained by effecting the data-comparison and/or information related to the difference indication is used when correcting errors in data read back from the target memory in a 'second read operation.'. The presently-disclosed teachings are applicable to any kind of memory including (i) non-volatile memories such as flash memory, magnetic memory and optical storage and (ii) volatile memory such as SRAM or DRAM.

16 Claims, 17 Drawing Sheets



US008265166B2

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

(10) **Patent No.: US 8,265,166 B2**
(45) **Date of Patent: *Sep. 11, 2012**

(54) **DUAL DECODER PORTABLE MEDIA DEVICE**

(75) Inventors: **Moshe Raines**, Tel Aviv (IL); **Eliyahou Harari**, Saratoga, CA (US); **Ran Carmeli**, Rinatya (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1155 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/120,256**

(22) Filed: **May 14, 2008**

(65) **Prior Publication Data**

US 2008/0285660 A1 Nov. 20, 2008

Related U.S. Application Data

(60) Provisional application No. 60/917,680, filed on May 14, 2007.

(51) **Int. Cl.**
H04N 7/12 (2006.01)

(52) **U.S. Cl.** **375/240.25**

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,128,015	A *	10/2000	Zenda	345/474
6,522,419	B1	2/2003	Ko	
7,012,610	B2	3/2006	Turner et al.	
7,149,811	B2 *	12/2006	Wise et al.	709/247
7,446,819	B2	11/2008	Kim et al.	
7,451,328	B2 *	11/2008	Hsieh	713/300
7,916,809	B2 *	3/2011	Tsushima	375/316

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1 557 750	A1	7/2005

(Continued)

OTHER PUBLICATIONS

International Preliminary Report on Patentability for International Application No. PCT/IL2008/000667 (Nov. 17, 2009).

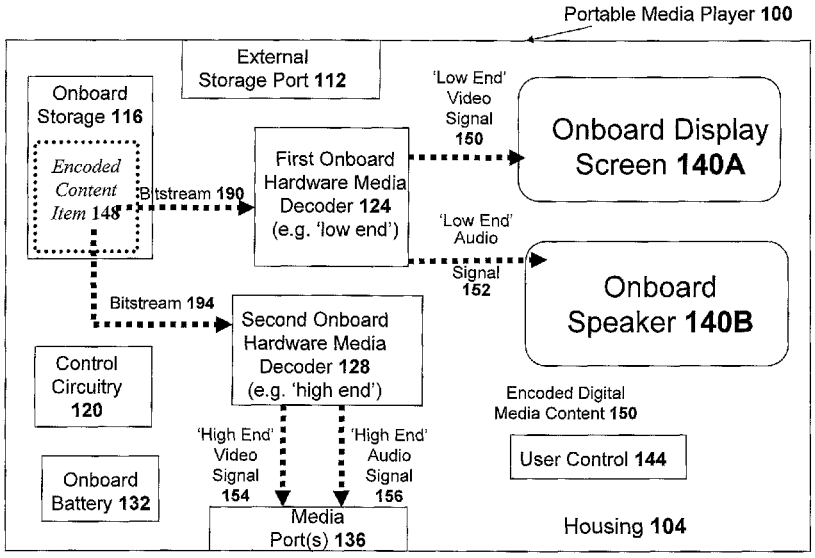
(Continued)

Primary Examiner — Ayaz Sheikh
Assistant Examiner — Faiyazkhan Ghafoerkhan
(74) *Attorney, Agent, or Firm* — Jenkins, Wilson, Taylor & Hunt, P.A.

(57) **ABSTRACT**

A portable media device **100** including two onboard hardware media decoders (**124**, **128**) operative to decode a given digital content item **148** is provided. In some embodiments, one of the onboard hardware media decoders **128** has a relatively high power consumption and produces a relatively 'high quality' media signal, and the other of the onboard hardware media decoder **124** has a relatively low power consumption and produces a relatively 'low quality' media signal. In one non-limiting use case: (i) when no external power is available, the relatively 'low power' hardware media decoder **124** may generate a relatively 'low quality' media signal which is presented on an onboard display screen **140***a* and/or onboard speaker **140***b;* and (ii) when external power is available, the relatively 'high power' hardware media decoder **128** may generate a relatively 'high quality' media signal which is exported out of the portable media device **100** via one or more media ports, and presented on an external host presentation device **160** (for example, a large-screen television).

21 Claims, 17 Drawing Sheets



US008244958B2

(12) **United States Patent**
Lasser

(10) **Patent No.: US 8,244,958 B2**
(45) **Date of Patent: Aug. 14, 2012**

(54) **METHOD AND SYSTEM FOR FACILITATING FAST WAKE-UP OF A FLASH MEMORY SYSTEM**

(75) Inventor: **Menahem Lasser**, Kohav-Yair (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/382,056**

(22) Filed: **May 8, 2006**

(65) **Prior Publication Data**

US 2006/0253645 A1 Nov. 9, 2006

Related U.S. Application Data

(60) Provisional application No. 60/678,902, filed on May 9, 2005.

(51) **Int. Cl.**
G06F 12/00 (2006.01)

(52) **U.S. Cl.** **711/103**; 711/154; 714/6.1; 713/2

(58) **Field of Classification Search** 711/103, 711/154; 714/6.1; 713/2

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,671,388	A *	9/1997	Hasbun	711/103
5,682,497	A *	10/1997	Robinson	711/103
5,937,425	A	8/1999	Ban	
6,026,465	A *	2/2000	Mills et al.	711/103
6,282,605	B1 *	8/2001	Moore	711/103
6,442,662	B1 *	8/2002	Komatsu	711/202
6,456,528	B1	9/2002	Chen	
6,510,488	B2	1/2003	Lasser	
6,678,785	B2	1/2004	Lasser	
6,788,575	B2 *	9/2004	Kozakai et al.	365/185.09
7,139,883	B2 *	11/2006	Aasheim et al.	711/156
2003/0163594	A1	8/2003	Aasheim et al.	
2004/0111582	A1 *	6/2004	Maeda et al.	711/202

FOREIGN PATENT DOCUMENTS

EP	1 524 603	A1	4/2005
JP	2003-015929	A	1/2003
JP	2004-234188	A	8/2004

(Continued)

OTHER PUBLICATIONS

EPO, "European Search Report," corresponding European Patent Application No. EP 06 72 8339, mailed on Mar. 3, 2009, 6 pages.

(Continued)

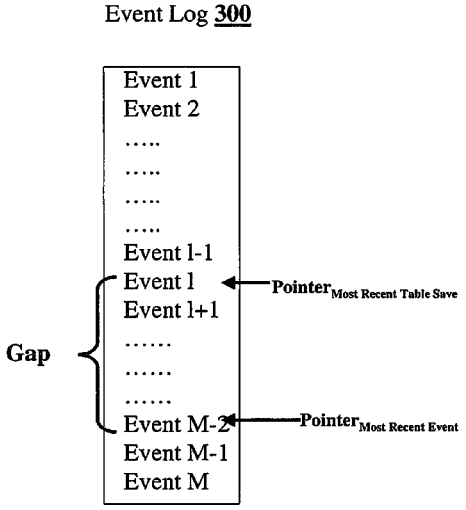
Primary Examiner — Arpan P. Savla

(74) *Attorney, Agent, or Firm* — Davis Wright Tremaine LLP

(57) **ABSTRACT**

Methods, systems and computer-readable code for maintaining flash data structures in accordance with events of a flash memory system are disclosed. Both an events log as well as at least one flash management table are maintained in flash memory. For at least one point in time, a most recently stored flash memory table is indicative of an earlier state of the flash memory system, while at least one event that is more recent than the earlier state is stored in the events log. During power-up, the flash management table is retrieved from flash memory. If the most recent event of the flash memory table is earlier than the most recent event of the events log, events are retrieved from the events log in order to update the flash memory table. Optionally, the updated flash memory table is saved to flash memory.

