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(54) **PORTABLE DATA TRANSFER AND MASS STORAGE DEVICE FOR REMOVABLE MEMORY MODULES**

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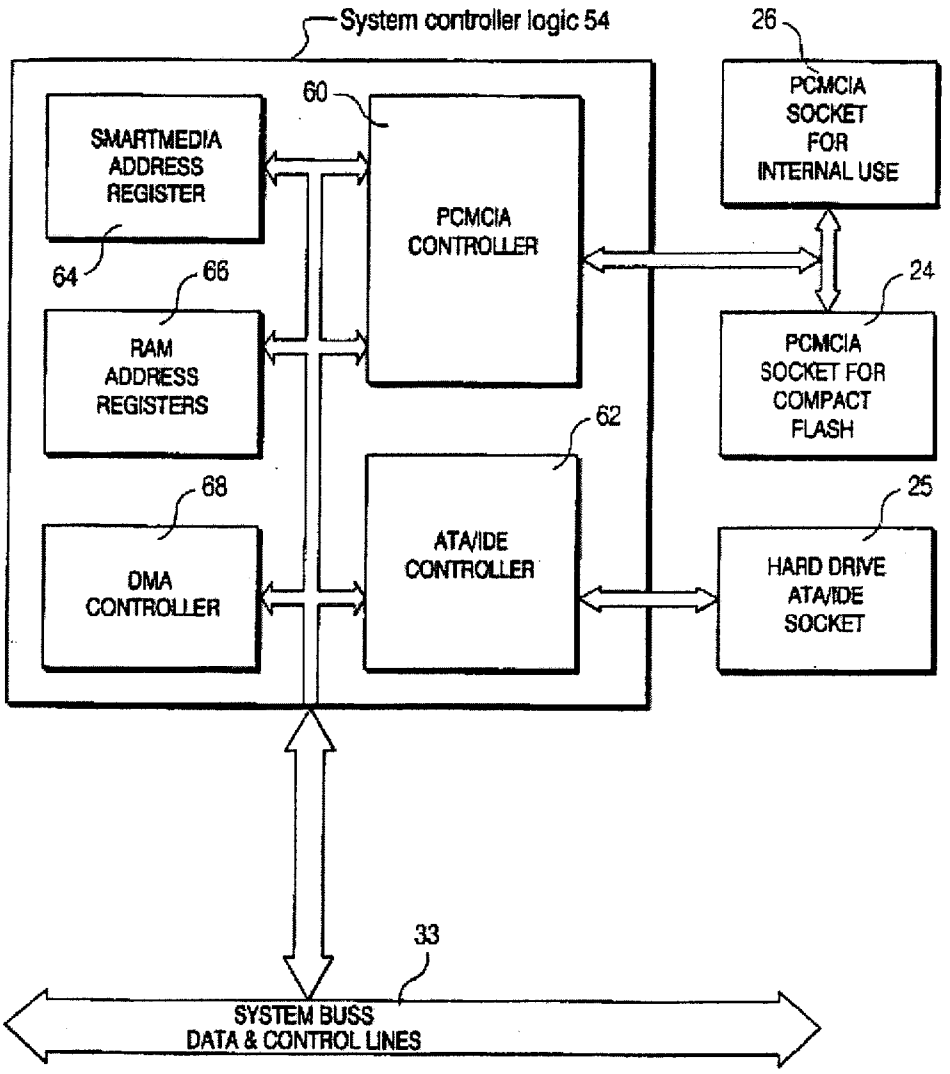
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(57) **ABSTRACT**

A hand-held battery powered device for transferring data between one or more flash memory modules and a mass storage device. The device includes one or more slots to accept a flash memory module into a housing which includes fixed or removable mass storage device and logic circuitry disposed within the housing for transferring data between the flash memory module and mass storage device. Ports are disclosed for transferring data from the resident mass storage device to the user's computer.



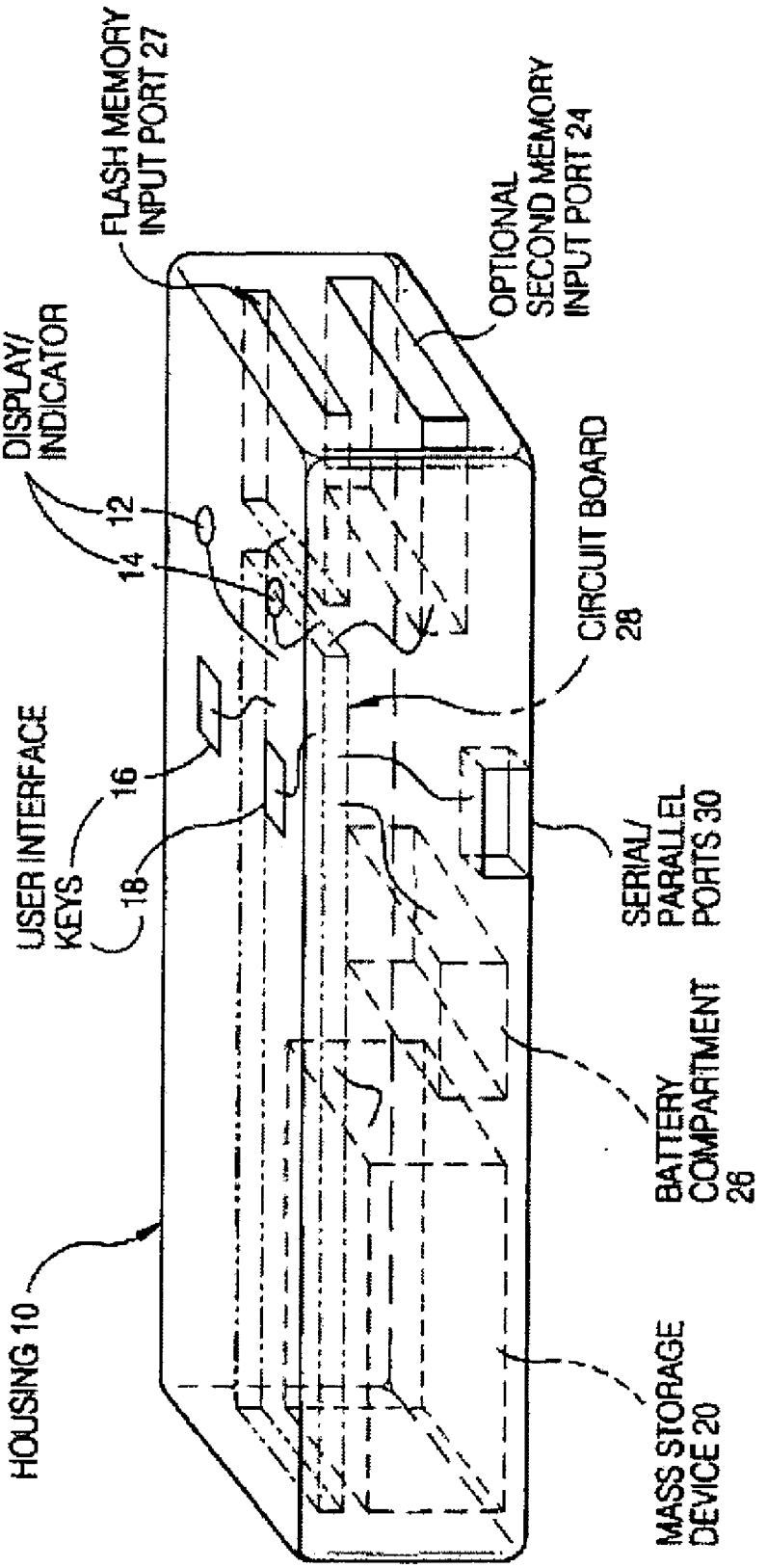

FLASH MEMORY INPUT PORT 27
OPTIONAL SECOND MEMORY INPUT PORT 24
DISPLAY/ INDICATOR
12
14
CIRCUIT BOARD 28
USER INTERFACE KEYS
16
18
SERIAL/ PARALLEL PORTS 30
BATTERY COMPARTMENT 26
HOUSING 10
MASS STORAGE DEVICE 20

