

US00RE43862E

(19) **United States**  
(12) **Reissued Patent**  
**Osborn**

(10) **Patent Number:** **US RE43,862 E**  
(45) **Date of Reissued Patent:** **Dec. 11, 2012**

(54) **PALMTOP COMPUTER EXPANSION USING SHAPED MEMORY ACCESS**

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(21) Appl. No.: **12/157,134**

(22) Filed: **Jun. 6, 2008**

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**Related U.S. Patent Documents**

Reissue of:

(64) Patent No.: **6,738,852**  
Issued: **May 18, 2004**  
Appl. No.: **09/671,657**  
Filed: **Sep. 27, 2000**

U.S. Applications:

(63) Continuation of application No. 11/437,005, filed on May 16, 2006, now Pat. No. Re. 40,421.

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

(52) **U.S. Cl.** ..... **710/303**

(58) **Field of Classification Search** ..... 710/72,  
710/301, 303

See application file for complete search history.

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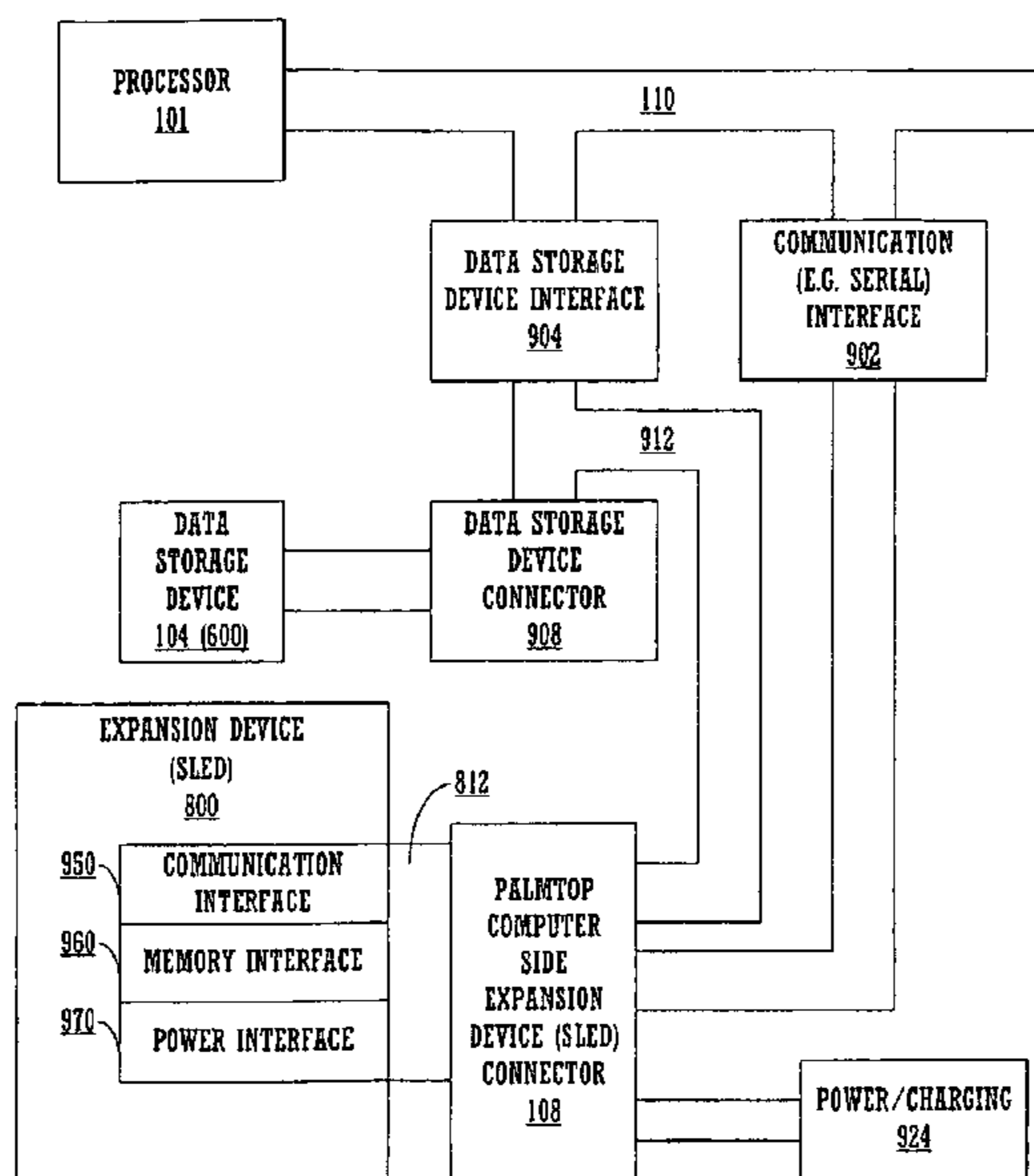
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(57) **ABSTRACT**

A palmtop computer utilizes SD memory modules or other types of memory modules to provide expansion memory. The expansion memory module plugs in to the palmtop computer via an external slot or compartment that is easily accessed by the user. This provides additional memory to the palmtop computer. To facilitate use of expansion devices such as sled or cradle based devices, a connector is provided on the palmtop computer that not only includes conventional power, ground and serial communication terminals, but also provides direct access to the memory module for use by the expansion device. This provides the advantage that the sled or cradle based device can directly access the palmtop computer's memory without using the palmtop computer's processing resources.