41 Claims, 11 Drawing Sheets



US008213519B2

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

(10) **Patent No.: US 8,213,519 B2**
(45) **Date of Patent: Jul. 3, 2012**

(54) **METHODS OF OPERATING A DUAL DECODER PORTABLE MEDIA DEVICE**

(75) Inventors: **Moshe Raines**, Tel Aviv (IL); **Eliyahou Harari**, Saratoga, CA (US); **Ran Carmeli**, Rinatya (IL)

(73) Assignee: **SanDisk IL, Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1069 days.

(21) Appl. No.: **12/120,253**

(22) Filed: **May 14, 2008**

(65) **Prior Publication Data**

US 2008/0285659 A1 Nov. 20, 2008

Related U.S. Application Data

(60) Provisional application No. 60/917,680, filed on May 14, 2007.

(51) **Int. Cl.**
H04N 7/24 (2011.01)
G06K 9/32 (2006.01)
G06T 1/20 (2006.01)

(52) **U.S. Cl.** **375/240.25**; 345/502; 348/725; 382/298

(58) **Field of Classification Search** 375/240, 375/240.1, 240.12, 240.25; 345/502; 348/725; 382/298

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,128,015 A 10/2000 Zenda
6,522,419 B1 * 2/2003 Ko 358/1.15
7,012,610 B2 * 3/2006 Turner et al. 345/519
7,149,811 B2 12/2006 Wise et al.
7,446,819 B2 * 11/2008 Kim et al. 348/559
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1 557 750 A1 7/2005
(Continued)

OTHER PUBLICATIONS

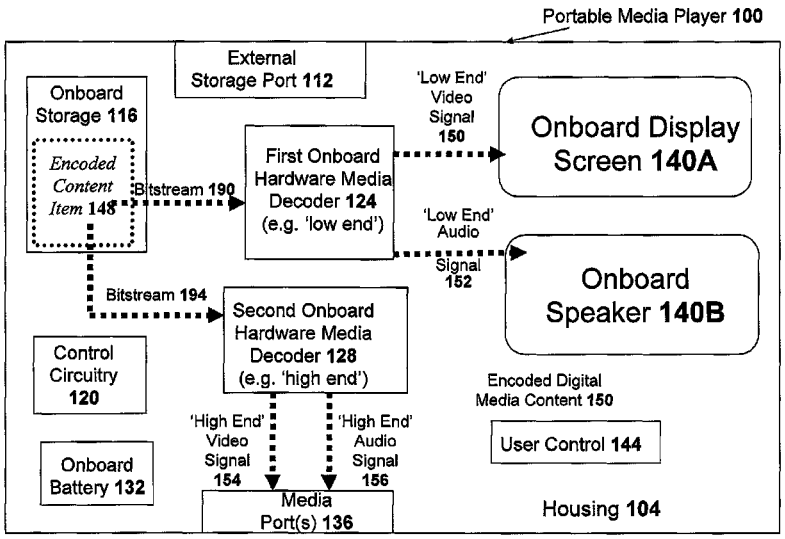
International Preliminary Report on Patentability for International Application No. PCT/IL2008/000667 (Nov. 17, 2009).
(Continued)

Primary Examiner — Hassan Kizou
Assistant Examiner — Emmanuel Maglo
(74) *Attorney, Agent, or Firm* — Jenkins, Wilson, Taylor & Hunt, P.A.

(57) **ABSTRACT**

Methods of operating a portable media device **100** including two onboard hardware media decoders (**124**, **128**) operative to decode a given digital content item **148** are disclosed. In some embodiments, one of the onboard hardware media decoders **128** has a relatively high power consumption and produces a relatively 'high quality' media signal, and the other of the onboard hardware media decoder **124** has a relatively low power consumption and produces a relatively 'low quality' media signal. In one non-limiting use case: (i) when no external power is available, the relatively 'low power' hardware media decoder **124** may generate a relatively 'low quality' media signal which is presented on an onboard display screen **140***a* and/or onboard speaker **140***b*; and (ii) when external power is available, the relatively 'high power' hardware media decoder **128** may generate a relatively 'high quality' media signal which is exported out of the portable media device **100** via one or more media ports, and presented on an external host presentation device **160** (for example, a large-screen television).

24 Claims, 17 Drawing Sheets



US008190206B2

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

(10) **Patent No.: US 8,190,206 B2**
(45) **Date of Patent: May 29, 2012**

(54) **DUAL CHANNEL SMART CARD DATA STORAGE**

(75) Inventors: **Menahem Lasser**, Kohav-Yair (IL); **Eitan Mardiks**, Ra'anana (IL)

(73) Assignee: **Sandisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1032 days.

(21) Appl. No.: **11/710,989**

(22) Filed: **Feb. 27, 2007**

(65) **Prior Publication Data**

US 2008/0009317 A1 Jan. 10, 2008

Related U.S. Application Data

(60) Provisional application No. 60/806,532, filed on Jul. 4, 2006.

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **455/558**; 235/380; 235/451; 235/441; 235/492; 711/103

(58) **Field of Classification Search** 455/558; 235/492, 380, 441, 451; 711/103
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,799,171	A *	8/1998	Kondou	703/27
2004/0065734	A1 *	4/2004	Piikivi	235/451
2007/0023503	A1 *	2/2007	Kang	235/380
2007/0136509	A1 *	6/2007	Agami	711/103
2007/0158439	A1	7/2007	Conner et al.	
2007/0259691	A1	11/2007	Santos Garcia	
2008/0009317	A1 *	1/2008	Lasser et al.	455/558

OTHER PUBLICATIONS

International Search Report and Written Opinion received in corresponding PCT Application No. PCT/IL07/00829 from the International Searching Authority (US) mailed Jul. 25, 2008, 7 pages.

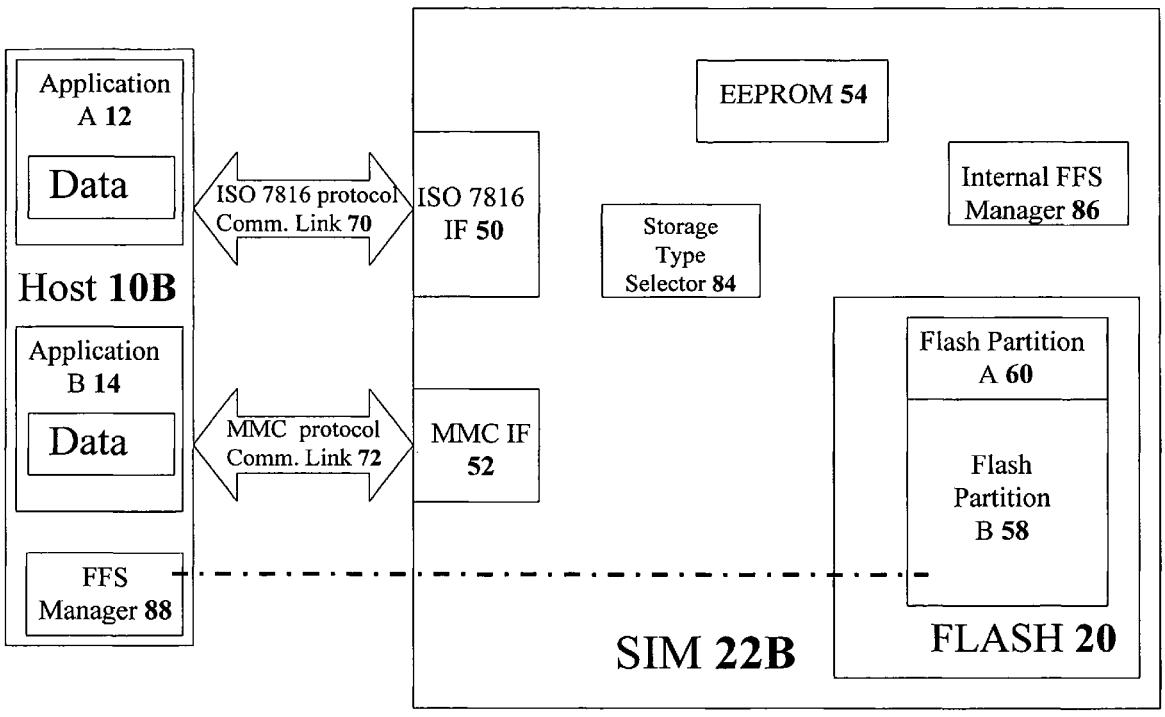
* cited by examiner

Primary Examiner — Pierre-Louis Desir
(74) *Attorney, Agent, or Firm* — Toler Law Group, PC