Fig. 1

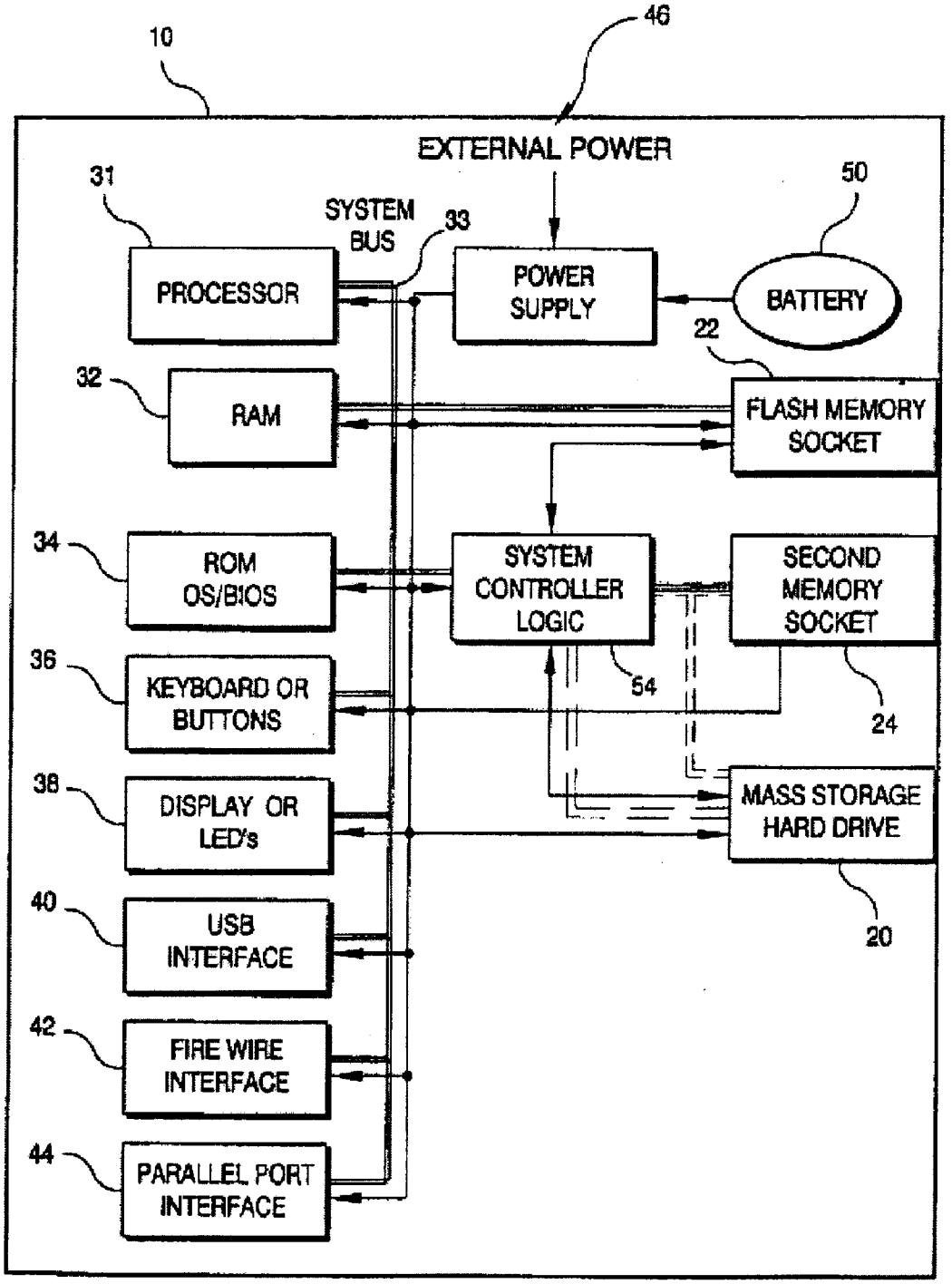

10
46
EXTERNAL POWER
31
SYSTEM BUS
33
50
PROCESSOR
POWER SUPPLY
BATTERY
22
32
RAM
FLASH MEMORY SOCKET
34
ROM OS/BIOS
SYSTEM CONTROLLER LOGIC
SECOND MEMORY SOCKET
36
KEYBOARD OR BUTTONS
54
24
38
DISPLAY OR LED's
MASS STORAGE HARD DRIVE
20
40
USB INTERFACE
42
FIRE WIRE INTERFACE
44
PARALLEL PORT INTERFACE

Fig. 2

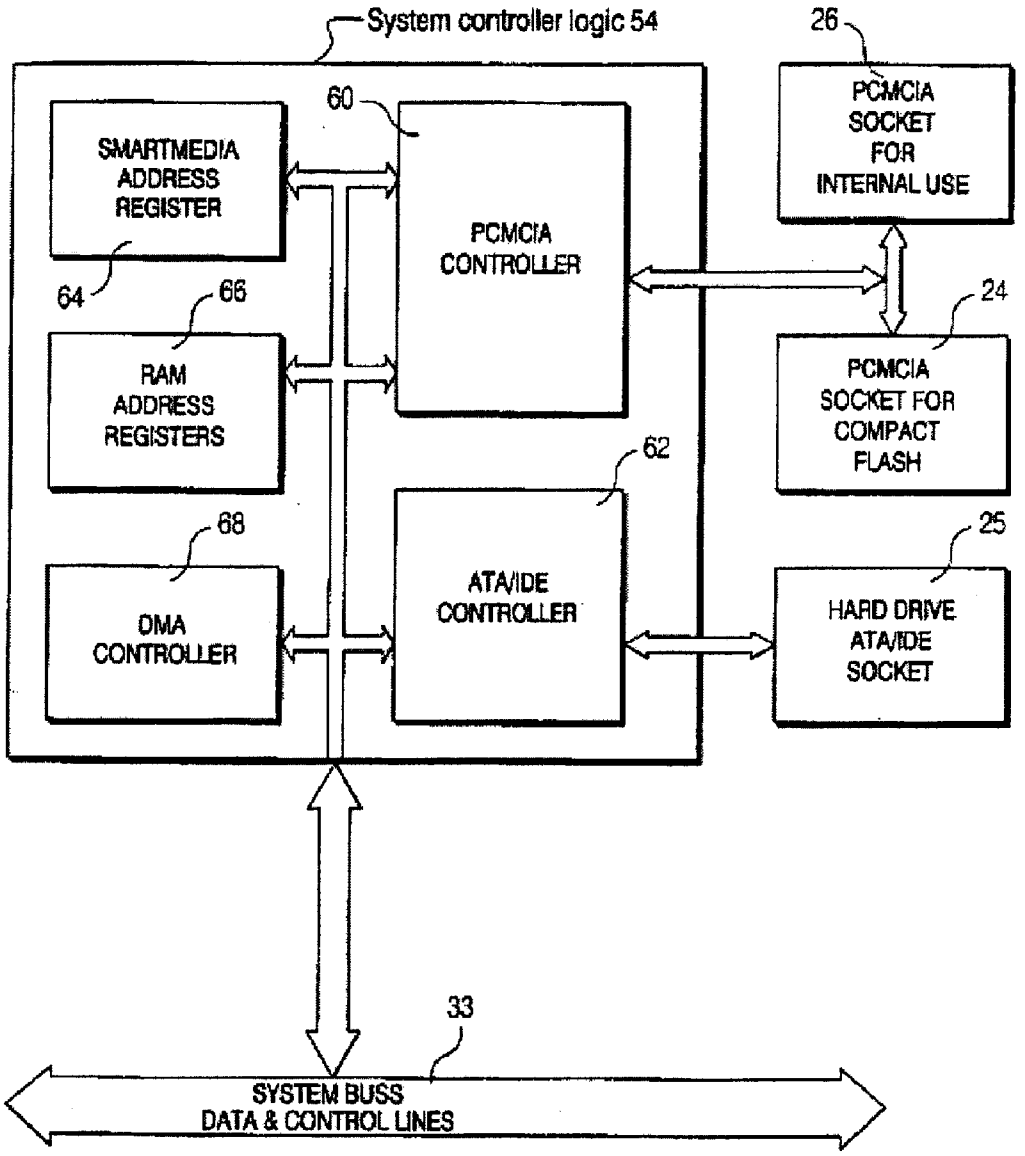

System controller logic 54
26
PCMCIA SOCKET FOR INTERNAL USE
60
SMARTMEDIA ADDRESS REGISTER
PCMCIA CONTROLLER
64
66
24
RAM ADDRESS REGISTERS
PCMCIA SOCKET FOR COMPACT FLASH
62
68
25
DMA CONTROLLER
ATA/IDE CONTROLLER
HARD DRIVE ATA/IDE SOCKET
33
SYSTEM BUSS DATA & CONTROL LINES