**12 Claims, 10 Drawing Sheets**



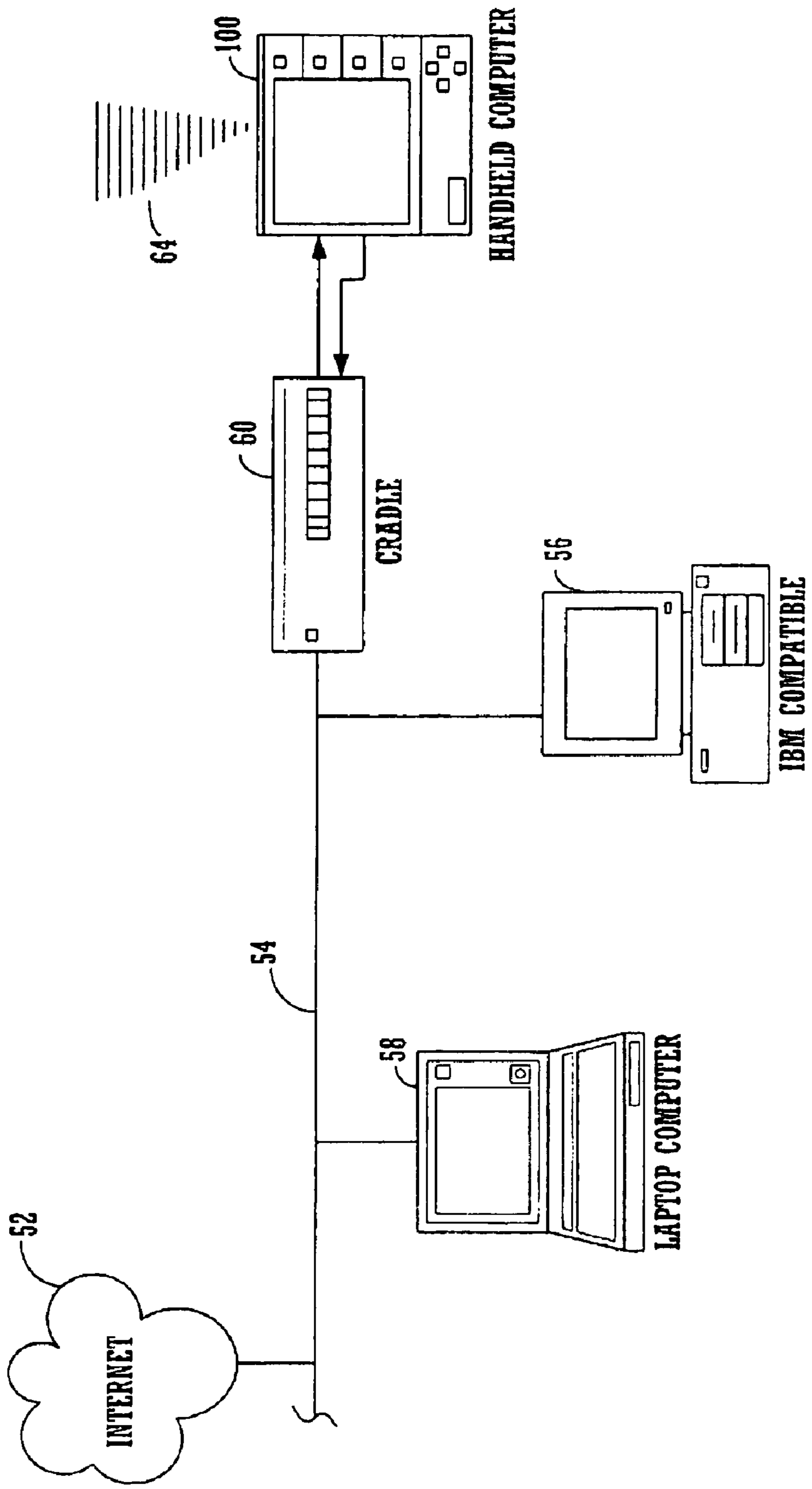


FIGURE 1

100a

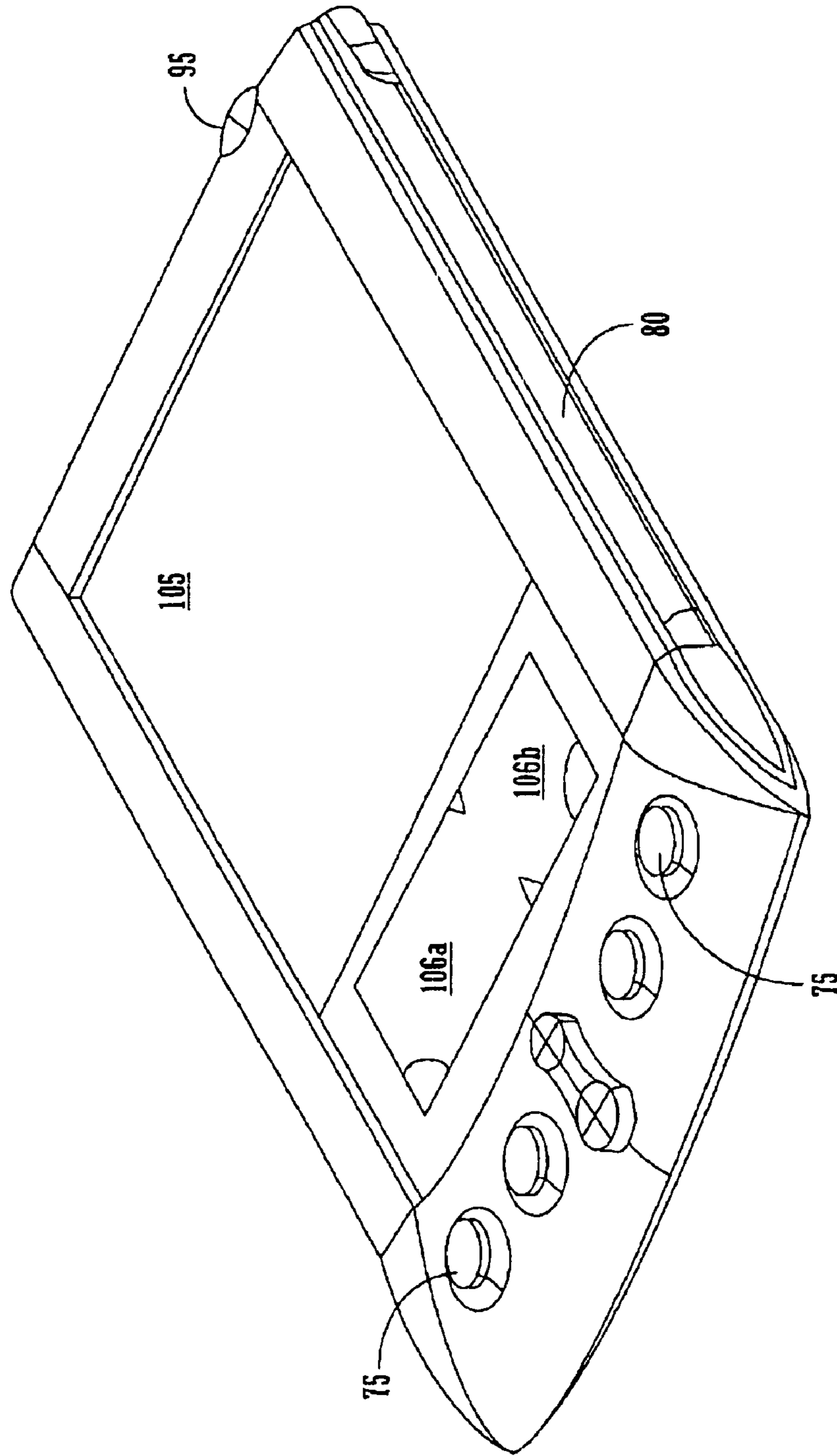


FIGURE 2A

100b

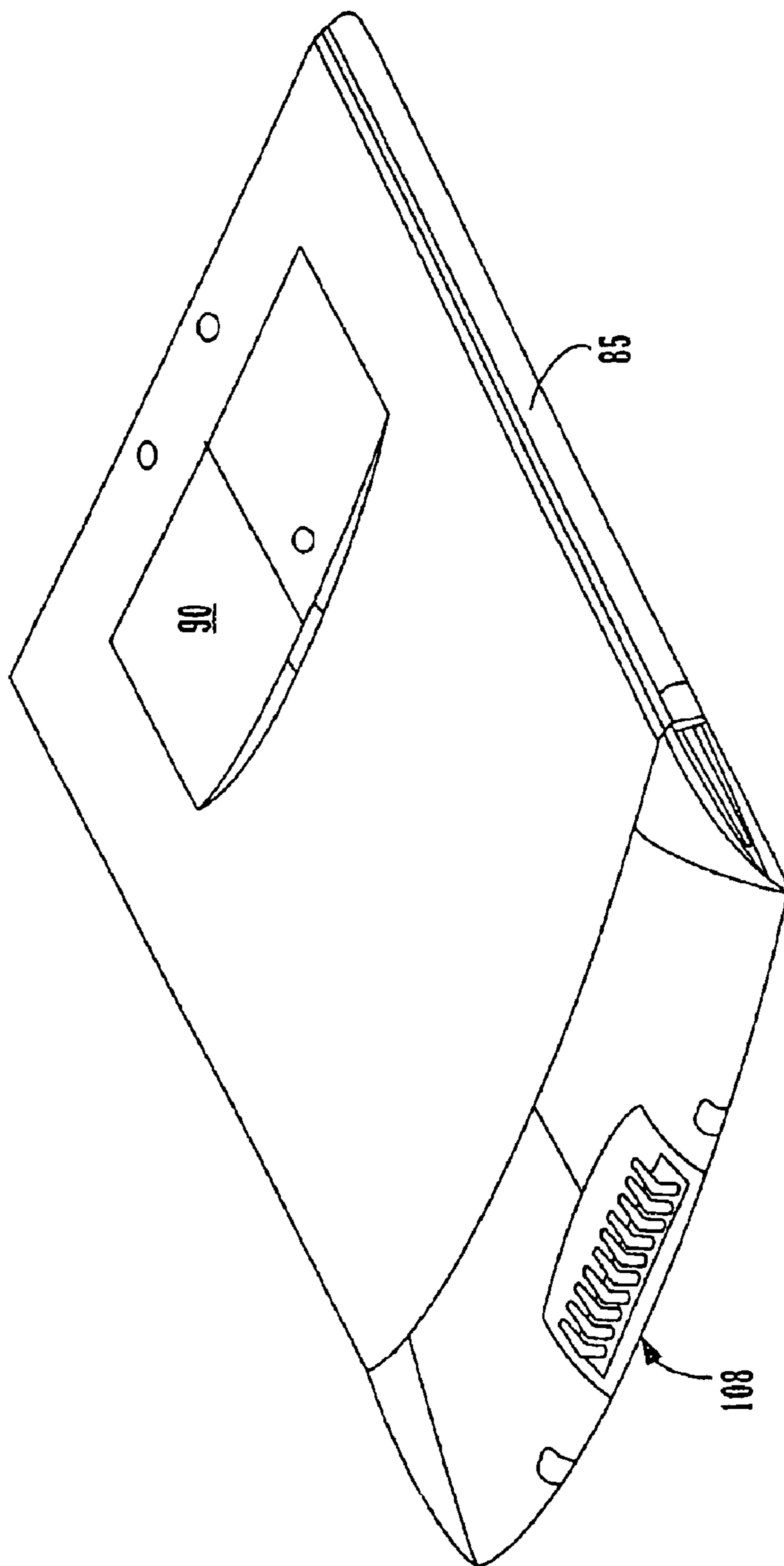


FIGURE 2B

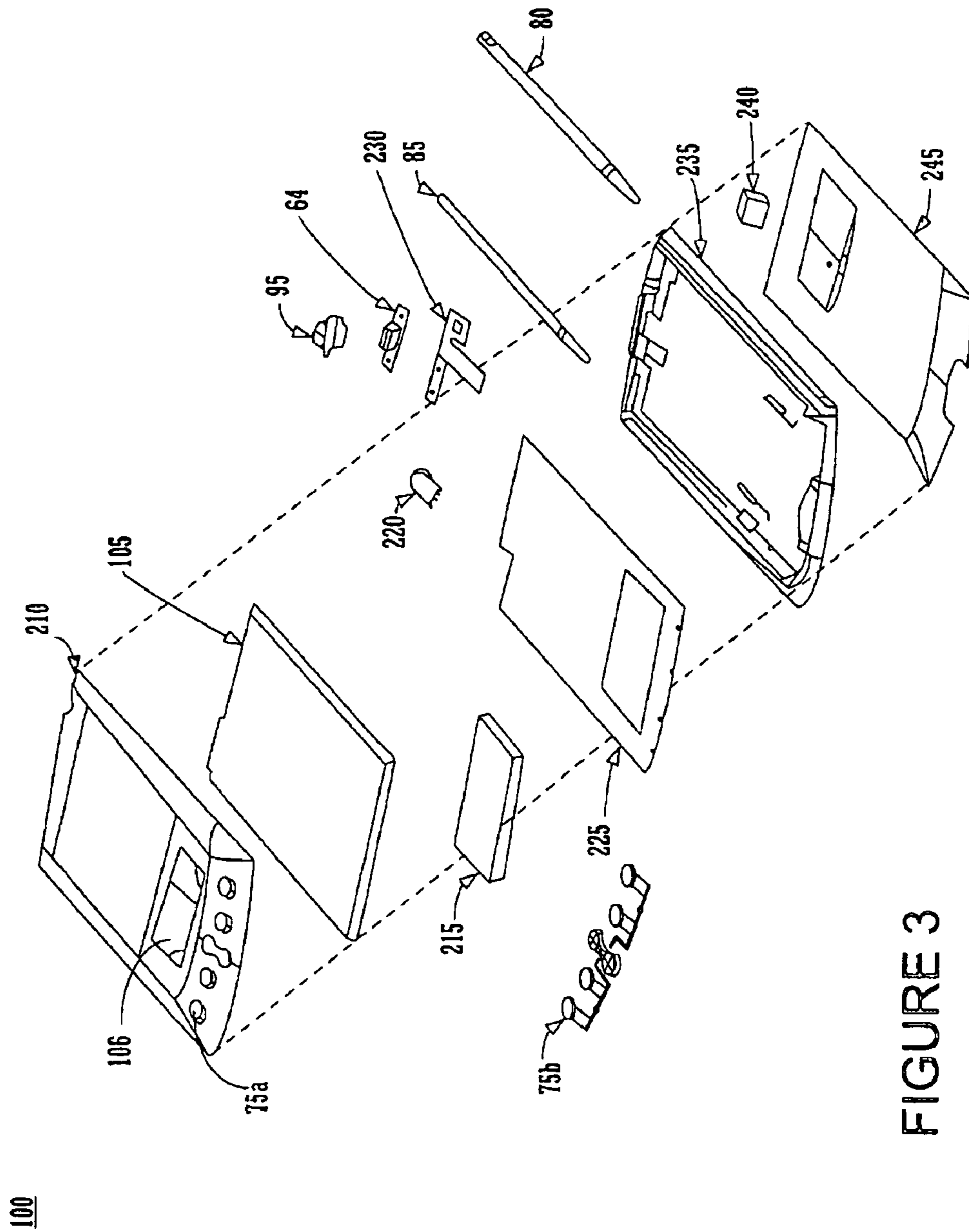


FIGURE 3

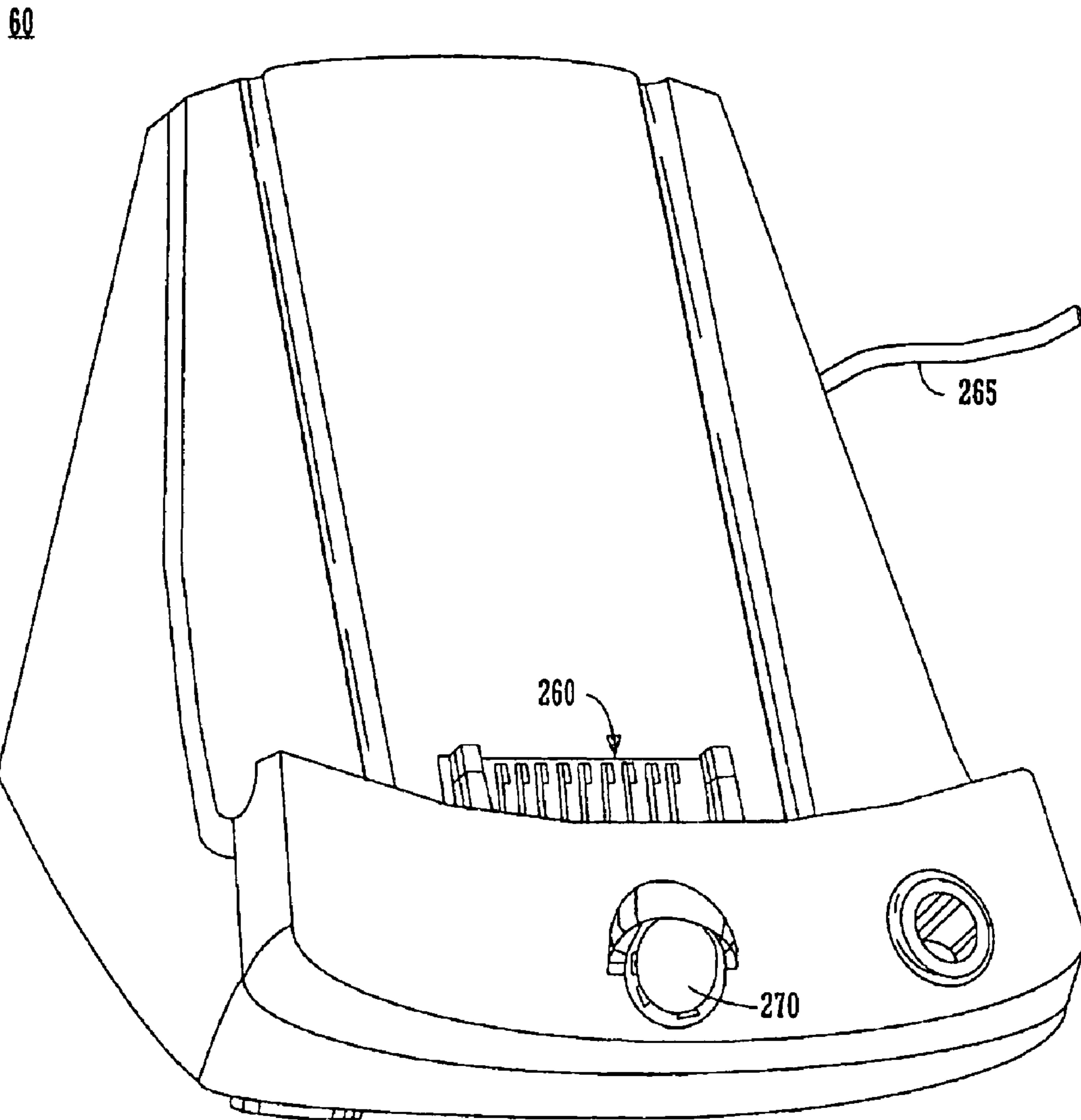


FIGURE 4

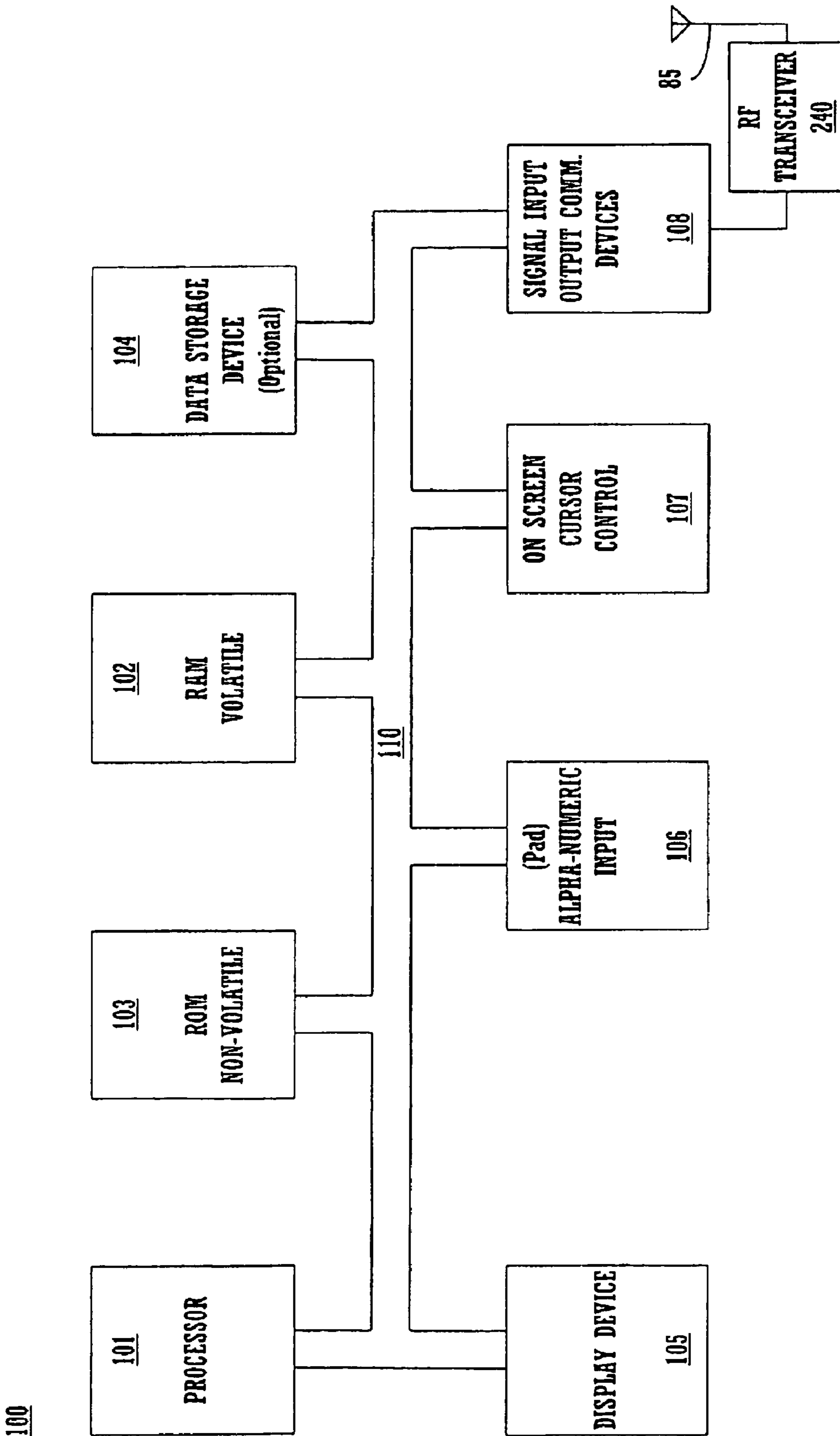


FIGURE 5