(57) **ABSTRACT**

A SIM card comprising at least a first interface and a second interface different from the first interface is disclosed. In some embodiments, the SIM card is operative to receive data through the first interface, store the received data within the SIM card, and send back the stored data via the second interface. This enables a host operatively coupled with the SIM card to write data to the SIM card via the first interface and to read back the data via the second interface. Furthermore, a technique for extending the SIM EEPROM storage by keeping a portion of the file in flash is provided.

26 Claims, 13 Drawing Sheets



US008135904B2

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

(10) **Patent No.: US 8,135,904 B2**
(45) **Date of Patent: Mar. 13, 2012**

(54) **METHOD AND APPARATUS FOR FACILITATING FAST WAKE-UP OF A NON-VOLATILE MEMORY SYSTEM**

(75) Inventors: **Menahem Lasser**, Kohav Yair (IL); **Meir Avraham**, Rishon Lezion (IL)

(73) Assignee: **Sandisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/823,053**

(22) Filed: **Jun. 24, 2010**

(65) **Prior Publication Data**

US 2010/0262799 A1 Oct. 14, 2010

Related U.S. Application Data

(63) Continuation of application No. 11/808,451, filed on Jun. 11, 2007, now Pat. No. 7,769,945.

(60) Provisional application No. 60/885,412, filed on Jan. 18, 2007.

(51) **Int. Cl.**
G06F 12/08 (2006.01)

(52) **U.S. Cl.** **711/103**; 711/206; 713/1

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,924,113	A	7/1999	Estakhri et al.
5,937,425	A	8/1999	Ban
6,510,488	B2	1/2003	Lasser
6,678,785	B2	1/2004	Lasser
7,191,306	B2	3/2007	Myoung et al.
7,516,267	B2	4/2009	Coulson et al.
2005/0223154	A1	10/2005	Uemura

FOREIGN PATENT DOCUMENTS

EP	0973097	A1	1/2000
WO	2007072313	A2	6/2007
WO	2007072317	A2	6/2007
WO	2007072367	A2	6/2007
WO	2007096844	A2	8/2007

OTHER PUBLICATIONS

International Search Report and Written Opinion received in corresponding PCT Application No. PCT/IL2008/000062 from the International Searching Authority (EPO) mailed Apr. 17, 2008, 16 pages.
HP OpenVMS Systems Documentation Guide to OpenVMS File Applications, 2007 Hewlett Packard Development Company L.P. <http://h71000.www7.hp.com/doc/73final/4506/4506pro_025.html>, printed Aug. 13, 2007, 7 pages.
Notice of Allowance and Fee(s) Due for U.S. Appl. No. 11/808,452 mailed Feb. 22, 2010, 6 pages.

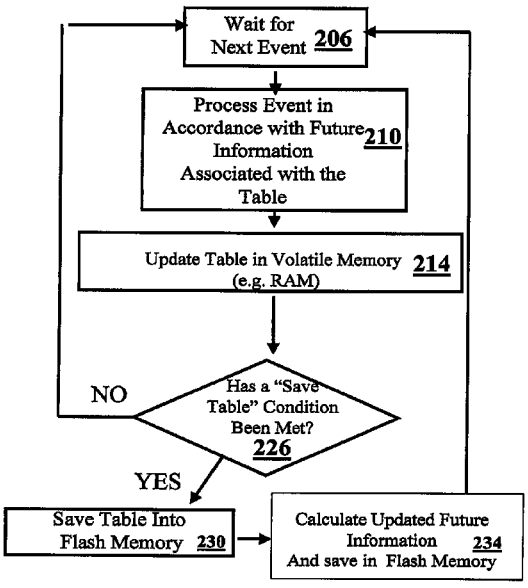
(Continued)

Primary Examiner — Gary J Portka
(74) *Attorney, Agent, or Firm* — Toler Law Group, PC

(57) **ABSTRACT**

A method includes storing at a non-volatile memory in a data storage device a first copy of a memory management table. The method further includes storing, at the non-volatile memory, a list of data entries that identify unused blocks of the non-volatile memory, where the list defines an order of allocating the unused blocks. The method further includes, in response to detecting a power event, accessing an entry of the ordered list to identify a block, and selectively updating the first copy of the memory management table based on a status of the identified block.

20 Claims, 7 Drawing Sheets



US008112682B2

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

(10) **Patent No.: US 8,112,682 B2**
(45) **Date of Patent: Feb. 7, 2012**

(54) **METHOD AND DEVICE FOR BAD-BLOCK TESTING**

(75) Inventors: **Menahem Lasser**, Kochav Yair (IL); **Mark Shlick**, Ganei Tikva (IL)

(73) Assignee: **SanDisk IL Ltd**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 252 days.

(21) Appl. No.: **12/428,485**

(22) Filed: **Apr. 23, 2009**

(65) **Prior Publication Data**

US 2010/0275073 A1 Oct. 28, 2010

(51) **Int. Cl.**
G11C 29/00 (2006.01)

(52) **U.S. Cl.** **714/718**; 714/733

(58) **Field of Classification Search** 711/54, 711/103, 162, 170; 714/2, 718, 742, 733
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,171,536	B2 *	1/2007	Chang et al.	711/170
7,424,659	B2 *	9/2008	Avraham	714/742
7,676,640	B2 *	3/2010	Chow et al.	711/162
7,702,984	B1 *	4/2010	Lee et al.	714/742
7,788,553	B2 *	8/2010	Chow et al.	714/718
2006/0282626	A1 *	12/2006	Fin	711/154
2007/0136509	A1 *	6/2007	Agami	711/103
2007/0168840	A1	7/2007	Roohparvar	
2010/0023800	A1 *	1/2010	Harari et al.	714/2

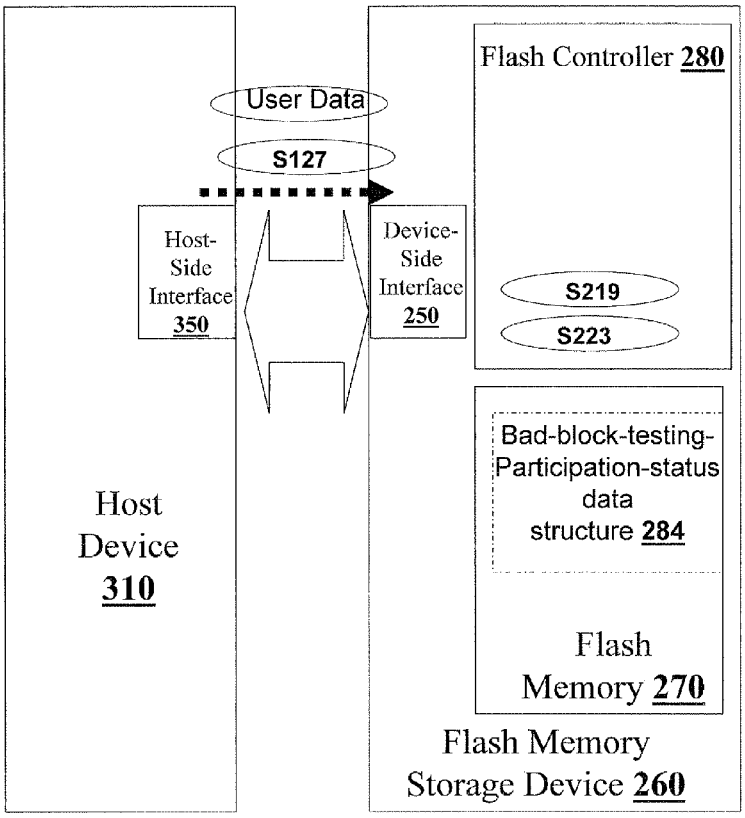
* cited by examiner

Primary Examiner — David Ton
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP

(57) **ABSTRACT**

Apparatus and methods for effecting bad-block testing operations are disclosed herein. In some embodiments, instead of effecting bad-block testing for the majority of the flash memory blocks of a flash memory device during manufacture, most or all bad-block testing is postponed until the end user is in possession of the flash memory device. In some embodiments, after user data is received by the flash memory device from a host device, one or more blocks of the flash memory device are subjected to bad-block testing.

23 Claims, 12 Drawing Sheets



US008103822B2

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

(10) **Patent No.: US 8,103,822 B2**
(45) **Date of Patent: Jan. 24, 2012**

(54) **METHOD AND APPARATUS FOR IMPLEMENTING A CACHING POLICY FOR NON-VOLATILE MEMORY**

(75) Inventors: **Amir Mosek**, Tel Aviv (IL); **Menahem Lasser**, Kochav Yair (IL); **Mark Murin**, Kfar Saba (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 450 days.

(21) Appl. No.: **12/430,089**

(22) Filed: **Apr. 26, 2009**
(Under 37 CFR 1.47)

(65) **Prior Publication Data**

US 2010/0274962 A1 Oct. 28, 2010

(51) **Int. Cl.**
G06G 12/08 (2006.01)

(52) **U.S. Cl.** **711/103**; 711/108; 711/118; 365/49; 365/185.08

(58) **Field of Classification Search** 711/138
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,263,398	B1 *	7/2001	Taylor et al.	711/3
6,496,905	B1	12/2002	Yoshioka et al.	
7,793,061	B1 *	9/2010	Gupta et al.	711/162
2004/0117441	A1	6/2004	Liu et al.	
2004/0128470	A1	7/2004	Hetzler et al.	
2005/0066121	A1	3/2005	Keeler	
2005/0193025	A1	9/2005	Mosek	
2005/0256838	A1	11/2005	Lasser	
2007/0016725	A1	1/2007	Chu et al.	
2007/0106842	A1	5/2007	Conley et al.	
2007/0113000	A1	5/2007	Murin et al.	
2007/0276989	A1	11/2007	Mosek et al.	
2007/0276990	A1	11/2007	Mosek et al.	
2007/0283081	A1	12/2007	Lasser	
2008/0209109	A1	8/2008	Lasser	

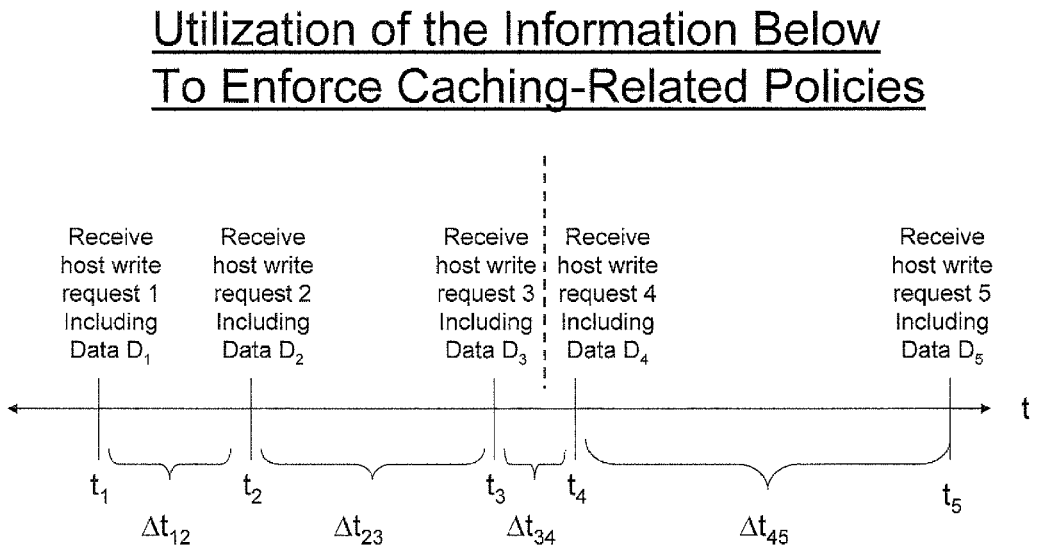
* cited by examiner

Primary Examiner — Tan T. Nguyen
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP

(57) **ABSTRACT**

The present disclosure relates to methods, devices and computer-readable medium for implementing a caching policy and/or a cache flushing policy in a peripheral non-volatile storage device operatively coupled to a host device. In some embodiments, data is stored to a cache area of a non-volatile memory within the peripheral non-volatile storage device in accordance with a historical rate at which other data was received by the peripheral storage device from the host device and/or a historical average time interval between successive host write requests received and/or an assessed rate at which data is required to be written to the non-volatile memory and/or a detecting by the peripheral non-volatile memory device that the host has read the storage ready/busy flag. In some embodiments, data is copied from a cache storage area of the non-volatile memory to a main storage area in accordance with the historical rate and/or the historical average time interval.

14 Claims, 14 Drawing Sheets



US008069380B2

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

(10) **Patent No.: US 8,069,380 B2**
(45) **Date of Patent: Nov. 29, 2011**

(54) **METHOD, SYSTEM AND COMPUTER-READABLE CODE TO TEST FLASH MEMORY**

(75) Inventors: **Mark Murin**, Kfar Saba (IL); **Menahem Lasser**, Kohav-Yair (IL); **Avraham Meir**, Rishon Lezion (IL)

(73) Assignee: **Sandisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/755,519**

(22) Filed: **Apr. 7, 2010**

(65) **Prior Publication Data**

US 2010/0199135 A1 Aug. 5, 2010

Related U.S. Application Data

(60) Division of application No. 11/397,578, filed on Apr. 5, 2006, now Pat. No. 7,730,368, which is a continuation-in-part of application No. 10/697,981, filed on Oct. 31, 2003, now Pat. No. 7,424,659.

(60) Provisional application No. 60/731,921, filed on Oct. 31, 2003.

(51) **Int. Cl.**
G11C 29/00 (2006.01)
G06F 11/00 (2006.01)

(52) **U.S. Cl.** **714/718**; 714/742

(58) **Field of Classification Search** 714/718, 714/723, 742; 365/200, 201
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,333,142	A	6/1982	Chesley
5,434,825	A	7/1995	Harari
5,525,971	A	6/1996	Flynn
5,566,303	A	10/1996	Tashiro et al.
5,566,344	A	10/1996	Hall et al.
5,598,573	A	1/1997	Hall et al.
5,606,710	A	2/1997	Hall et al.