Fig.3

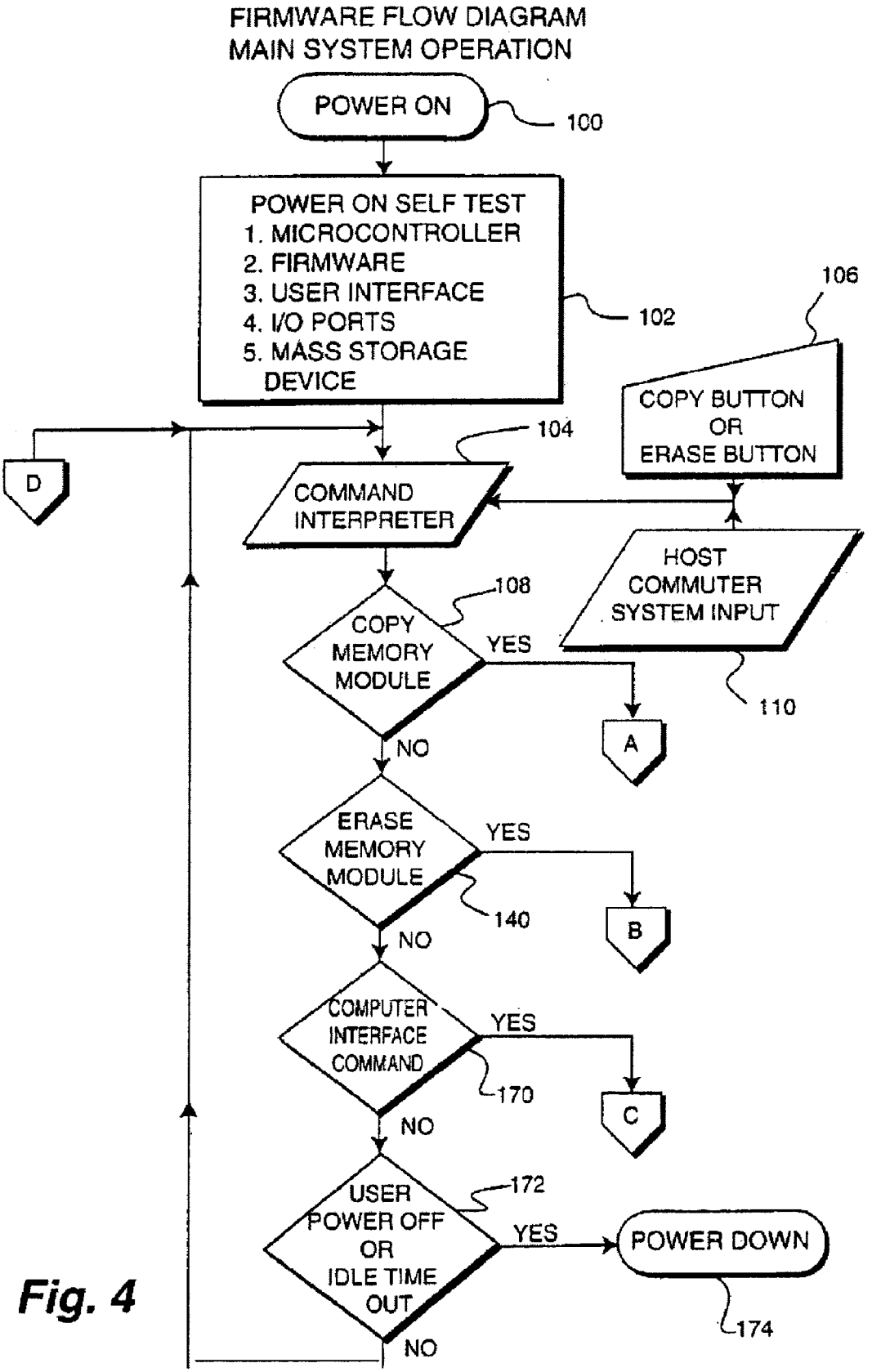

FIRMWARE FLOW DIAGRAM
MAIN SYSTEM OPERATION
POWER ON
100
POWER ON SELF TEST
1. MICROCONTROLLER
2. FIRMWARE
3. USER INTERFACE
4. I/O PORTS
5. MASS STORAGE DEVICE
102
106
COPY BUTTON OR ERASE BUTTON
D
104
COMMAND INTERPRETER
HOST COMMUTER SYSTEM INPUT
108
COPY MEMORY MODULE
YES
110
A
NO
ERASE MEMORY MODULE
YES
140
B
NO
COMPUTER INTERFACE COMMAND
YES
170
C
NO
USER POWER OFF OR IDLE TIME OUT
172
YES
POWER DOWN
174
NO

Fig. 4

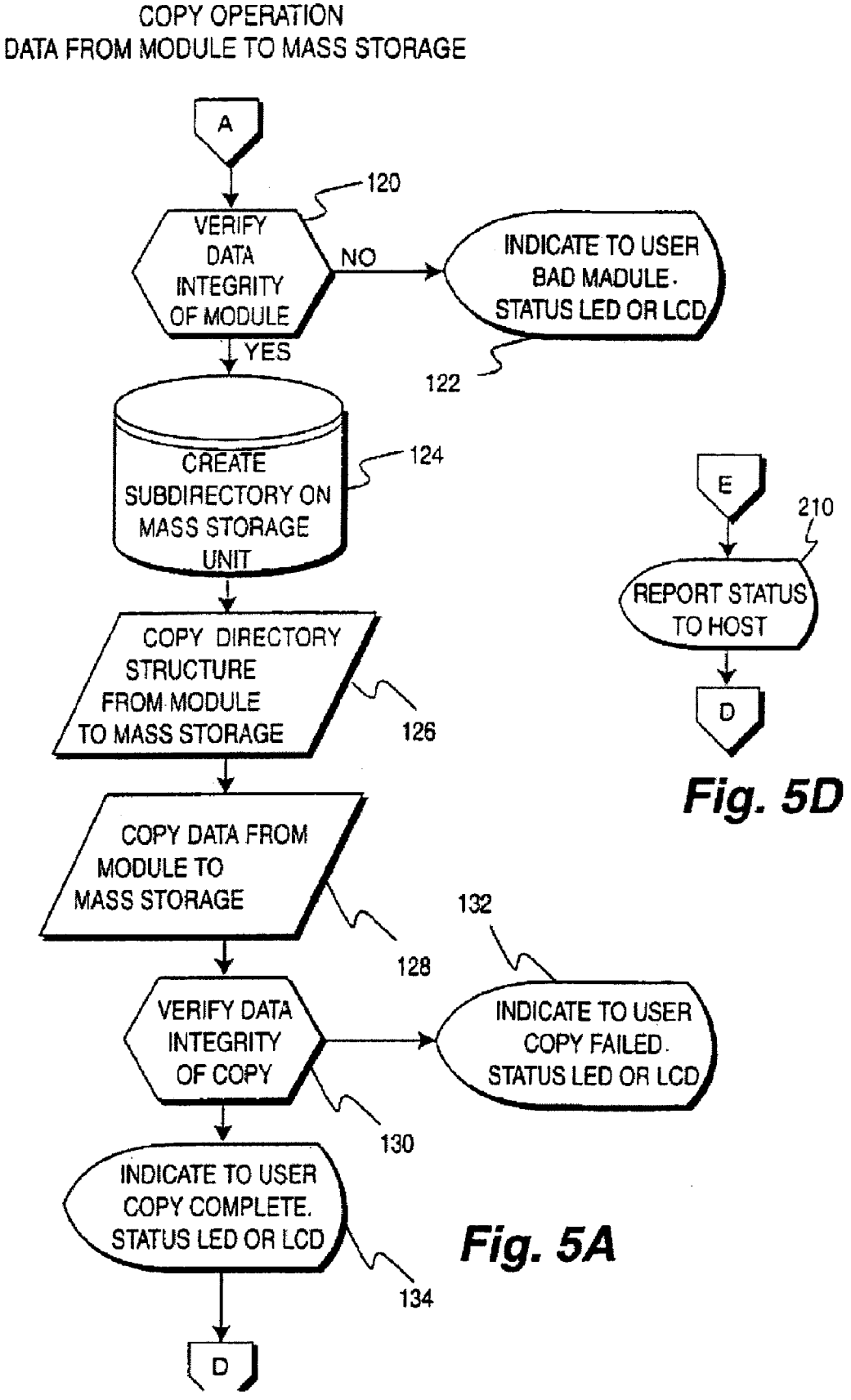

COPY OPERATION
DATA FROM MODULE TO MASS STORAGE
A
120
VERIFY DATA INTEGRITY OF MODULE
NO
INDICATE TO USER BAD MADULE. STATUS LED OR LCD
122
YES
CREATE SUBDIRECTORY ON MASS STORAGE UNIT
124
COPY DIRECTORY STRUCTURE FROM MODULE TO MASS STORAGE
126
COPY DATA FROM MODULE TO MASS STORAGE
128
VERIFY DATA INTEGRITY OF COPY
130
132
INDICATE TO USER COPY FAILED. STATUS LED OR LCD
INDICATE TO USER COPY COMPLETE. STATUS LED OR LCD
134
D
E
210
REPORT STATUS TO HOST
D