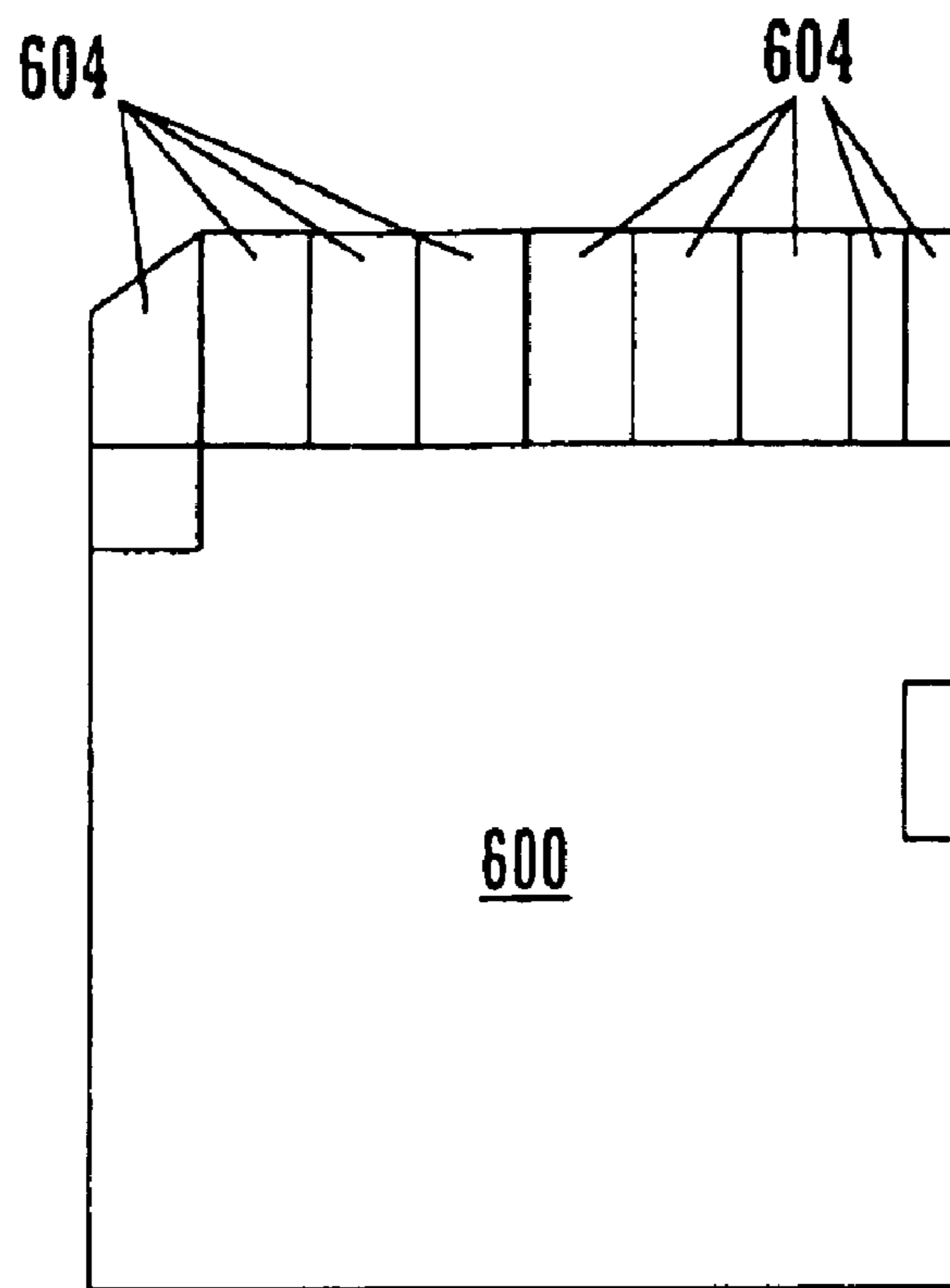


FIGURE 6



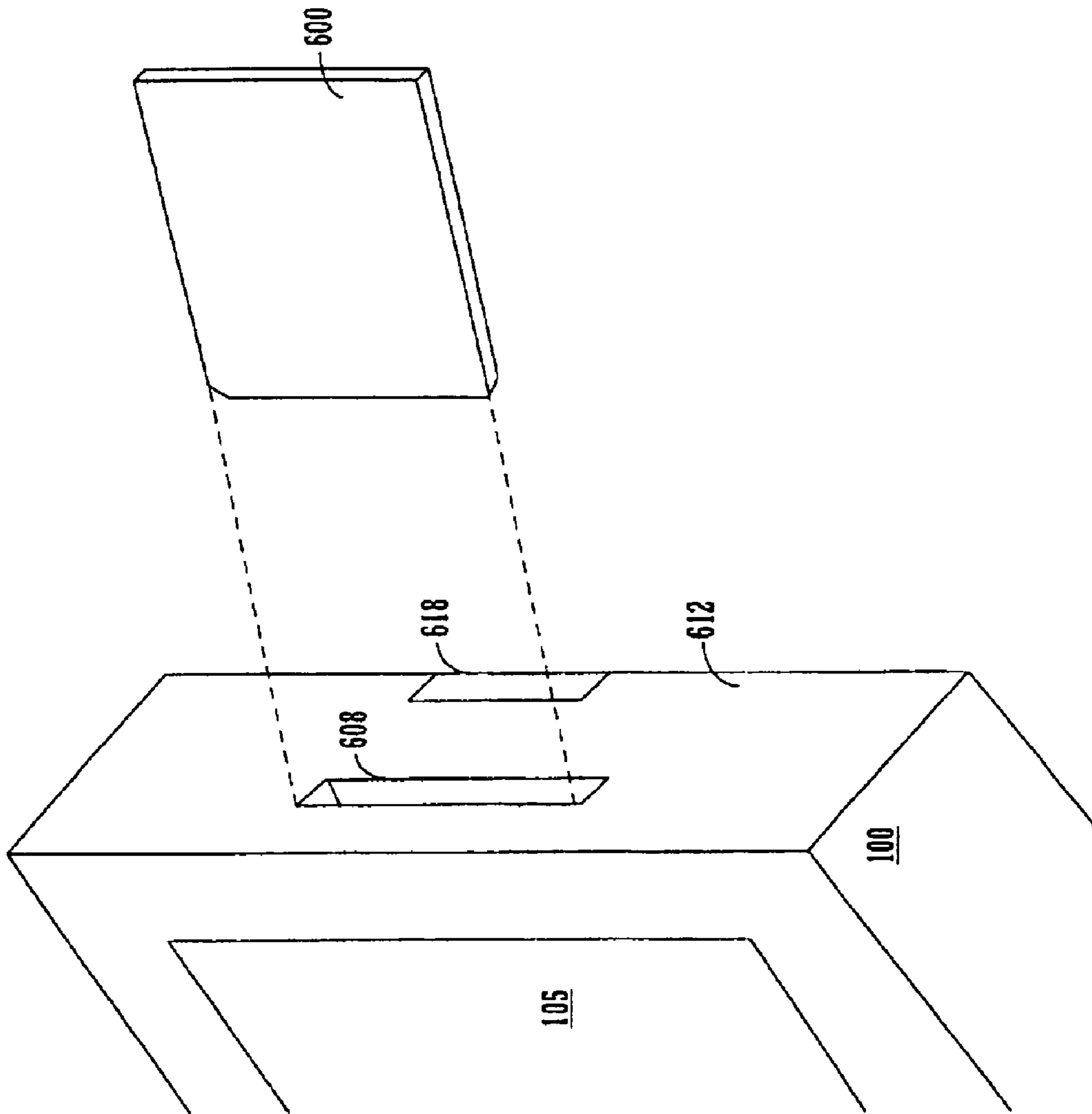


FIGURE 7

800

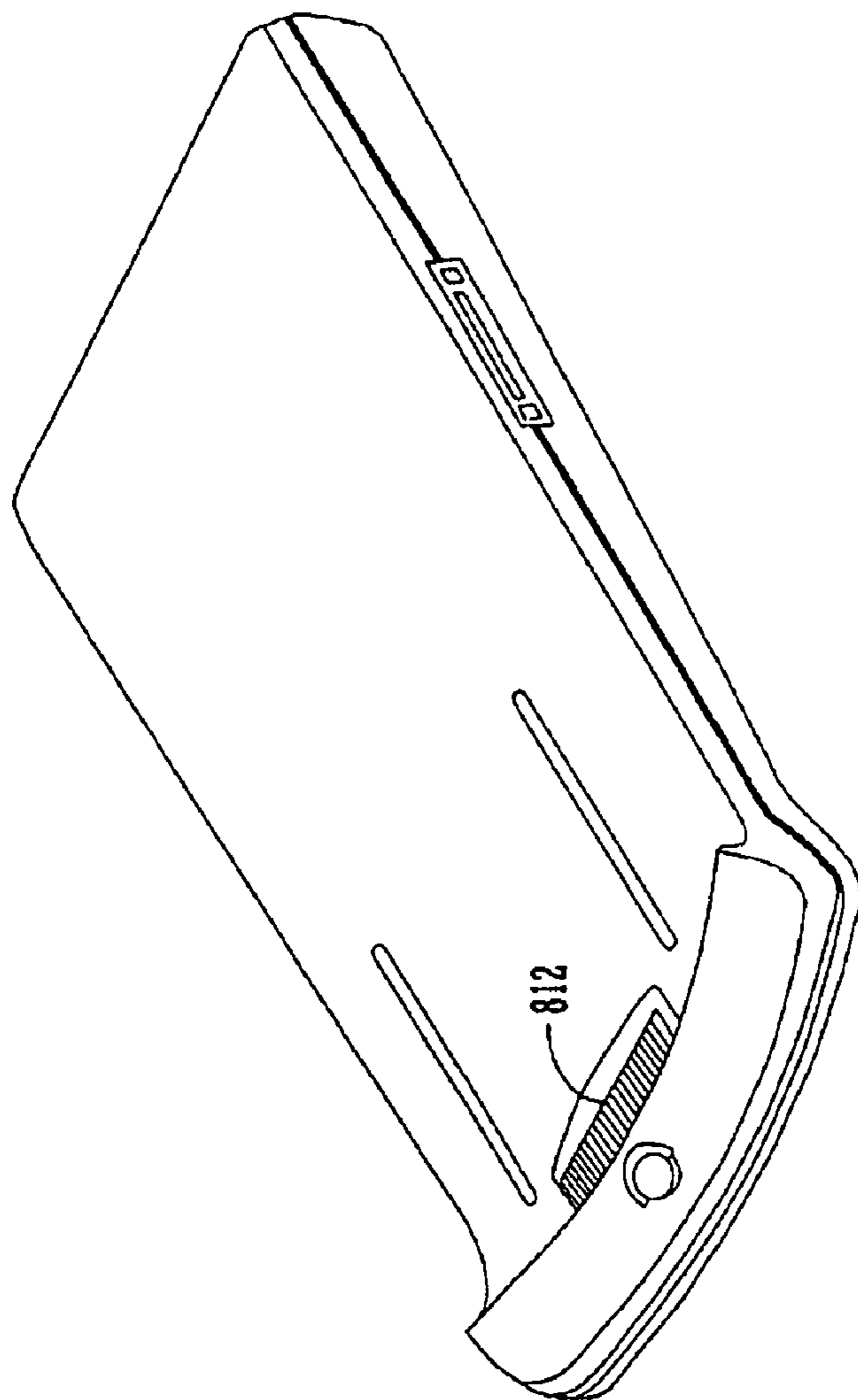


FIGURE 8

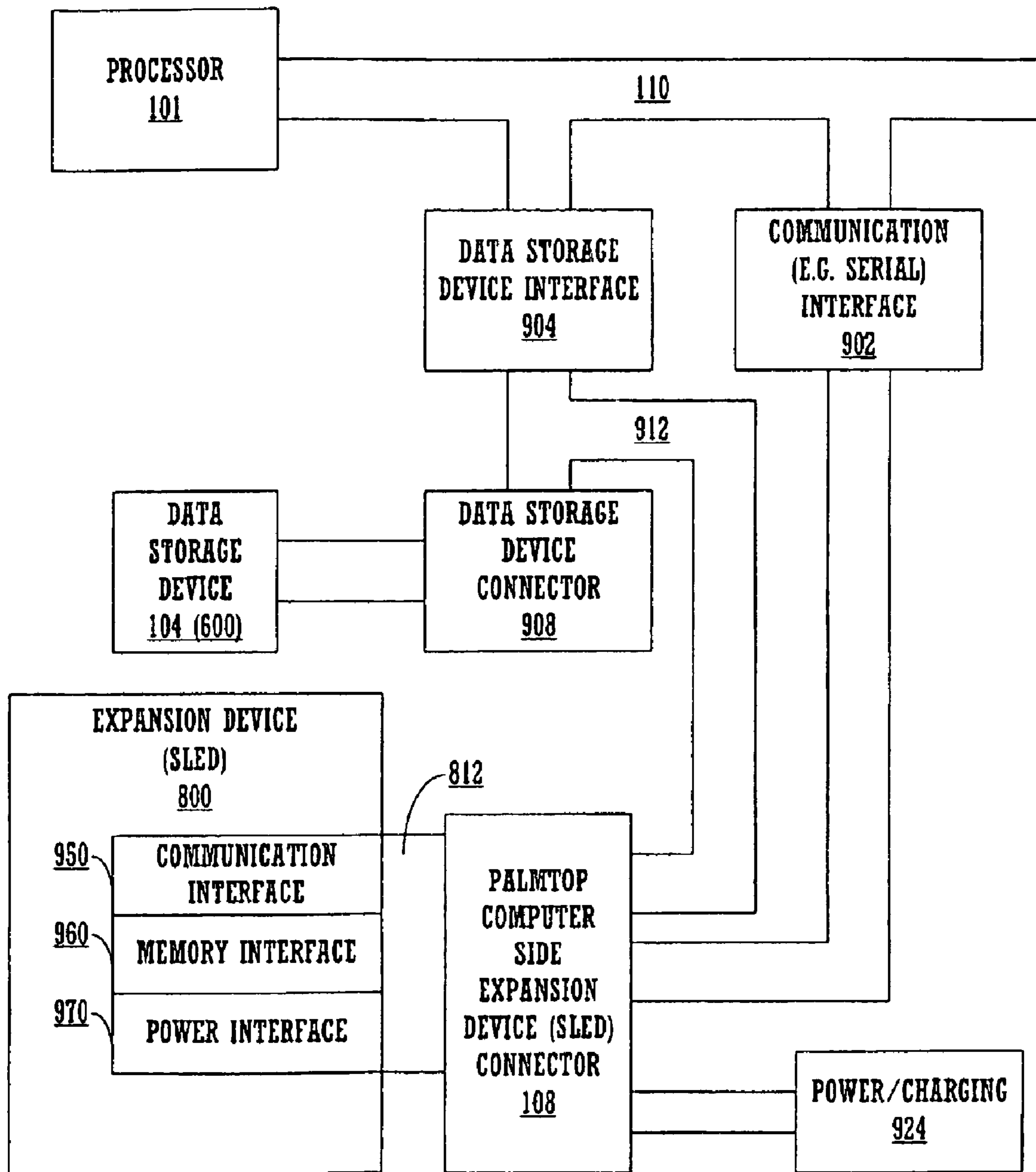


FIGURE 9

**PALMTOP COMPUTER EXPANSION USING  
SHAPED MEMORY ACCESS**

**Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.**

*Notice: More than one reissue application has been filed for the reissue of U.S. Pat. No. 6,738,852. The reissue applications are application Ser. No. 11/437,005 filed on May 16, 2006 and is a parent reissue application of U.S. Pat. No. 6,738,852, and application Ser. No. 12/157,134 (the present application) filed on Jun. 6, 2008 and is a continuation reissue application of parent reissue application Ser. No. 11/437,005 filed May 16, 2006 of U.S. Pat. No. 6,738,852 now U.S. Pat. No. Re. 40,421.*

FIELD OF THE INVENTION

The present invention relates to the field of expansion mechanisms for a palmtop computer. More particularly, the present invention relates to a mechanism for sharing memory access with an accessory such as a palmtop sled based accessory.