(Continued)

FOREIGN PATENT DOCUMENTS

CN	1452070	A	10/2003

(Continued)

OTHER PUBLICATIONS

Seki, K.; Kume, H.; Ohji, Y.; Kobayashi, T.; Hiraiwa, A.; Nishida, T.; Wada, T.; Komori, K.; Izawa, K.; Nishimoto, T.; Kubota, Y.; Shoji, K.; , "An 80-ns. 1-Mb flash memory with on-chip erase/erase-verify controller," Solid-State Circuits, IEEE Journal of , vol. 25, No. 5, pp. 1147-1152, Oct. 1990 doi: 10.1109/4.62136.*

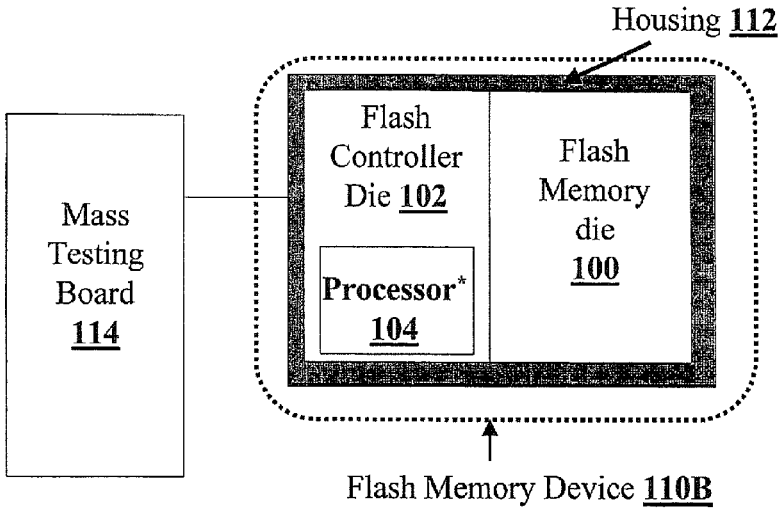
(Continued)

Primary Examiner — Cynthia Britt
(74) *Attorney, Agent, or Firm* — Toler Law Group

(57) **ABSTRACT**

A flash memory device includes a flash memory residing on at least one flash memory die. The flash memory device also includes a flash controller residing on a flash controller die that is separate from the at least one flash memory die. The flash memory and the flash controller reside within, reside on, or are attached to a common housing. The flash controller is configured to execute at least one test program to test at least one flash memory die.

20 Claims, 5 Drawing Sheets



US007996579B2

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

(10) **Patent No.: US 7,996,579 B2**
(45) **Date of Patent: Aug. 9, 2011**

(54) **APPARATUS, METHODS, AND COMPUTER-CODE FOR HANDLING AN IMPENDING DECOUPLING BETWEEN A PERIPHERAL DEVICE AND A HOST DEVICE**

(75) Inventors: **Yehuda Hahn**, Ofra (IL); **Mordechai Teicher**, Hod Hasharon (IL); **Itzhak Pomerantz**, Kfar Saba (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/798,424**

(22) Filed: **May 14, 2007**

(65) **Prior Publication Data**

US 2007/0266194 A1 Nov. 15, 2007

Related U.S. Application Data

(60) Provisional application No. 60/747,195, filed on May 14, 2006.

(51) **Int. Cl.**
G06F 13/00 (2006.01)
G06F 12/00 (2006.01)
G06F 15/00 (2006.01)

(52) **U.S. Cl.** **710/15**; 710/302; 710/304; 710/16; 710/17; 710/18; 710/19; 710/64; 710/72; 711/115; 711/135; 702/188

(58) **Field of Classification Search** 710/15–19, 710/62, 64, 100, 302, 304, 72; 714/1–4; 702/188; 711/115, 135
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,564,024	A *	10/1996	Pemberton	710/302
5,664,119	A *	9/1997	Jeffries et al.	710/302
5,758,101	A *	5/1998	Pemberton	710/302
5,768,541	A *	6/1998	Pan-Ratzlaff	710/304
6,005,769	A *	12/1999	Cho	361/686
6,098,127	A *	8/2000	Kwang	710/62
6,134,615	A *	10/2000	Chari et al.	710/302
6,138,194	A *	10/2000	Klein et al.	710/302
6,141,711	A *	10/2000	Shah et al.	710/302
6,225,711	B1	5/2001	Gupta et al.	
6,836,212	B2 *	12/2004	Sawinski	340/539.23
6,928,504	B2 *	8/2005	Peacock	710/302
7,234,014	B2 *	6/2007	Molander et al.	710/302
7,277,011	B2 *	10/2007	Estakhri	340/540
7,490,199	B2 *	2/2009	Camiel	711/115
2003/0023410	A1 *	1/2003	Roth	702/188
2004/0117651	A1 *	6/2004	Little et al.	713/200
2007/0162594	A1 *	7/2007	Henry et al.	709/224

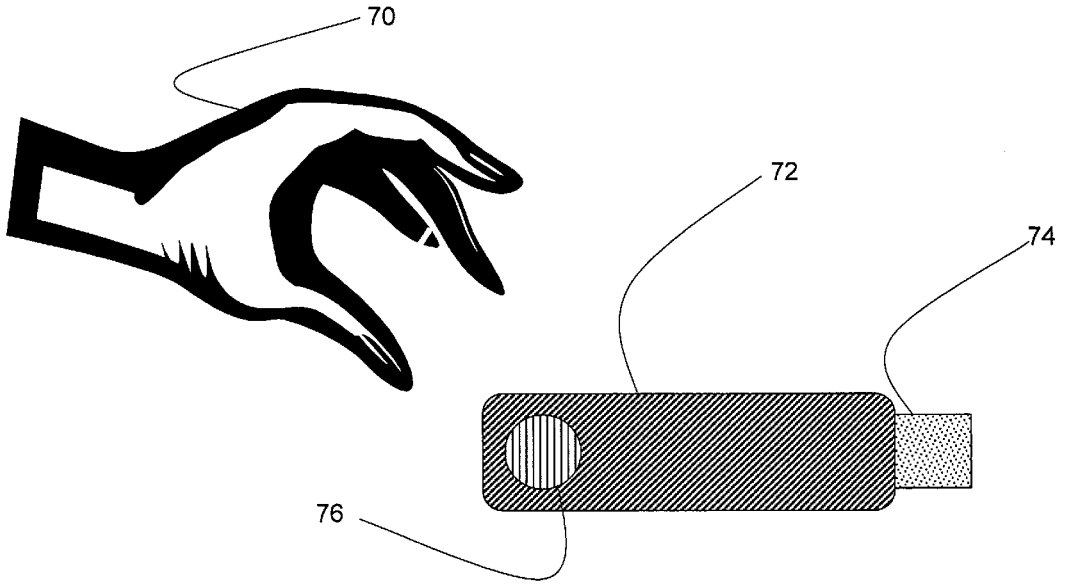
* cited by examiner

Primary Examiner — Tammara Peyton
(74) *Attorney, Agent, or Firm* — Vierra Magen Marcus & DeNiro LLP

(57) **ABSTRACT**

Apparatus, methods and computer-code are disclosed where an impending decoupling between a peripheral device and a host is detected. In some embodiments, in response to the detected impending disconnection, a user alert signal is generated. In some embodiments, an 'onboard detector' that is associated with housing of the peripheral device and operative to detect the impending disconnection is provided. In some embodiments, the user alert signal is generated in accordance with inter-device data flow between the host and the peripheral device. Exemplary peripheral devices include but are not limited to transient storage devices such as a USB flash drives (UFD).

14 Claims, 12 Drawing Sheets



US007970957B2

(12) **United States Patent**
Mosek

(10) **Patent No.: US 7,970,957 B2**
(45) **Date of Patent: Jun. 28, 2011**

(54) **APPARATUS, METHOD AND COMPUTER READABLE MEDIUM FOR DISAMBIGUATING COMMANDS WITH RESPECT TO LOGICAL PROTOCOLS**

(75) Inventor: **Amir Mosek**, Tel Aviv (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 116 days.