Fig. 5D

Fig. 5A

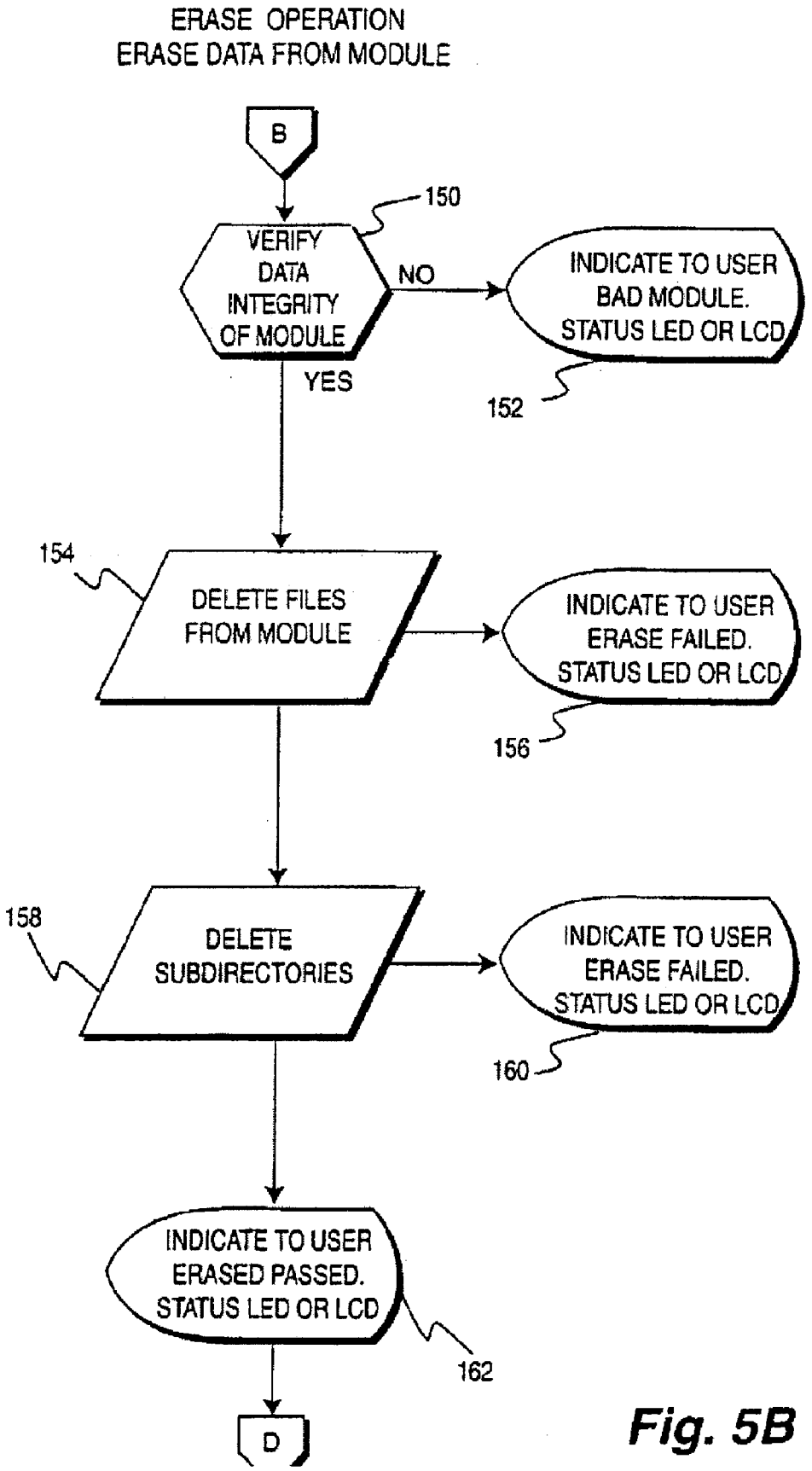

ERASE OPERATION
ERASE DATA FROM MODULE
B
150
VERIFY DATA INTEGRITY OF MODULE
NO
INDICATE TO USER BAD MODULE. STATUS LED OR LCD
152
YES
154
DELETE FILES FROM MODULE
INDICATE TO USER ERASE FAILED. STATUS LED OR LCD
156
158
DELETE SUBDIRECTORIES
INDICATE TO USER ERASE FAILED. STATUS LED OR LCD
160
INDICATE TO USER ERASED PASSED. STATUS LED OR LCD
162
D