BACKGROUND

As the components required to build a computer system have reduced in size, new categories of computer systems have emerged. One of the new categories of computer systems is the "palmtop" computer system. A palmtop computer system is a computer that is small enough to be held in the hand of a user and can be "palm-sized." Most palmtop computer systems are used to implement various Personal Information Management (PIM) applications such as an address book, a daily organizer and electronic notepads, to name a few.

While these palm sized computers ("palmtop" computers) have dramatically reduced size when compared to a desktop or notebook computer, the user would like to be able to perform many of the same types of functions performed using physically larger and more powerful computers. Such functions often require substantial amounts of memory and/or circuitry that is not generally incorporated within a palmtop computer. An example of such a function is that of an MP3 music player. It is conceivable to embed such a player within a so-called "sled" device that couples to the palmtop computer. Unfortunately, such devices are taxing on the processing power of a palmtop computer if the music is stored either on the palmtop computer itself or on a storage device associated with the palmtop computer. In order to access such storage for real time audio playback using an MP3 player, the data stored in the memory device of a conventional palmtop must be converted to a serial format to be transferred through the processor to the serial connector of the palmtop before being played back by such a sled based MP3 player. This is cumbersome and taxing on battery life and processing power of the palmtop computer. Nonetheless, such an arrangement would have advantages since the MP3 player or other sled-based device could theoretically use the palmtop computer as a user interface and could use an existing memory interface to store music or other relevant data.

Unfortunately, the above listed drawbacks may be prohibitive in implementing such an arrangement. Thus, the cost of

such sled accessories may suffer by needing to supply an additional connector to support its own memory for storing data (e.g. MP3 music) or personality programs.

SUMMARY OF THE INVENTION

Accordingly, what is needed is an arrangement to permit a sled-based device to directly access a palmtop computer's memory.

In accordance with one embodiment of the invention, a palmtop computer utilizes SD memory modules or other types of memory modules to provide expansion memory. The expansion memory module plugs in to the palmtop computer via an external slot or compartment that is easily accessed by the user. This provides additional memory to the palmtop computer. To facilitate use of expansion devices such as sled or cradle based devices, a connector is provided on the palmtop computer that not only includes conventional power, ground and serial communication terminals, but also provides direct access to the memory module for use by the expansion device. This provides the advantage that the sled or cradle based device can directly access the palmtop computer's memory without using the palmtop computer's processing resources.

A method of expanding capabilities of a palmtop computer with a memory expansion module in accordance with an embodiment of the present invention includes: coupling the memory expansion module to a processor within the palmtop computer; coupling the memory module to an expansion port of the palmtop computer; and coupling a sled device to the palmtop computer, so that the sled device is coupled directly to the memory expansion module and to a communication port of the palmtop computer.

A palmtop computer having enhanced expansion consistent with embodiments of the present invention includes a central processor connected to a bus. An expansion memory is operatively coupled to the bus to provide the central processor with access to the expansion memory. A communication interface is operatively coupled to the bus to provide the central processor with communication with devices outside the palmtop computer. A connector, operatively coupled to communication interface and to the expansion memory, permits an external device to communicate with the central processor via the communication interface and to permit the external device to directly access the expansion memory module.

An expansion device for a palmtop computer consistent with the present invention, wherein the palmtop computer has a central processor, an expansion memory, a communication interface and a palmtop-side connector, the palmtop-side connector being operatively coupled to the communication interface and to the expansion memory, includes an expansion device-side connector suitable for mating with the palmtop-side connector. An expansion device-side communication interface is connected to the expansion device-side connector for communicating with the communication interface of the palmtop computer. A memory interface is connected to the expansion device-side connector for directly accessing the expansion memory of the palmtop computer.

The above summaries are intended to illustrate exemplary embodiments of the invention, which will be best understood in conjunction with the detailed description to follow, and are not intended to limit the scope of the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is system illustration of a palmtop computer system connected to other computer systems and the Internet via a cradle device.

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FIG. 2A is a top side perspective view of a palmtop computer system that can be used as a platform for the data entry embodiments of the present invention.

FIG. 2B is a bottom side perspective view of the palmtop computer system of FIG. 2A.

FIG. 3 is an exploded view of the components of the palmtop computer system of FIG. 2A.

FIG. 4 is a perspective view of the cradle device for connecting the palmtop computer system to other systems via a communication interface.

FIG. 5 is a logical block diagram of the palmtop computer system in accordance with an embodiment of the present invention.

FIG. 6 illustrates a memory or personality module used with the palmtop computer system in accordance with an embodiment of the present invention.

FIG. 7 illustrates one embodiment for coupling the memory module 600 to a port at the top of a palmtop computer.

FIG. 8 illustrates a "sled" device used to expand the capabilities of the palmtop computer.

FIG. 9 is a more detailed block diagram of the bus and connector configuration illustrating direct memory access to the sled device.

#### DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description of the present invention, of a palmtop computer expansion using shared memory access, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be recognized by one skilled in the art that the present invention may be practiced without these specific details or with equivalents thereof. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present invention.

#### Notation and Nomenclature

Some portions of the detailed descriptions which follow are presented in terms of procedures, steps, logic blocks, processing, and other symbolic representations of operations on data bits that can be performed on computer memory. These descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. A procedure, computer executed step, logic block, process, etc., is here, and generally, conceived to be a self-consistent sequence of steps or instructions leading to a desired result. The steps are those requiring physical manipulations of physical quantities.

Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated in a computer system. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, it is appreciated that throughout the present invention, discussions utilizing terms such as "processing" or "computing" or "translating" or "calculating" or "determining" or "scrolling" or "displaying" or

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"recognizing" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

#### Palmtop Computer Expansion Using Shared Memory Access in Accordance with the Present Invention

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail specific embodiments, with the understanding that the present disclosure is to be considered as an example of the principles of the invention and not intended to limit the invention to the specific embodiments shown and described. In the description below, like reference numerals are used to describe the same, similar or corresponding parts in the several views of the drawings.

FIG. 1 illustrates a system 50 that can be used in conjunction with the present invention. System 50 comprises a host computer system 56 which can either be a desktop unit as shown, or, alternatively, can be a laptop system 58. Optionally, one or more host computer systems can be used within system 50. Host computer systems 58 and 56 are shown connected to a communication bus 54, which in one embodiment can be a serial communication bus, but could be of any of a number of well known designs, e.g., a parallel bus, Ethernet Local Area Network (LAN), etc. Optionally, bus 54 can provide communication with the Internet 52 using a number of well known protocols.

Bus 54 is also coupled to a cradle 60 for receiving and initiating communication with a palmtop ("palm-sized") portable computer system 100 of the present invention. Cradle 60 provides an electrical and mechanical communication interface between bus 54 (and anything coupled to bus 54) and the computer system 100 for two way communications. Computer system 100 also contains a wireless infrared communication mechanism 64 for sending and receiving information from other devices.

FIG. 2A is a perspective illustration of the top face 100a of one embodiment of the palmtop computer system of the present invention. The top face 110a contains a display screen 105 surrounded by a bezel or cover. A removable stylus 80 is also shown. The display screen 105 is a touch screen able to register contact between the screen and the tip of the stylus 80. The stylus 80 can be of any material to make contact with the screen 105. The top face 100a also contains one or more dedicated and/or programmable buttons 75 for selecting information and causing the computer system to implement functions. The on/off button 95 is also shown.

FIG. 2A also illustrates a handwriting recognition pad or "digitizer" containing two regions 106a and 106b. Region 106a is for the drawing of alphabetic characters therein for automatic recognition and region 106b is for the drawing of numeric characters therein for automatic recognition. The stylus 80 is used for stroking a character within one of the regions 106a and 106b. The stroke information is then fed to an internal processor for automatic character recognition. Once characters are recognized, they are typically displayed on the screen 105 for verification and/or modification.

FIG. 2B illustrates the bottom side 100b of one embodiment of the palmtop computer system of the present invention. An optional extendible antenna 85 is shown and also a

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battery storage compartment door **90** is shown. A communication interface **108** is also shown. In one embodiment of the present invention, the serial communication interface **108** is a serial communication port, but could also alternatively be of any of a number of well known communication standards and protocols, e.g., parallel, SCSI, Firewire (IEEE 1394), Ethernet, USB (Universal Serial Bus), etc. In addition to providing the serial interface, some versions of palmtop computers consistent with the present invention include charging terminals for charging internal batteries through the cradle connection at interface **108**. Accordingly, interface **108** typically comprises approximately ten to twelve electrical connector terminals.

FIG. **3** is an exploded view of the palmtop computer system **100** in accordance with one implementation. System **100** contains a front cover **210** having an outline of region **106** and holes **75a** for receiving buttons **75b**. A flat panel display **105** (both liquid crystal display and touch screen) fits into front cover **210**. Any of a number of display technologies can be used, e.g., LCD, FED, plasma, etc., for the flat panel display **105**. A battery **215** provides electrical power. A contrast adjustment (potentiometer) **220** is also shown. On/off button **95** is shown along with an infrared emitter and detector device **64**. A flex circuit **230** is shown along with a PC board **225** containing electronics and logic (e.g., memory, communication bus, processor, etc.) for implementing computer system functionality. The digitizer pad is also included in PC board **225**. A midframe **235** is shown along with stylus **80**. Position adjustable antenna **85** is shown.