(21) Appl. No.: **11/960,770**

(22) Filed: **Dec. 20, 2007**

(65) **Prior Publication Data**

US 2008/0155130 A1 Jun. 26, 2008

Related U.S. Application Data

(60) Provisional application No. 60/870,846, filed on Dec. 20, 2006.

(51) **Int. Cl.**
G06F 3/00 (2006.01)

(52) **U.S. Cl.** **710/11**; 710/14; 710/15; 710/16

(58) **Field of Classification Search** 710/1, 5–7, 710/8, 11, 14, 15, 16, 30
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,339,586	B1	1/2002	Motobayashi	
7,401,086	B2 *	7/2008	Chorafakis et al.	707/101
2002/0062407	A1	5/2002	Tateyama et al.	
2004/0078704	A1	4/2004	Malueg et al.	
2004/0164170	A1	8/2004	Krygier et al.	
2006/0026269	A1	2/2006	Sadovsky et al.	
2007/0094246	A1 *	4/2007	Dill et al.	707/4
2007/0204089	A1	8/2007	Proctor	

FOREIGN PATENT DOCUMENTS

WO	2003003220	A2	1/2003

OTHER PUBLICATIONS

International Search Report and Written Opinion for International Application No. PCT/IL2007/001587, dated Jan. 28, 2009, 12 pages.

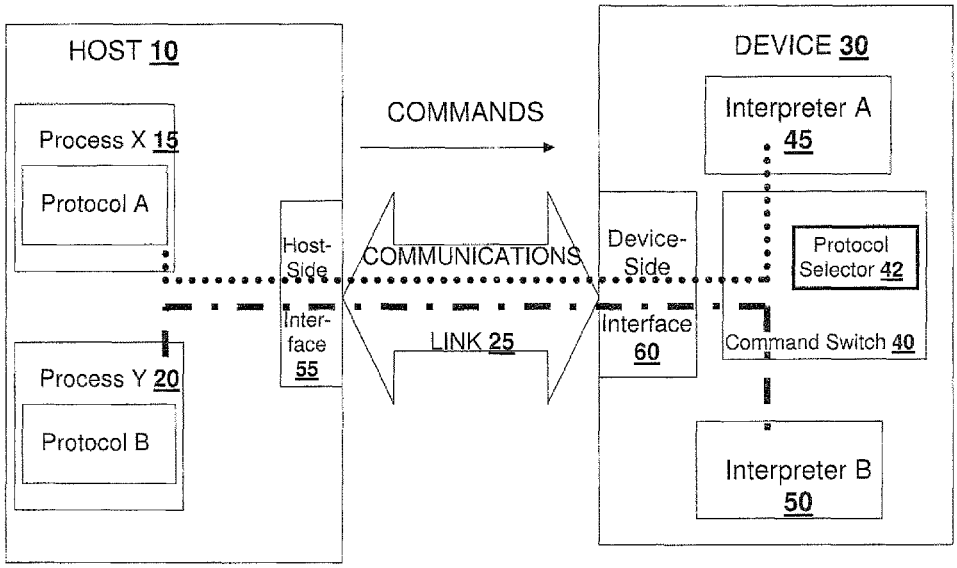
* cited by examiner

Primary Examiner — Alford W Kindred
Assistant Examiner — Richard Franklin
(74) *Attorney, Agent, or Firm* — Toler Law Group

(57) **ABSTRACT**

An apparatus, method and computer readable medium for disambiguating commands with respect to logical protocols is disclosed herein. In some embodiments, commands are disambiguated in accordance with an extent of device usage since a most recent device reset event. In some embodiments, commands are disambiguated in accordance with one or more command target parameters of a current command and/or one or more previous commands. In some embodiments, commands are disambiguated in accordance with a security policy and/or a data access policy and/or an indication of a data damage risk.

120 Claims, 23 Drawing Sheets



US007954037B2

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

(10) **Patent No.: US 7,954,037 B2**
(45) **Date of Patent: May 31, 2011**

(54) **METHOD FOR RECOVERING FROM ERRORS IN FLASH MEMORY**

(75) Inventors: **Menahem Lasser**, Kohav-Yair (IL); **Mark Murin**, Kfar Saba (IL)

(73) Assignee: **Sandisk IL Ltd**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 740 days.

(21) Appl. No.: **11/397,609**

(22) Filed: **Apr. 5, 2006**

(65) **Prior Publication Data**

US 2007/0091677 A1 Apr. 26, 2007

Related U.S. Application Data

(60) Provisional application No. 60/729,608, filed on Oct. 25, 2005.

(51) **Int. Cl.**
G11C 29/00 (2006.01)

(52) **U.S. Cl.** **714/763**

(58) **Field of Classification Search** 714/763
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,434,825	A	7/1995	Harari	
5,657,332	A	8/1997	Auclair	
5,724,285	A	3/1998	Shinohara	
6,522,580	B2	2/2003	Chen	
6,751,766	B2	6/2004	Guterman et al.	
7,012,835	B2 *	3/2006	Gonzalez et al.	365/185.11
7,181,572	B2 *	2/2007	Walmsley	711/128
7,592,829	B2 *	9/2009	Walmsley et al.	326/8

(Continued)

FOREIGN PATENT DOCUMENTS

JP 04-337857 A 11/1992

(Continued)

OTHER PUBLICATIONS

EPO/ISA, "Notification of Transmital of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration," corresponding International Application No. PCT/IL06/01220, mailed on Oct. 27, 2008, 9 pages.
Korean Patent Office, "Notice of Grounds for Rejection," corresponding Korean Patent Application No. 10-2008-7012350, mailed on Feb. 26, 2010, 2 pages (translation only.).

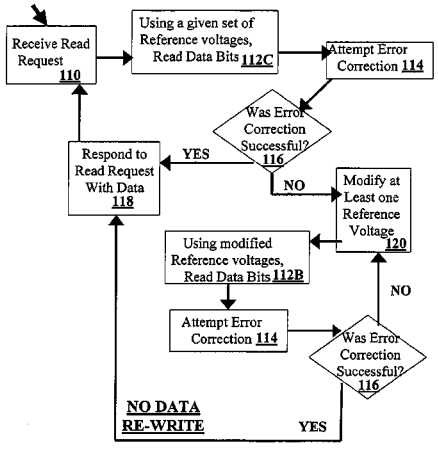
(Continued)

Primary Examiner — Scott T Baderman
Assistant Examiner — Enam Ahmed
(74) *Attorney, Agent, or Firm* — Davis Wright Tremaine LLP

(57) **ABSTRACT**

Methods, devices and computer readable code for reading data from one or more flash memory cells, and for recovering from read errors are disclosed. In some embodiments, in the event of an error correction failure by an error detection and correction module, the flash memory cells are re-read at least once using one or more modified reference voltages, for example, until a successful error correction may be carried out. In some embodiments, after successful error correction a subsequent read request is handled without re-writing data (for example, reliable values of the read data) to the flash memory cells in the interim. In some embodiments, reference voltages associated with a reading where errors are corrected may be stored in memory, and retrieved when responding to a subsequent read request. In some embodiments, the modified reference voltages are predetermined reference voltages. Alternatively or additionally, these modified reference voltages may be determined as needed, for example, using randomly generated values or in accordance with information provided by the error detection and correction module. Methods, devices and computer readable code for reading data for situations where there is no error correction failure are also provided.

12 Claims, 8 Drawing Sheets



US007930585B2

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

(10) **Patent No.: US 7,930,585 B2**
(45) **Date of Patent: Apr. 19, 2011**

(54) **RECOVERY OF A FAILED FILE TRANSFER BETWEEN A HOST AND A DATA STORAGE DEVICE**

(75) Inventors: **Eyal Bychkov**, Hod Hasharon (IL); **Avraham Meir**, Rishon Lezion (IL)

(73) Assignee: **SanDisk IL Ltd**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 495 days.