Fig. 5B

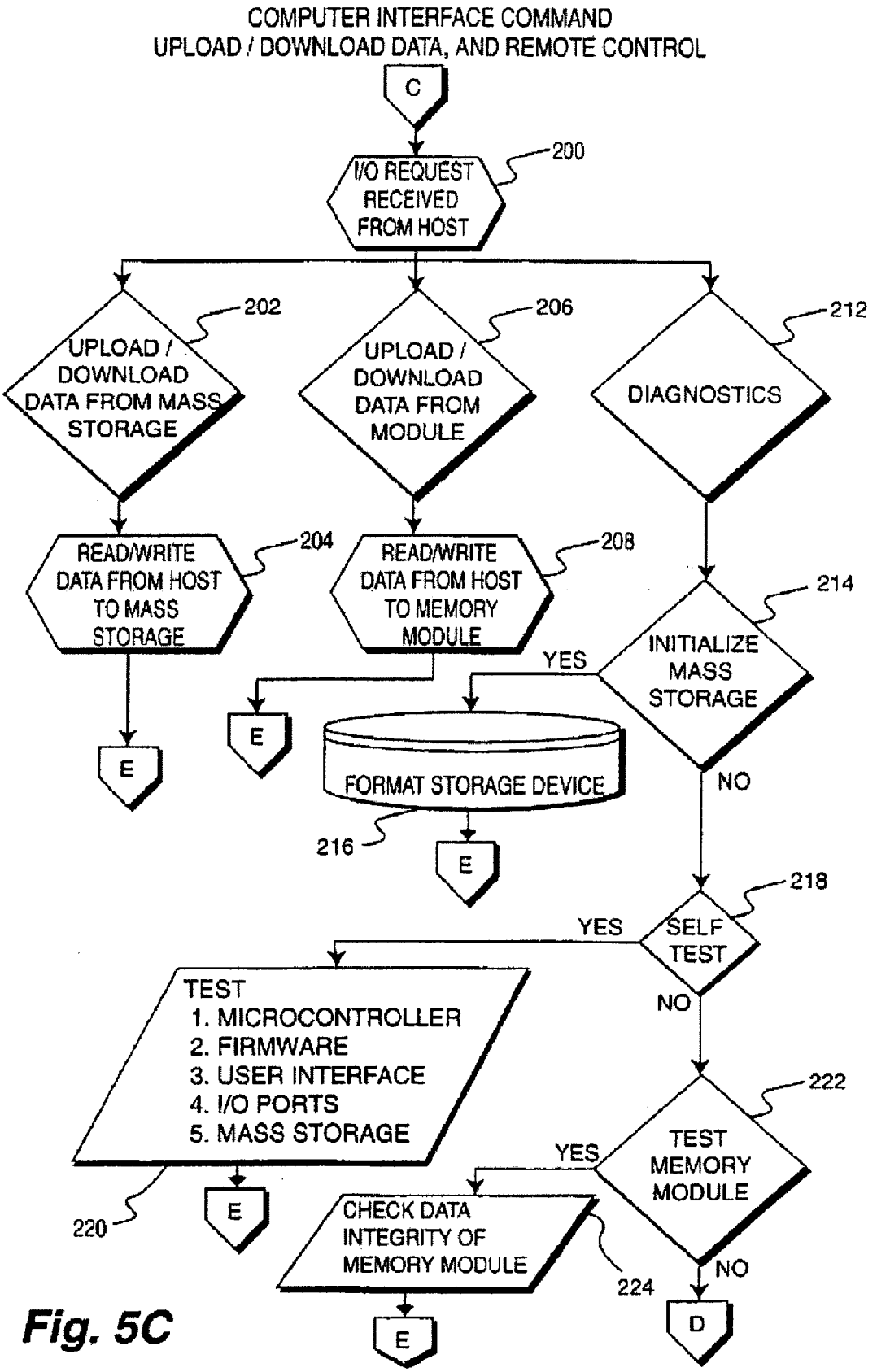

COMPUTER INTERFACE COMMAND
UPLOAD / DOWNLOAD DATA, AND REMOTE CONTROL
C
I/O REQUEST RECEIVED FROM HOST
200
UPLOAD / DOWNLOAD DATA FROM MASS STORAGE
202
UPLOAD / DOWNLOAD DATA FROM MODULE
206
DIAGNOSTICS
212
READ/WRITE DATA FROM HOST TO MASS STORAGE
204
READ/WRITE DATA FROM HOST TO MEMORY MODULE
208
INITIALIZE MASS STORAGE
214
YES
NO
E
E
FORMAT STORAGE DEVICE
216
E
SELF TEST
218
YES
NO
TEST
1. MICROCONTROLLER
2. FIRMWARE
3. USER INTERFACE
4. I/O PORTS
5. MASS STORAGE
220
E
TEST MEMORY MODULE
222
YES
NO
CHECK DATA INTEGRITY OF MEMORY MODULE
224
E
D

Fig. 5C

PORTABLE DATA TRANSFER AND MASS STORAGE DEVICE FOR REMOVABLE MEMORY MODULES

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Ser. No. 10/629,905 filed Jul. 30, 2003, now pending, which is a continuation of U.S. Pat. No. 6,658,202 ('202). The entire contents of Ser. No. 10/629,905 and the '202 patent are hereby incorporated by reference in this application.

FIELD OF THE INVENTION

[0002] This invention relates generally to data transfer and storage devices. More particularly, the invention relates to a hand-held, battery-powered, portable device for transferring data between, for example, a flash memory module used in conjunction with a digital camera or audio device and a mass storage device.

BACKGROUND AND SUMMARY OF THE INVENTION

[0003] Over recent years, digital cameras have been rapidly growing in worldwide popularity. Such cameras provide many advantages over the conventional film camera. For example, digital cameras do not require the time and financial expenditures of conventional cameras in terms of film development. Digital cameras are designed to be used in conjunction with a wide range of sophisticated computer graphics processing packages not available for conventional film cameras. Display devices associated with certain digital cameras advantageously provide the photographer with an enhanced ability to frame desired images and to review pictures just taken.

[0004] Digital cameras, however, are not without their disadvantages. Conventional high resolution digital cameras are currently very costly and employ expensive memory media which are capable of only capturing a relatively limited number of pictures. Such cameras may utilize a flash memory module having a storage capacity of, for example, 2 to 32 megabytes. These memory modules become increasingly more expensive as the storage capacity increases.

[0005] A high resolution digital camera with a conventional flash memory module may only have a storage capacity to permit a photographer to take a very limited number of pictures such as, for example, a half dozen or even fewer pictures. The vacationing photographer may choose to undertake a major expense to be assured of having enough memory modules to record memorable events from a two week vacation.

[0006] In accordance with an exemplary embodiment of the present invention, this digital camera shortcoming is overcome by a hand-held, battery-powered portable device for transferring data between a flash memory module and a mass storage device. The mass storage device may be able to store, for example, the contents of the equivalent of hundreds of flash memory modules.

[0007] In accordance with one exemplary embodiment of the present invention, the contents of a flash memory module inserted into an insertion memory port in the portable hand-held device is downloaded under operator control to a mass storage device in the form of a fixed or removable hard disk drive. Thereafter, the memory module is reinitialized so that it may be immediately reused in its associated camera.

[0008] The above-described features and other advantages of the present invention will become apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a perspective illustration of an exemplary embodiment of the present invention showing a hand-held housing and an exemplary component layout.

[0010] FIG. **2** is an exemplary block diagram of an exemplary implementation of the data transfer and storage system shown in FIG. **1**.

[0011] FIG. **3** is a block diagram depicting the system controller logic shown in FIG. **2**.

[0012] FIG. **4** is a flowchart of exemplary firmware depicting the portable storage device main system operation.

[0013] FIGS. **5**A-**5**D are flowcharts delineating the sequence of processing for copy, erase, and computer interface command operations.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0014] FIG. **1** is a schematic, perspective illustration of an exemplary embodiment of the data transfer and storage device in accordance with the present invention. The battery-powered device for transferring data includes a housing **10**, which preferably is of a size which can be comfortably held in a user's palm and which is lightweight and readily portable.

[0015] As shown in the right hand portion of FIG. **1**, the data transfer device includes a flash memory input port **22**. In the exemplary embodiment, port **22** is utilized to receive and electrically couple a memory module removed from a digital camera (or other device) to the mass storage device **20** under microprocessor control, as will be explained further in conjunction with FIGS. **2**-**5**. In the presently preferred embodiment, flash memory input port **22** is designed to receive the commercially available Toshiba SmartMedia flash memory module standard. The SmartMedia memory standard is utilized in various digital cameras and may be directly interfaced with a PC's disk drive, for example, via the commercially available FlashPath product. The SmartMedia module includes a flash memory chip, and processing circuitry in the form of a state control machine which controls reading and writing operations to an 8-bit bus. It should be understood that the present invention is not limited to any particular memory media, but may be utilized in conjunction with a variety of memory media where bulk data transfer is desirable. Although the memory module in the presently preferred embodiment contains image data captured from a digital camera, it should be understood that it alternatively may store any type of computer data including audio data used, for example, to reproduce music.

[0016] The data transfer and storage device of the presently preferred exemplary embodiment additionally includes an optional second memory input port **24**, which is preferably designed to receive a storage media of a different standard than the memory media received in input port **22**. By way of example only, the second memory input port **24** is designed to receive the CompactFlash or MMC media sold by SanDisk Corporation and/or the Sony Memory Stick. One or more of the memory media inserted into input ports **22** and **24** may

include a microcontroller for performing more sophisticated processing operations as, for example, is done in the CompactFlash product.

[0017] Thus, the data transfer and storage device of the presently preferred embodiment is designed to accept more than a single standard flash memory card, and includes multiple slots (e.g., two or more) to support more than one standard. Because input ports **22** and **24** accept memory media of different standards, the media are coupled to mass storage device **20** via different interface and/or control logic circuitry as will be appreciated by those skilled in the art.

[0018] User interface keys **16**, **18** are utilized by a user to initiate a download of information from the memory media to the mass storage device **20**. At least one control key is provided for initiating the download operation. Another user interface key is used to reformat the memory module in accordance with its requirements for reuse in, for example, a digital camera for taking further photographs. The memory module is reformatted to reinitialize the memory module to place it in its initial default state where no data is stored. A "reformat" control key/button may be utilized to, for example, initiate the erasure of data stored on the media. By way of example, the erasure operation may delete all the files on the media, or in more sophisticated embodiments delete certain directories or subdirectories.

[0019] In an alternative embodiment of the present invention, the user interface keys **16**, **18** comprise a portion of a miniaturized keyboard, which may, for example, be utilized to select particular files and directories to copy to the mass storage device **20**, which may (prior to downloading) be displayed on, for example, an LCD display (not shown). Graphical images may be displayed on the LCD display so that the user may preview a particular video image to decide whether it should be saved for long term storage. Such a capability advantageously provides the user with added selectivity and flexibility as to what image data is most desirable to maintain in mass storage device **20**.

[0020] As opposed to using an LCD display, the user display may include, for example, LED display indicators **12** and **14**. Display indicators **12** and **14** may display a wide range of status indications such as, for example, indicating that the flash memory copying operation is complete, and that the power is on. Additional display indicators may show the status of other operations such as, for example, a download operation being in progress.

[0021] FIG. **1** also depicts printed circuit board **28**, which supports the electronic components schematically represented in FIG. **1** and which is shown in further detail in FIG. **2**. These components are preferably powered by rechargeable batteries stored in battery compartment **26** and/or an AC adapter may be used.