A radio receiver/transmitter device **240** is also shown between the midframe and the rear cover **245** of FIG. **3**. The receiver/transmitter device **240** is coupled to the antenna **85** and also coupled to communicate with the PC board **225**. In one implementation the Mobitex wireless communication system is used to provide two way communication between system **100** and other networked computers and/or the Internet via a proxy server.

FIG. **4** is a perspective illustration of one embodiment of the cradle **60** for receiving the palmtop computer system **100**. Cradle **60** contains a mechanical and electrical interface **260** for interfacing with serial connection **108** (FIG. **2B**) of computer system **100** when system **100** is slid into the cradle **60** in an upright position. Once inserted, button **270** can be pressed to initiate two way communication between system **100** and other computer systems coupled to serial communication **265**.

FIG. **5** illustrates circuitry of computer system **100** in accordance with an embodiment of the present invention, some of which can be implemented on PC board **225**. Computer system **100** includes an address/data bus **110** for communicating information, a central processor **101** coupled with the bus **110** for processing information and instructions, a volatile memory **102**, e.g., random access memory (RAM), coupled with the bus **110** for storing information and instructions for the central processor **101** and a non-volatile memory **103**, e.g., read only memory (ROM), coupled with the bus **110** for storing static information and instructions for the processor **101**. Computer system **100** also includes an optional data storage device **104** (e.g., memory stick, SD memory, etc.) coupled with the bus **110** for storing information and instructions. Device **104** can be removable. As described above, system **100** also contains a display device **105** coupled to the bus **110** for displaying information to the computer user. PC board **225** can contain the processor **101**, the bus **110**, the ROM **103** and the RAM **102**.

Also included in computer system **100** of FIG. **5** is an optional alphanumeric input device **106** which in one imple-

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mentation is a handwriting recognition pad ("digitizer") having regions **106a** and **106b** (FIG. **2A**), for instance. Device **106** can communicate information and command selections to the central processor **101**. System **100** also includes an optional cursor control or directing device **107** coupled to the bus **110** for communicating user input information and command selections to the central processor **101**. In one implementation, device **107** is a touch screen device incorporated with screen **105**. Device **107** is capable of registering a position on the screen **105** where the stylus makes contact. The display device **105** utilized with the computer system **100** may be a liquid crystal device, cathode ray tube (CRT), field emission device (FED, also called flat panel CRT) or other display device suitable for creating graphic images and alphanumeric characters recognizable to the user. In the preferred embodiment, display **105** is a flat panel display.

Signal communication device **108**, also coupled to bus **110**, can be a serial communication port, USB (Universal Serial Bus), SCSI (Small Computer System Interface), Ethernet or any other suitable communication interface for communicating with the cradle **60** and other external devices. Device **108** can also include an infrared communication port.

Referring now to FIG. **6**, a so-called SD (Secure Digital) memory module **600** used with the palmtop computer system **100** in accordance with an embodiment of the present invention is illustrated. SD cards are an industry standard memory expansion device utilizing flash memory in a package approximately the size of a U.S. postal stamp. Information regarding the SD memory standard can be obtained from [www.sdcard.org](http://www.sdcard.org). SD card **600** includes a plurality of nine electrical connectors situated at one end and labeled **604**. The SD memory module standard calls for nine such electrical connectors that carry two ground connections, one power connection, one clock connection, one command connection and four data connections. While currently palmtop computers are available with standard memory in the range of approximately 2 to 16 MB, SD memory expansion cards (and similar expansion products such as the trademarked Memory Stick and SmartMedia memory modules) can provide dramatically more memory in a very compact package. Currently, up to approximately 256 MB of expansion memory is contemplated in the near future for such modules, with even greater capacity likely.

Memory module **600** can be utilized to provide raw data storage as well as to modify the personality or functionality of palmtop computer **100** by storing computer programs and the like. Thus, SD memory module **600** can be used as data storage device **104** (FIG. **5**) to provide additional data storage to the palmtop computer **100**. Large amounts of data storage capacity can be utilized to store large numbers of entries in an address book or provide access to large documents, images and audio files in the palmtop computer **100**.

Referring now to FIG. **7**, memory module **600** is illustrated in conjunction with palmtop computer **100**. Memory module **600**, in the embodiment illustrated, plugs into a port **608** on a top surface **612** of the palmtop computer **100**. The port **608** is illustrated as a slot in the top surface **612** for receiving the memory module **600**, but this should not be considered limiting. Any suitable mechanism for conveniently installing the expansion memory module, be it an SD module, Memory Stick, SmartMedia or any other type of memory expansion module including custom designed memory expansion modules, is appropriate. In other embodiments, a door may be removed or opened to easily permit access to the expansion storage media. In other embodiments, a slot adjacent a rear surface of the palmtop computer **100** that reveals a surface of the expansion module can be used. The memory card slot **608**

is illustrated as being situated near the front surface of palmtop computer **100** with an infrared communication port **618** situated near the rear of the palmtop computer. However, the exact arrangement, as previously stated, is not critical to the present invention.

Referring now to FIG. **8**, another popular mechanism for expanding the functionality of a palmtop computer is illustrated as sled type expansion device **800**. Such a sled-type expansion device is illustrated in greater detail in U.S. design patent application Ser. No. 29/114,772, filed Nov. 30, 1999, attorney docket number 15886-371 entitled "Communication Accessory Device for Handheld Computer", to Francavilla, Urban and Stowers, which is hereby incorporated by reference. Sled device **800** may embody any of a number of electronic devices utilized to enhance the functionality of the palmtop computer **100**. By way of example, and not limitation, sled device **800** may incorporate an internal modem, music player (e.g. an MP3 player) or video game device. Sled device **800** may also include latching mechanisms and the like (not shown) to mechanically secure the sled **800** to the palmtop computer **100**. Sled type expansion device **800** incorporates a connector **812**, which may be any suitable electrical connector that appropriately mates with a similar connector **108** (FIG. **2B**) of the palmtop computer **100**. Conventionally, connector **812** incorporates a serial communication interface such as an RS232 compliant interface. Other types of interfaces such as Universal Serial Bus (USB), Ethernet, etc. may be similarly utilized to permit communication from the outside world to the processor **101** and associated circuitry of the palmtop computer **100**. In addition, power and ground terminals are sometimes provided in connector **812** to either supply power to the palmtop computer **100** to charge its internal batteries or to receive power from the palmtop computer **100** to power the sled device **800**.

By interconnecting the sled device **800** with the palmtop computer **100** electrically, the sled device **800** can utilize the processor, memory, display and input capabilities of the palmtop computer **100**. However, depending upon the application and type of device embodied in the sled, the functionality may be restricted by the speed of the communication mechanism used for communication between the sled **800** and the palmtop computer **100** or by the processing speed of the palmtop computer's processor **101** or battery capacity of the palmtop computer **100**. Since it is desirable to maintain long battery life in the palmtop computer **100**, memory access by serial communication through connector **812** imposes severe limitations upon the capabilities of the sled **800** in combination with the palmtop computer **100**.

Consider, for example, if sled **800** implements an MP3 player for playing digitally stored music. In order for the MP3 player within sled **800** to access music stored in the expansion memory module **600**, processor **101** must retrieve the data representing the music from the data storage device **104** (in the preferred embodiment SD memory module **600**), convert the data to serial data for communication via the connector **108** and pass the data on to the sled device **800**. In order to accomplish this in real time so that the user does not have to wait for a download from the memory module **600** to listen to a selection of music, processor **101** operates at an extremely high capacity robbing power from other applications and exhausting battery life. Alternatives to this problem might include providing a memory module connector on sled **800**. However, this solution increases the cost of the sled device **800** by requiring a memory module connector when one is already readily available within palmtop computer **100**. In accordance with the present invention, the sled **800** is pro-

vided with direct access to memory module **600** (data storage device **104**), bypassing the need for intervention by processor **101**.

Referring now to FIG. **9**, the electrical block diagram **100** of FIG. **5** is expanded in part to illustrate the detailed connection of the processor **101** within an expansion device such as a sled **800**. Processor **101** is coupled to bus **110** as described previously. One function of signal input/output communication device **108** is illustrated as a communication interface **902**. In this example, a serial interface is shown, however, a Universal Serial Bus or other serial or parallel communication interfaces are also possible. Communication interface **902** is coupled to connector **108** on the palmtop computer **100** to facilitate communication with devices outside the palmtop computer **100** such as sled **800** or cradle **60**. In addition, A bus **110** is connected to a data storage device interface **904** that converts data to and from data storage device **104** (for example, SD module **600**) so that processor **101** and other devices connected to bus **110** can access data stored in the data storage device **104**. Data storage device **104** is connected to the data storage device interface **904** via a data storage device connector **908** that provides electrical connections which mate with terminals **604** in the case of SD connector **600**. Data storage device connector **908**, in the case of SD memory expansion module **600** provides a data path for the four data lines of SD module **600** as well as the clock and command lines. Power and ground connections are also supplied on data storage device connector **908**. At least the data lines, command line and clock line are provided on bus **912** which is connected to the expansion device connector **108**. In this manner, an external expansion device such as sled **800** is provided with direct access to the data storage device **104** via the expansion device connector **108**.