(21) Appl. No.: **11/968,668**

(22) Filed: **Jan. 3, 2008**

(65) **Prior Publication Data**

US 2008/0168243 A1 Jul. 10, 2008

Related U.S. Application Data

(60) Provisional application No. 60/883,345, filed on Jan. 4, 2007.

(51) **Int. Cl.**
G06F 12/16 (2006.01)

(52) **U.S. Cl.** **714/6**; 714/5; 714/42; 711/115

(58) **Field of Classification Search** 714/5, 6
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,504,883	A *	4/1996	Coverston et al.	1/1
6,385,707	B1	5/2002	Maffezzoni	
6,665,778	B1	12/2003	Assaf	
7,174,420	B2	2/2007	Malueg et al.	
7,299,314	B2	11/2007	Lin et al.	
2002/0087673	A1 *	7/2002	Selkirk et al.	709/223
2002/0128994	A1 *	9/2002	Sadhasivan et al.	707/1
2003/0041284	A1 *	2/2003	Mambakkam et al.	714/15
2003/0093610	A1 *	5/2003	Lai et al.	711/103
2004/0078704	A1 *	4/2004	Malueg et al.	714/42
2004/0080558	A1 *	4/2004	Blumenau et al.	347/19
2004/0250172	A1	12/2004	Patel et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0690380 1/1996

(Continued)

OTHER PUBLICATIONS

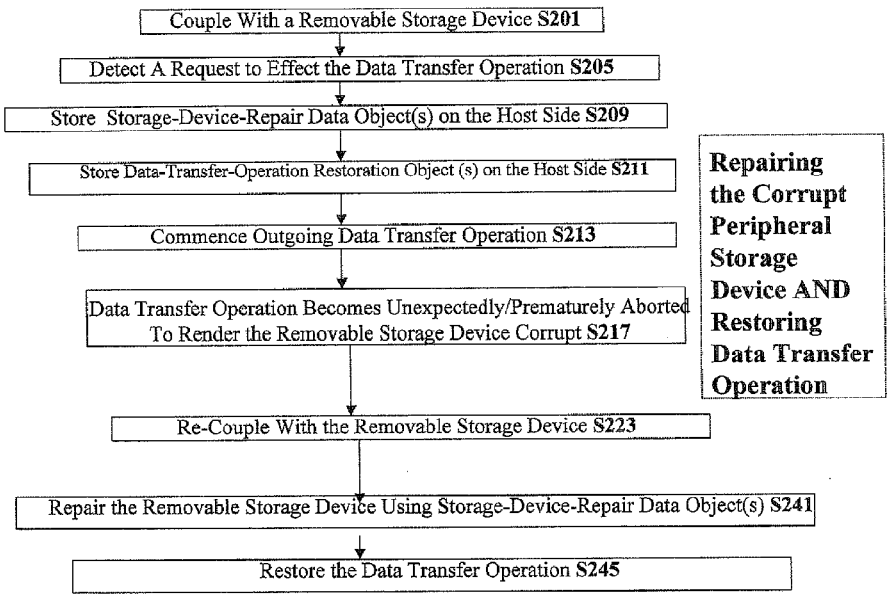
Seung-Ho Lim , Kyu-Ho Park, An Efficient NAND Flash File System for Flash Memory Storage, IEEE Transactions on Computers, v. 55, n. 7, p. 906-912, Jul. 2006.*

Primary Examiner — Scott T Baderman
Assistant Examiner — Chae Ko
(74) *Attorney, Agent, or Firm* — Martine Penilla & Gencarella, LLP

(57) **ABSTRACT**

Embodiments of the present invention relate to an apparatus, method and computer readable medium for recovering from a failed or aborted outgoing data transfer operation from a host device to a peripheral storage device. In some embodiments, before the peripheral storage device is corrupted by the failed outgoing data transfer operation, one or more recovery data objects are stored on the host-side. After the peripheral storage device is corrupted by the failed data transfer, the host device responds to a subsequent coupling with the peripheral storage device by repairing the corrupted peripheral storage device using one or more of the host-side stored recovery data objects. Optionally, the host device also restores the outgoing aborted or failed data transfer operation.

27 Claims, 8 Drawing Sheets



US007913004B2

(12) **United States Patent**
Pomerantz

(10) **Patent No.: US 7,913,004 B2**
(45) **Date of Patent: Mar. 22, 2011**

(54) **PORTABLE SELECTIVE MEMORY DATA EXCHANGE DEVICE**

(75) Inventor: **Itzhak Pomerantz**, Kfar Saba (IL)

(73) Assignee: **Sandisk IL Ltd**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 287 days.

(21) Appl. No.: **11/503,146**

(22) Filed: **Aug. 14, 2006**

(65) **Prior Publication Data**

US 2007/0065119 A1 Mar. 22, 2007

Related U.S. Application Data

(60) Provisional application No. 60/714,215, filed on Sep. 6, 2005.

(51) **Int. Cl.**
G06F 13/12 (2006.01)
G11B 15/18 (2006.01)

(52) **U.S. Cl.** **710/74**; 360/69

(58) **Field of Classification Search** 710/74; 360/69

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,993,618 B2 * 1/2006 Chen et al. 710/305
2002/0054224 A1 * 5/2002 Wasula et al. 348/232
2003/0163622 A1 8/2003 Moran

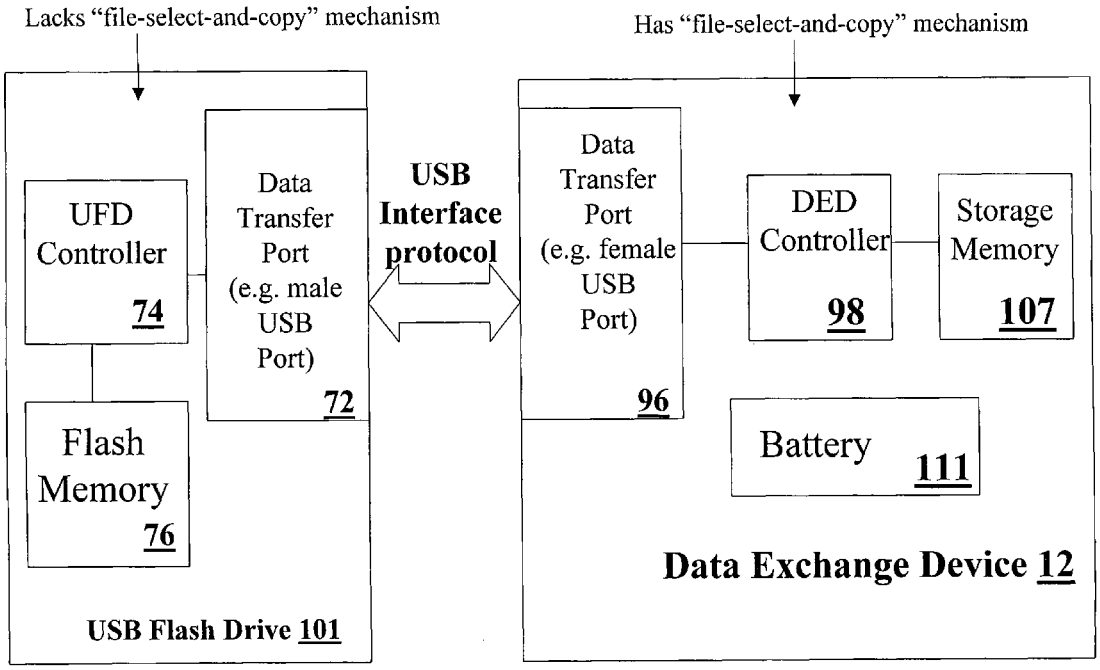
* cited by examiner

Primary Examiner — Henry W Tsai
Assistant Examiner — Juanito C Borromeo
(74) *Attorney, Agent, or Firm* — Davis Wright Tremaine LLP

(57) **ABSTRACT**

A portable data exchange device including a storage memory for storing data, a USB interface, and a device controller having a file-selection-and-transfer mechanism is disclosed. Upon coupling of the presently disclosed data exchange device with a USB flash drive (UFD), the file-selection-and-transfer mechanism is operative to automatically select for transfer a set of files residing in the data exchange device and/or the UFD, and to effect an inter-device file transfer between the data exchange device and the UFD of only the selected files. In exemplary embodiments, the data exchange device has at most a minimal user interface, no video display, and only one or two data ports. Optionally, the presently disclosed data exchange device automatically modifies names of files copied from the USB flash drive to the data exchange device in accordance with an identity of the source USB flash drive.