[0022] Data is extracted from the FIG. **1** data transfer device through serial/parallel ports **30**. Ports **30** are utilized, for example, after flash memory module data has been downloaded from multiple modules to mass storage device **20**. The serial/parallel ports **30** permit downloading information from the FIG. **1** portable data repository to the user's personal computer at a convenient future time.

[0023] Ports **30** are intended to encompass a wide range of I/O ports including, for example, a Universal Serial Bus (USB), a parallel port, and a high speed serial port, such as a Fire Wire port or any desired subset of these or other known ports. The ports **30** may be designed to receive modules plugged into sockets for operating one of the desired ports.

[0024] Mass storage device **20** is preferably a commercially available hard drive. By way of example, such a hard drive may be a 2.5 inch hard drive or other appropriately sized hard drive commercially available from various vendors. The mass storage device **20** preferably includes at least one gigabyte of storage. The mass storage device **20** may, in accordance with one embodiment of the present invention, be fixed internally, or in another embodiment, removable from housing **10**. In accordance with yet another embodiment of the present invention, the mass storage device **20** may be a battery backed SRAM. By way of example only, another option for mass storage device **30** is a high capacity flash memory module.

[0025] FIG. **2** is a block diagram showing the electronic interconnection between components of an exemplary embodiment of the data transfer and storage device of the present invention. As also depicted in FIG. **1**, FIG. **2** includes a flash memory socket **22** and a second memory socket **24** which may be, by way of example only, respectively configured to receive Toshiba's commercially available SmartMedia, SanDisk's Compact Flash or MMC media, or the Sony Memory Stick. The SmartMedia is, in the exemplary embodiment, directly connected to system bus **33**. System controller logic **54** includes the logic circuitry for transferring data from, for example, the Smart Media and Compact Flash memory media onto the system bus **33** for transfer to mass storage device **20** as will be explained below in conjunction with the description of FIG. **3**.

[0026] FIG. **3** is an exemplary implementation of the FIG. **2** system controller logic **54** coupled to memory media receiving sockets **24**, **25** and **26**. In accordance with an exemplary embodiment, sockets **24** and **26** are conventional PCMCIA ports which are electrically and mechanically compatible with the memory media coupled thereto. Thus, the Compact Flash socket **24** is a PCMCIA socket which is mechanically and electrically compatible with a Compact Flash media. If storage device **20** is implemented as a hard drive, a conventional hard drive ATA/IDE socket **25** is used to couple mass storage device **20** to the system controller logic **54**. If mass storage device **20** is selected to be a removable hard drive, then a PCMCIA socket **26** may be utilized.

[0027] The system controller logic **54** manages the various memory devices to which it is connected under processor **31** control via system bus **33**. The system controller logic **54** includes a SmartMedia address register **64** which is coupled to the flash memory/Smart Media socket **22** and which stores the Smart Media starting address to be accessed. Data may then be written to or read from the identified SmartMedia flash memory starting address. Similarly, RAM address registers **66** define desired starting addresses in RAM **32**.

[0028] DMA controller **68** manages data flow between the various memory devices and may be implemented by a conventional DMA controller having a byte transfer counter and control registers. Through DMA controller **68**, data may be moved from, for example, SmartMedia to RAM **32**. Under such circumstances, processor **31** loads the appropriate addresses into Smart Media address register **64** and RAM address register **66**. The byte transfer counter in DMA controller **68** is then loaded by processor **31** with the number of bytes to be transferred and a DMA controller **68** control register is loaded with information specifying the appropriate operation.

[0029] A conventional PCMCIA controller **60** may be utilized to control data exchange operations between the media

in PCMCIA sockets **24** and **26** and devices coupled to system bus **33**. Controller **60** includes an address decoder (not shown) that is coupled to the system bus **33**. Controller **60** also includes configuration registers (not shown) which identify configuration information such as the number of memory media or other devices to which it is connected and the device which is currently communicating with processor **31**. Controller **60** also includes a storage device for buffering data, and internal buses for interconnecting controller components. A conventional ATA/IDE controller **62** interfaces hard drive **20** with the system bus **33** and the devices connected thereto. As described above in conjunction with controller **60**, ATA/IDE controller **62** includes an address decoder, configuration registers, a memory and internal bus for interfacing with hard drive **20**.

[0030] Turning back to FIG. **2**, data transfers are preferably initiated via a user keyboard, control keys, or buttons **36** under the control of processor **31**. In one embodiment of the present invention, a miniature keyboard is utilized by a user to associate notes with an identified image, change the name of files, or to selectively create directories identifying where the user desires to move data.

[0031] As set forth in conjunction with the description of FIG. **1**, the present invention contemplates a wide range of possible user graphic interfaces. For example, LED's may be utilized to indicate a downloading or other status condition. Alternatively (or additionally, if desired), an LCD display may be utilized for visually depicting, for example, a file name or subdirectory to permit the user to selectively delete undesirable pictures, which also may be displayed for the user to review.

[0032] Processor **31** may be any of a wide range of processors but preferably is a RISC-based, for example, 8 bit processor, such as the Atmel 8513. Processor **31**, like each of the other components embodied in the data transfer and storage device, is selected to provide optimally low power consumption. Thus, while a variety of different processors may be selected, processor **31** is preferably a high speed processor having extremely low power consumption. The processor's operating system is resident in ROM **34**.

[0033] The data transfer and storage device shown in FIG. **2** also includes RAM **32**. RAM **32** stores operating system (and other processing) variables and buffers data being transferred between, for example, memory modules inserted into ports **22** and **24** and mass storage device **20**.

[0034] The serial/parallel ports **30** represented in FIG. **1** are shown in FIG. **2** as USB interface **40**, Fire Wire interface **42**, and parallel port interface **44**. These interfaces are utilized for transferring data from mass storage device **20** to, for example, a user's PC or notebook computer. For users having older computers which do not include a USB or Fire Wire interface, parallel port interface **44** may be utilized for downloading data to the user's computer. For newer computers, high speed data transfer may be accomplished via the USB or Fire Wire interfaces **40** or **42**, respectively. The output interface ports shown in FIG. **2** are provided by way of example to indicate that a variety of interfaces are contemplated for interfacing with a wide range of user's computers.

[0035] The portable device shown in FIG. **2** typically operates under battery power such as, for example, by rechargeable AA batteries **50**. Power supply **48**, in addition to being powered by batteries **50**, may also receive external power to permit a user upon arriving home to save battery power by using household power during uploading information to his or her computer. The external power source also permits batteries **50** to be recharged if rechargeable batteries are being used.

[0036] Mass storage **20** is preferably a hard drive as set forth in conjunction with FIG. **1**. It is also contemplated that mass storage **20** may be a removable hard drive, a SRAM, or a large storage capacity, high density flash memory or other mass memory media which is commercially available today or becomes commercially available in the future. Mass storage device is coupled to control logic **54** via an ATA/IDE bus or a PCMCIA.

[0037] FIG. **4** is a firmware flowchart showing an exemplary set of processing operations that the present preferred embodiment sequences through. After power is turned on (**100**), processor **31** executes a power-on self test routine whereby the integrity of the device is initially confirmed. The device internal logic is exercised and checked to a limited extent before operating data transfer device. Initially, the integrity of processor **31** and its associated firmware is checked. Next, the user interface functions, the I/O ports, and the mass storage device are checked (**102**). The power-on self tests include executing diagnostic routines to ensure, for example, that RAM **32** is operational.

[0038] Thereafter, a command interpreter loop is entered (**104**). The system monitors all associated input/output devices for activity to determine the next operation to initiate (**104**). As represented schematically at block **106**, an operation is initiated by a user, for example, actuating a copy or erase button. Alternatively, activity may be detected by processor **31** via the FIG. **2** USB, Fire Wire, or parallel ports **40**, **42**, and **44** (**110**). If activity is detected via the host computer system input, then processor **31** must interpret the host command.

[0039] At block **108** a check is made to determine whether the detected operational command is a copy memory module command. If so, "copy" operation processing is initiated, whereby data from a memory module is downloaded to mass storage **20** as set forth in the flowchart of FIG. **5**A. Initially, the integrity of the data in the memory module is verified to determine that the memory media is a valid module (**120**). Thus, if the data stored in the memory module does not conform with the appropriate standard format, a "copy" operation will not be performed and an indication will be displayed to the user that the memory module is bad. Such an indication may be displayed, for example, via a status indicating LED or on an LCD display (**122**).