In some embodiments, terminals may be provided at expansion device connector **108** to provide for charging and power circuitry **924** to either power the palmtop computer device or the expansion device or charge batteries at one or the other devices. The expansion device connector **108** may be termed the palmtop computer side connector since it is connected physically to the palmtop computer and whether or not the palmtop computer **100** resides in a cradle, sled or neither of the above. A mating connector **812** (an expansion device-side connector) mates with the expansion device connector **108** to electrically provide access to the communication interface **902** and data storage device **104** by the expansion device **800**. Appropriate electrical connections are provided to an expansion device-side communication interface **950**, memory interface **960** and possibly power interface **970**. In this manner, expansion device **800** can communicate with processor **101** or other circuitry of the palmtop computer **100** via the communication interface **902** and can directly access data stored in data storage device **104** via the expansion device connector **108**. The expansion device-side communication interface includes at least one of a Universal Serial Bus (USB) interface, an Ethernet interface, a Serial interface and a Small Computer System Interface (SCSI).

The connectors used in the sled **800** and the palmtop computer **100** are depicted as printed circuit board edge connector type structures. This should not be considered limiting of the present invention, however. In other embodiments, any suitable electrical connector mechanism can be used.

Minimal arbitration is required between the sled **800** and the palmtop computer **100** to use the same memory (e.g., SD memory module **600**). The only arbitration required is that only one device can access the memory at any given time. Thus, the palmtop computer **100** is essentially off or quiescent with respect to the memory module **600** whenever the

sled **800** is accessing the memory module **600**. By way of example and not limitation, a simple handshake or semaphore exchange via serial communication channel between the sled **800** and the host palmtop computer **100** meets these requirements.

In the case of the MP3 player as described earlier, with the arrangement shown in FIG. 9, processor **101** is not required for interaction between the expansion device **800** and the data storage device **104** such as SD memory module **600**. In such a player, the communication interface **902** can be utilized by the expansion device **800** to communicate with processor **101** to implement, for example, volume control, play list, music selection, graphics, tone and balance controls, etc. using the palmtop computer **100**'s I/O capabilities. The data representing MP3 music stored on data storage device **104** can be directly accessed by the expansion device **800** without depleting the palmtop computer **100**'s battery rapidly by requiring intervention of processor **101** and with great speed since the limitation of the speed of the communication interface **902** is not a factor. In addition, this provides a mechanism whereby the expansion device **800** can utilize an existing hardware expansion port **604** to supply content or data to the expansion device **800** without requiring that the expansion device **800** duplicates such hardware and thereby increase its cost.

Those skilled in the art will appreciate that the embodiments described above can be implemented using other forms of storage than SD. Disc storage as well as other forms of storage including Read Only Memory (ROM) devices, Random Access Memory (RAM) devices, optical storage elements, magnetic storage elements, magneto-optical storage elements, flash memory, core memory and/or other memory modules such as SmartMedia cards, Memory Sticks and other equivalent storage technologies without departing from the present invention. Such alternative storage devices should be considered equivalents.

While the invention has been described in conjunction with specific embodiments, it is evident that many alternatives, modifications, permutations and variations will become apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended that the present invention embrace all such alternatives, modifications and variations as fall within the scope of the appended claims.

What is claimed is:

**[1.** A method of expanding capabilities of a palmtop computer with a memory expansion module, comprising:

coupling the memory expansion module to a processor within the palmtop computer;  
coupling the memory expansion module to an expansion port of the palmtop computer; and  
coupling a sled device to the palmtop computer, so that the sled device is coupled directly to the memory expansion module and to a communication port of the palmtop computer.]

**[2.** The method according to claim 1, wherein the expansion memory module comprises a Secure Digital (SD) compliant memory module.]

**[3.** The method according to claim 1, wherein the expansion memory module comprises a SmartMedia compliant memory module.]

**[4.** The method according to claim 1, wherein the expansion memory module comprises a memory stick compliant memory module.]

**[5.** The method according to claim 1, wherein the sled device comprises a music player; and further comprising:  
at said sled device, directly accessing music stored on the expansion memory module.]

**[6.** The method according to claim 5, wherein the music player comprises an MP3 music player.]

**[7.** A palmtop computer having enhanced expansion, comprising:

a central processor connected to a bus;  
an expansion memory operatively coupled to the bus to provide the central processor with access to the expansion memory;  
a communication interface operatively coupled to the bus to provide the central processor with communication with devices outside the palmtop computer; and  
a connector, operatively coupled to the communication interface and to the expansion memory, to permit an external device to communicate with the central processor via the communication interface and to permit the external device to directly access the expansion memory.]

**[8.** The apparatus according to claim 7, further comprising a memory interface connected to the bus and adapting the expansion memory for access over the bus.]

**[9.** The apparatus according to claim 7, wherein the expansion memory comprises one of a Secure Digital (SD) compliant memory module, a SmartMedia compliant memory module and a memory stick compliant memory module.]

**[10.** The apparatus according to claim 7, wherein the external device comprises a sled device.]

**[11.** The apparatus according to claim 10, wherein the sled device comprises a music player wherein said sled device directly accesses music stored on the expansion memory.]

**[12.** The apparatus according to claim 11, wherein the music player comprises an MP3, music player.]

**[13.** The apparatus according to claim 11, wherein the connector comprises one of a circuit board edge connector and a bullet style connector.]

**[14.** An expansion device for a palmtop computer, the palmtop computer having a central processor, an expansion memory, a communication interface and a palmtop-side connector, the palmtop-side connector being operatively coupled to the communication interface and to the expansion memory, the expansion device comprising:

an expansion device-side connector suitable for mating with the palmtop-side connector;  
an expansion device-side communication interface connected to the expansion device-side connector for communicating with the communication interface of the palmtop computer; and  
a memory interface connected to the expansion device-side connector for directly accessing the expansion memory of the palmtop computer.]

**[15.** The apparatus according to claim 14, wherein the expansion memory comprises one of a Secure Digital (SD) compliant memory module, a SmartMedia compliant memory module and a memory stick compliant memory module, and wherein the memory interface directly accesses the expansion memory.]

**[16.** The apparatus according to claim 14, wherein the external device comprises a sled device.]

**[17.** The apparatus according to claim 16, wherein the sled device comprises a music player wherein said sled device directly accesses music stored on the expansion memory.]

**[18.** The apparatus according to claim 17, wherein the music player comprises an MP3 music player.]

**[19.** The apparatus according to claim 17, wherein the palmtop-side connector comprises one of a circuit board edge connector and a bullet style connector.]

**[20.** The apparatus according to claim 17, wherein the expansion device-side communication interface comprises at



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least one of a Universal Serial Bus (USB) interface, an Ethernet interface, a Serial interface and a Small Computer System Interface (SCSI).】

21. A method of accessing a storage medium of a device including a processor, said method comprising:

communicating with said device; and  
accessing said storage medium without use of said processor.

22. The method as recited in claim 21 wherein said accessing comprises:

accessing said storage medium based on at least one rule.

23. The method as recited in claim 22 wherein said rule comprises allowing either said processor or other than said processor to access said storage medium at any given time.

24. The method as recited in claim 21 wherein said accessing comprises:

participating in an arbitration with said device to acquire access to said storage medium while denying said processor access to said storage medium; and  
based on said arbitration, accessing said storage medium.

25. The method as recited in claim 24 wherein said arbitration comprises a handshake exchange.

26. The method as recited in claim 24 wherein said arbitration comprises a semaphore exchange.

27. The method as recited in claim 21 wherein said communicating comprises:

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communicating via a communication interface comprising at least one of a Universal Serial Bus (USB) interface, an Ethernet interface, a Small Computer System Interface (SCSI), IEEE 1394 interface, a serial interface, a parallel interface, and a wireless communication interface.

28. A method of accessing a storage medium of a device including a processor, said method comprising:

enabling access to said storage medium without use of said processor; and  
controlling said access to said storage medium.

29. The method as recited in claim 28 wherein said controlling said access comprises:

controlling said access with at least one rule, wherein said rule comprises allowing either said processor or other than said processor to access said storage medium at any given time.

30. The method as recited in claim 28 wherein said controlling said access comprises:

controlling said access with arbitration to acquire access to said storage medium while denying said processor access to said storage medium.

31. The method as recited in claim 30 wherein said arbitration comprises a handshake exchange.

32. The method as recited in claim 30 wherein said arbitration comprises a semaphore exchange.

\* \* \* \* \*

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : RE43,862 E  
APPLICATION NO. : 12/157134  
DATED : December 11, 2012  
INVENTOR(S) : Neal A. Osborn

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title page, item (54) and in the Specification, column 1, line 2, Title, delete "SHAPED" and insert -- SHARED --, therefor.

Signed and Sealed this  
Second Day of April, 2013



Teresa Stanek Rea  
*Acting Director of the United States Patent and Trademark Office*