21 Claims, 6 Drawing Sheets



US007716400B2

(12) **United States Patent**
Raines

(10) **Patent No.: US 7,716,400 B2**
(45) **Date of Patent: May 11, 2010**

(54) **DUAL MODE DIGITAL MULTIMEDIA CONNECTOR**

(75) Inventor: **Moshe Raines**, Tel Aviv (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 96 days.

(21) Appl. No.: **11/747,928**

(22) Filed: **May 14, 2007**

(65) **Prior Publication Data**

US 2008/0005424 A1 Jan. 3, 2008

Related U.S. Application Data

(60) Provisional application No. 60/747,194, filed on May 14, 2006.

(51) **Int. Cl.**
G06F 13/12 (2006.01)

(52) **U.S. Cl.** **710/74**; 710/8; 710/11; 710/13; 710/14; 710/62

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,073,201	A *	6/2000	Jolley et al.	710/315
6,775,715	B2 *	8/2004	Spitaels et al.	710/8
6,934,467	B1 *	8/2005	Herz	386/125
2001/0049826	A1	12/2001	Wilf	
2004/0056841	A1	3/2004	Slotta	
2004/0182938	A1	9/2004	Chen et al.	
2005/0005045	A1 *	1/2005	Kim et al.	710/74

(Continued)

FOREIGN PATENT DOCUMENTS

EP	0 974 945	A2	1/2000

(Continued)

OTHER PUBLICATIONS

Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for International Application No. PCT/IL2007/000630 (Nov. 20, 2007).

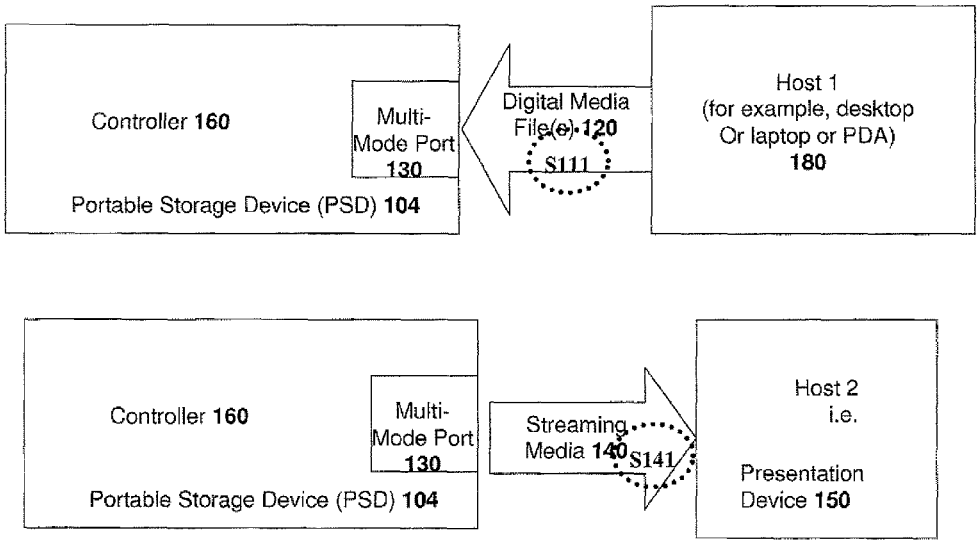
(Continued)

Primary Examiner—Eron J Sorrell
(74) *Attorney, Agent, or Firm*—Jenkins, Wilson, Taylor & Hunt, P.A.

(57) **ABSTRACT**

The present disclosure relates to a portable storage device that can communicate with different types of host devices. In some embodiments, the portable storage device receives digital media content via a multi-mode device port and exports a derivative of the digital media content (for example, a media stream) via the same multi-mode device port. In some embodiments, the device port has at least one selectively active pin which is active when receiving digital media content and is dormant when exporting a derivative of the digital media content. Alternatively or additionally, the device port includes at least one selectively active pin which is dormant when receiving digital media content and is active when exporting a derivative of the digital media content. In some embodiments, the portable storage device selects a device mode and/or communications protocol in accordance with at least one detected feature of a complementary port and/or a host. Methods for operating the presently disclosed portable external storage device are disclosed herein.

25 Claims, 14 Drawing Sheets



US007631245B2

(12) **United States Patent**
Lasser

(10) **Patent No.: US 7,631,245 B2**
(45) **Date of Patent: Dec. 8, 2009**

(54) **NAND FLASH MEMORY CONTROLLER EXPORTING A NAND INTERFACE**

(75) Inventor: **Menahem Lasser**, Kohav-Yair (IL)

(73) Assignee: **SanDisk IL Ltd.**, Kfar Saba (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 877 days.

(21) Appl. No.: **11/326,336**

(22) Filed: **Jan. 6, 2006**

(65) **Prior Publication Data**

US 2007/0074093 A1 Mar. 29, 2007

Related U.S. Application Data

(60) Provisional application No. 60/720,098, filed on Sep. 26, 2005.

(51) **Int. Cl.**
G11C 29/00 (2006.01)

(52) **U.S. Cl.** **714/768**; 365/185

(58) **Field of Classification Search** 714/763, 714/776, 768; 365/185
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,404,485	A	4/1995	Ban
5,434,825	A	7/1995	Harari
5,532,962	A	7/1996	Auclair et al.
5,799,168	A	8/1998	Ban
5,818,757	A	10/1998	So et al.
5,937,425	A	8/1999	Ban
5,943,283	A	8/1999	Wong et al.
6,034,882	A	3/2000	Johnson et al.
6,119,245	A	9/2000	Hiratsuka
6,181,599	B1	1/2001	Gongwer
6,185,122	B1	2/2001	Johnson et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1146428	10/2001

(Continued)

OTHER PUBLICATIONS

Toshiba TC58NVG1S3BFT00/TC58NVG1S8BFT000 Tentative, Toshiba MOS Digital Integrated Circuit Silicon Gate CMOS, pp. 1-37, 2003.

(Continued)

Primary Examiner—Esaw T Abraham
(74) *Attorney, Agent, or Firm*—Brinks Hofer Gilson & Lione

(57) **ABSTRACT**

A NAND controller for interfacing between a host device and a flash memory device (e.g. a NAND flash memory device) fabricated on a flash die is disclosed. In some embodiments, the presently disclosed NAND controller includes electronic circuitry fabricated on a controller die, the controller die being distinct from the flash die, a first interface (e.g. a host-type interface, for example, a NAND interface) for interfacing between the electronic circuitry and the flash memory device, and a second interface (e.g. a flash-type interface) for interfacing between the controller and the host device, wherein the second interface is a NAND interface. According to some embodiments, the first interface is an inter-die interface. According to some embodiments, the first interface is a NAND interface. Systems including the presently disclosed NAND controller are also disclosed. Methods for assembling the aforementioned systems, and for reading and writing data using NAND controllers are also disclosed.

35 Claims, 13 Drawing Sheets