[0040] If the data integrity of the module is good, then subdirectories are created on the mass storage unit (**124**). Thus, in the process of making such data transfers, processor **31** creates appropriate subdirectories which, for example, may be sequentially numbered for each module that is inserted into, for example, socket **22**. Each flash memory module may include its own subdirectory having all the contents of that module resident therein. The contents of the module is then copied into the created subdirectory. After the subdirectory has been created at block **126**, the directory structure from the module is copied to the mass storage device (**126**). Thereafter, the files from the memory module are copied to the mass storage device **20** into the directory structure that had been created (**128**).

[0041] After the data has been copied, the integrity of the data that has been copied is verified to, for example, determine whether data has been loaded onto a defective portion of the hard drive, or whether there has been a power failure or a

component failure (**130**). If the data cannot be verified, then an indication that the copying operation failed is conveyed to the user via a status LED or via an LCD display (**132**). If desired, an indication of the nature of the error may be displayed on an LCD display. If the integrity of the data is verified, then the user receives an indication that the copying operation has been successfully completed via a status LED or LCD (**134**) and the routine branches back to the command interpreter block **104** to await further activity.

[0042] If a copy memory module operation was not initiated then, as shown in FIG. **4**, a check is made to determine whether an "erase memory" command has been initiated (**140**). If so, the routine branches to the flowchart shown in FIG. **5**B, which delineates erase operation processing. Erase operation processing is utilized, for example, to prepare a flash memory module for reuse so that further pictures can be taken with the user's digital camera. Initially, a check is made to verify the data integrity of the memory module (**150**). This check ensures that the module has, for example, the proper data fields or supported density or supported voltage before any operation is performed thereon. If the memory module is determined to be bad, then the user receives a "bad memory media" indication, either via a status LED or via an LCD display (**152**).

[0043] If the module has been verified as being a valid module, then the desired files are deleted from the module (**154**). If the files cannot be deleted, then information is conveyed to the user that the erase operation has failed via a status LED or an LCD display (**156**). After the files have been deleted, memory media subdirectories are deleted (**158**). If the subdirectories cannot be deleted, then an indication is conveyed to the user that the erase operation failed via status LED or a LCD display (**160**). After subdirectories have been deleted, an indication is conveyed to the user that the erasure operation was successful via a status LED or LCD display (**162**) and the routine branches back to the FIG. **4** command interpreter.

[0044] If an "erase memory module" operation has not been initiated, then a check is made at block **170** to determine whether a computer interface command was initiated. If so, the routine branches to the FIG. **5**C flowchart depicting computer interface command processing.

[0045] Computer interface processing typically occurs after the user, for example, has completed a photography session and has interconnected the portable data storage and transfer device to his or her PC. During such operations a user may download pictures stored in the mass storage device to the PC or alternatively, upload, for example, pictures stored in the PC to the portable storage device's mass media.

[0046] Initially, a check is made at block **200** to determine whether an I/O request has been received from a user's host PC and, if so, what kind of request has been initiated. As indicated at block **202**, a check is made as to whether the requested activity is to upload or download data from or to mass storage device **20** to, for example, upload or download pictures (**202**). By uploading pictures from a user's PC, the portable data transfer and storage device thereafter may be utilized to hand-carry highly desirable pictures from one user's PC to another user's PC. Depending upon the desired direction of data transfer, data is either read from or written to the host or the mass storage device **20** (**204**). As indicated in FIG. **5**D, a status report is then sent to the host and the routine branches back to FIG. **4** and its command interpreter block **104**. During the data transfer process from or to the mass storage, the user would have the ability to delete files, rename files, and a wide range of other conventional file processing operations. Such host/mass storage data exchanges operate under the control of software resident in the user's PC.

[0047] As indicated at block **206**, a check is also made to determine whether data exchanges are to take place between the memory module and the host computer (**206**). In this fashion, reading to or writing from the host to the memory module is controlled (**208**). Similar to exchanges between the host PC and mass storage, a wide range of data transfer operations may be controlled. After the host to memory module data exchange, a status report is sent to the host (**210**) and the routine branches back to the FIG. **4** command interpreter **104**.

[0048] If the processing of block **200** reveals that an I/O request was received from the host, a check is also made to determine if the request was a diagnostics command (**212**). Such diagnostics may appropriately be initiated either during the device manufacturing phase or for user diagnostics. Initially, a check is made as to whether to initialize mass storage **20** (**214**). If the check at **214** indicates that mass storage is to be initialized to, for example, recover from a failure, the storage device **20** is reformatted (**216**), a status report is transmitted to the host (FIG. **5**D at **210**), and the routine branches back to the FIG. **4** command interpreter (**104**).

[0049] If the check at block **214** indicates that the mass storage **20** is not to be initialized, then a check is made to determine whether self test processing is be initiated (**218**). If self tests are to be initiated, then self test processing begins (**220**). The self tests performed at block **220** are more comprehensive than the power-on self tests previously referenced in that they output diagnostic information useful to service personnel for correcting a problem relating to processor **31** and its associated firmware, the user interface devices, the I/O ports and the mass storage device. Upon completion of these tests, the host processor is sent a status report (**210**) and the routine branches to the FIG. **4** command interpreter block **104**.

[0050] If no self test command was received, a check is made to determine whether the memory media should be tested (**222**). If so, the integrity of data from the memory module is checked to respond for example, to a user complaint that the memory media can not be read. Service personnel can then determine that, for example, a particular data field has been corrupted requiring reformatting of the module. If no memory module testing has been initiated, the routine branches back to the command interpreter at block **104**.

[0051] If no computer interface command has been initiated as determined at block **170**, a check is made at **172** (FIG. **4**) to determine if the user has depressed a power off key or alternatively has let the data transfer device sit idle for more than a predetermined idle time. If so, the device powers down (**174**). If not, the routine branches back to command interpreter block **104** to continue checking for command related activity.

[0052] The present invention may be utilized in a wide range of applications in addition to being used by amateur photographers. For example, the present invention may be used in conjunction with a team of professional photographers covering an event for a newspaper or magazine. Individual photographers having digital cameras may, for example, meet at a central location and transfer flash memory modules to a colleague having the present data transfer and storage device for storage of all the data. Such accumulated

data may thereafter be downloaded to the newspaper's or magazine's central office computer.

[0053] It will be understood by those skilled in the art that the foregoing description is in the terms of a preferred embodiment of the present invention, wherein various changes and modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

1. An apparatus comprising:
- a housing configured to be held in the palm of a user's hand and including a memory input port configured to receive a removable digital camera memory module having at least one digital data structure;
- a mass storage device configured to:
  - receive and store image data from the digital camera memory module,
  - have at least one gigabyte of storage, and
  - be accessible to transfer the image data to a computer;
- a user interface configured to receive user input to initiate a copy operation, wherein the copy operation copies image data from the digital camera memory module to the mass storage device;
- processing circuitry configured to:
  - control the transfer of data stored in the digital camera memory module inserted into the memory input port to the mass storage device,
  - initiate the copy operation in response to the user interface receiving user input,
  - verify that the copy operation has been correctly performed, and
  - change a name associated with the at least one digital data structure;
- a display device configured to display the image data; and
- an output interface configured to
  - transfer the image data stored in the mass storage device to the computer, and
  - be compatible with an interface of the computer,
- wherein the apparatus is configured to transfer data between the removable digital camera memory module to the computer.

2. The apparatus of claim **1**, wherein said processing circuitry is further configured to reformat the digital camera memory module inserted into said memory input port to place the digital camera memory module into a state where it can be reused in a digital camera for picture capture.

3. The apparatus of claim **1**, wherein the output interface includes a USB interface configured to communicate with the mass storage device to transfer picture image data to the computer, further wherein the processing circuitry is configured to power down upon detecting more than a predetermined idle time.

4. The apparatus of claim **1**, wherein the processing circuitry is configured to verify that the copy operation has been correctly performed by determining whether the image data stored in the digital camera memory module conforms with a standard format.

5. The apparatus of claim **1**, wherein the mass storage device is a removable hard drive.

6. The apparatus of claim **1**, wherein the mass storage device is a hard drive, further wherein the apparatus is configured to receive digital image data from the computer.

7. The apparatus of claim **1**, wherein the processing circuitry is a RISC-based processor operable to edit image-related data.

8. The apparatus of claim **7**, wherein the processing circuitry is configured to delete files on the digital camera memory module.

9. The apparatus of claim **7**, wherein the display device is configured to display a preview of a video image prior to transfer to the mass storage device.

10. The apparatus of claim **1**, wherein the mass storage device is removable.

11. The apparatus of claim **1**, wherein the user interface comprises a single button configured to initiate the copy operation.

12. An apparatus comprising:
- A housing configured to be held in the palm of a user's hand and including a flash memory insertion section configured to receive a flash memory module having at least one data structure,
- a mass storage device contained within the housing and configured to:
  - receive and store data from the flash memory module,
  - be accessible to transfer the data to a computer, and
  - have at least one gigabyte of storage;
- a user interface configured to change a name associated with the data structure in response to user input;
- a processor contained within the housing configured to:
  - control the transfer of data stored in the flash memory module to the mass storage device, and
  - change a name associated with the data structure in response to input received by the user interface;
- a display device configured to display data relating to the contents of the flash memory module, wherein the processor is further configured to control the display of data on the display device enabling a user to preview the data in a preview mode; and
- an output interface configured to
  - transfer data stored in the mass storage device to the computer,
  - be compatible with an interface of the computer,
  - wherein the apparatus is configured to transfer data between the flash memory module to the computer.

13. The apparatus of claim **12**, wherein the user interface is configured to associate text information with an image in response to user input.

14. The apparatus of claim **12**, wherein the digital data structure is a file and the apparatus is configured to allow a user to change the name of the file.

15. The apparatus of claim **12**, wherein the user interface is configured to allow a user to enter data corresponding to a creation of a directory.

16. The apparatus of claim **12**, wherein the user interface is configured to allow a user to enter location information indicative of where the data is to be moved.

17. The apparatus of claim **12**, wherein the display device is further configured to display video image data, further wherein the apparatus is configured to receive digital image data from the computer.

18. The apparatus of claim **12**, wherein the flash memory module stores audio data.

19. The apparatus of claim **12**, wherein the processor is configured to:
- reformat a flash memory module inserted into the flash memory insertion section to place the flash memory module into a state where it can be reused, and
- power down upon detecting more than a predetermined idle time.

20. The apparatus of claim **12**, wherein the user interface comprises a single button configured to initiate the copy operation.

21. An apparatus comprising:

a housing configured to be held in the palm of a user's hand and including a flash memory port configured to receive a removable flash memory module having at least one digital data structure;

a mass storage device configured to:

receive and store image data from the flash memory module,

be accessible to transfer the data to a computer, and

have at least one gigabyte of storage;

a user interface configured to receive user input to initiate a copy operation, wherein the copy operation copies image data from the flash memory module to the mass storage device;

a display device configured to display the image data;

a processor configured to:

control the transfer of data stored in the digital camera memory module inserted into the flash memory port to the mass storage device,

initiate a copy operation in response to the user interface receiving user input,

verify that the copy operation has been correctly performed,

control the display of the image data on the display device to enable previewing of the image data, and

change a name associated with the digital data structure in response to user input;

one or more LED displays, wherein the processor is further configured to energize the one or more LED displays providing indication of at least one status; and

an output interface configured to

communicate with the mass storage device,

transfer image data stored in the mass storage device to the computer,

be compatible with an interface of the computer,

wherein the apparatus is configured to transfer data between the flash memory module to the computer.

22. The apparatus of claim **21**, wherein the processor is configured to access information from a plurality of different types of digital camera memory modules.

23. The apparatus of claim **21**, wherein the output interface includes a USB interface configured to communicate with the mass storage device, wherein the USB interface is further configured to transfer picture image data to the computer.

24. The apparatus of claim **21**, wherein the flash memory port is Compact-Flash compatible, further wherein the apparatus includes an additional memory input port configured to receive flash media of a type different than Compact-Flash media.

25. The apparatus of claim **21**, wherein the apparatus is configured to receive digital image data from the computer.

26. The apparatus of claim **21**, wherein the processor is configured to power down upon detecting more than a predetermined idle time.

27. The apparatus of claim **26**, wherein the processor is configured to delete files on the digital camera memory module.

28. The apparatus of claim **26**, wherein the display device is configured to display a graphical image enabling a user to preview the image prior to transferring the image to the mass storage device.

29. The apparatus of claim **21**, wherein the mass storage device is removable.

30. The apparatus of claim **21**, wherein the user interface comprises a single button configured to initiate the copy operation.

31. An apparatus comprising:

a housing configured to be held in the palm of a user's hand and including a plurality of flash memory input ports; wherein at least a first flash memory input port is configured to be compatible with a first type of flash memory storing at least one digital data structure, and wherein at least a second flash memory input port is configured to be compatible with a second type of flash memory storing at least one digital data structure;

a mass storage device configured to:

communicate with a flash memory inserted into one of the flash memory input ports,

receive and store image data from the flash memory,

transfer the image data to a computer, and

have at least one gigabyte of storage;

a user interface configured to receive user input to initiate a copy operation, wherein the copy operation copies image data from the flash memory to the mass storage device;

a display device configured to display the image data;

a processor configured to:

access information from a plurality of different types of flash memory;

control the transfer of data stored in the flash memory inserted into the memory input port to the mass storage device,

initiate a copy operation in response to the user interface receiving user input to initiate the copy operation,

verify that the copy operation has been correctly performed,

control the display of the image data on the display device to enable previewing of the image data, and

change a name associated with the digital data structure associated with the flash memory in response to user input;

one or more LED displays, wherein the processor is further configured to energize the one or more LED displays providing indication of at least one status; and

a USB interface configured to

communicate with the mass storage device,

transfer image data stored in the mass storage device to the computer,

wherein the apparatus is configured to transfer data between the flash memory to the computer.

32. The apparatus of claim **31**, wherein the first flash memory input port is Compact-Flash compatible.

33. The apparatus of claim **32**, further comprising processing circuitry configured to delete files on the flash memory.

34. The apparatus of claim **33**, wherein the mass storage device is removable.

35. The apparatus of claim **33**, wherein the processor is configured to power down upon detecting more than a predetermined idle time.

36. The apparatus of claim **31**, wherein the user interface comprises a single button configured to initiate the copy operation.

37. A method comprising:

displaying on a display within a repository device, under the control of a processor, image data enabling a user to

preview the image data, wherein the image data is related to data obtained from a digital camera;

initiating, under the control of the processor, a selection of a copy operation to transfer data from a digital camera memory module to a mass storage device within the repository device;

verifying that the copy operation was performed correctly;

changing a name of a digital data structure in response to user input; and

displaying at least one status indicator identifying an operation being performed by the repository device,

wherein the repository device is embodied in a housing of a size to be held in the palm of a user's hand and connectable to both a removable memory module and a computer, wherein the mass storage device has at least one gigabyte of storage.

38. The method of claim **37**, further comprising deleting a file associated with the digital camera memory module.

39. The method of claim **37**, further comprising initiating a power down of the processor upon detecting more than a predetermined idle time.

40. The method of claim **37**, further comprising transferring image data to a computer.

41. The method of claim **37**, further comprising receiving data from flash media inserted into a first memory port within the repository device, wherein the flash media is not Compact-Flash media, further wherein a second memory input port within the repository device is Compact-Flash compatible.

42. An apparatus comprising:

a housing configured to be held in the palm of a user's hand and including

a flash memory insertion section configured to receive a flash memory module,

a mass storage device contained within the housing and configured to:

receive and store data from the flash memory module,

be accessible to transfer the data to a computer, and

have at least one gigabyte of storage;

a processor contained within the housing configured to:

control the transfer of data stored in the flash memory module to the mass storage device, and

reformat the flash memory module to place the flash memory module into a state in which it is reusable to store data; and

an output interface configured to

transfer data stored in the mass storage device to the computer,

be compatible with an interface of the computer,

wherein the apparatus is configured to transfer data between the flash memory module to the computer.

43. The apparatus of claim **42**, wherein said output interface includes a USB interface configured to transfer data stored in the mass storage device to the computer.

44. The apparatus of claim **42**, further including a key configured to initiate the transfer of contents of the flash memory module to the mass storage device.

45. The apparatus of claim **42**, further including a display configured to display digital photograph related data.

46. The apparatus of claim **42**, further including an additional flash memory insertion section to receive an additional flash memory module, the processor configured to selectively transfer contents of the flash memory module and the additional flash memory module to the mass storage device.

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