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Ng

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- [54] **HAND HELD VIDEO GAME**
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- [73] Assignee: **Tiger Electronics, Ltd.**, Pawtucket, R.I.
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- [22] Filed: **Feb. 10, 1997**
- [51] **Int. Cl.**⁷ **G06F 15/44; A63F 9/22**
- [52] **U.S. Cl.** **463/44; 273/148 B**
- [58] **Field of Search** 463/1-9, 30-31, 463/36, 44-45; 273/148 B; 3647/410.1

"The Newton Generation", MacUser, Oct. 1993, pp. 102-107.

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Attorney, Agent, or Firm—Fitch, Even, Tabin & Flannery

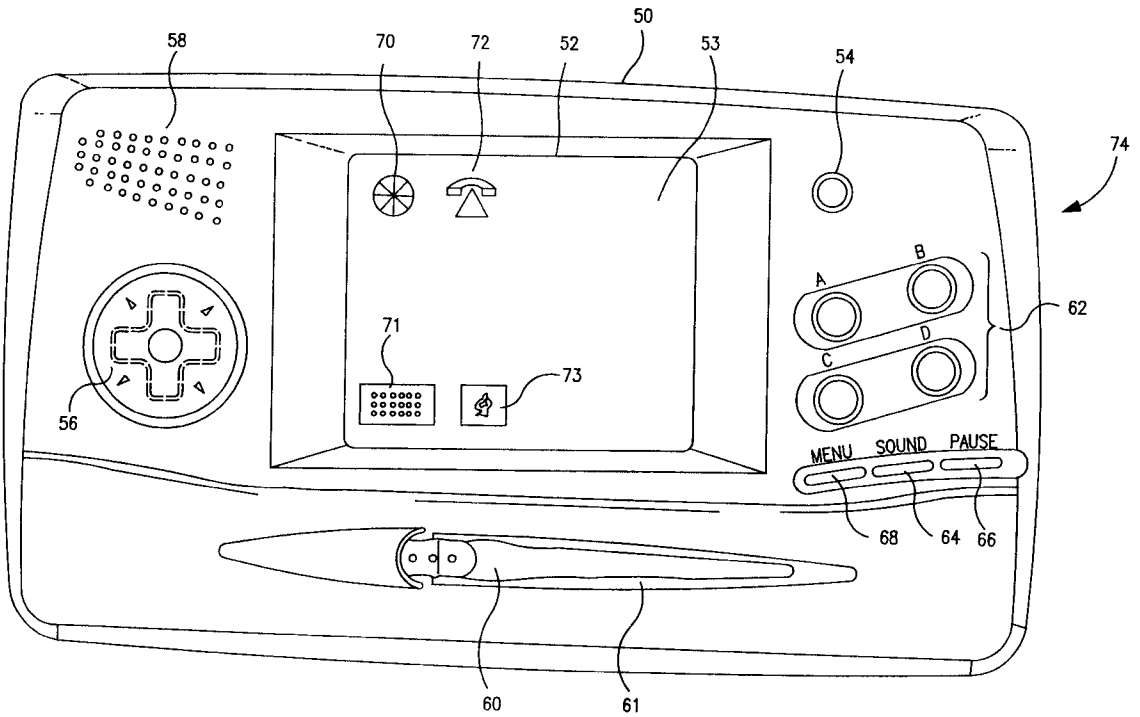
[57] **ABSTRACT**

A hand-held video game system having a microprocessor controller with address and data buses for providing memory accesses during memory cycles to a plurality of cartridge slots for electrically connecting cartridges containing memory to the address and data buses. An output terminal of the microprocessor controller provides cartridge-select signal which identifies a first memory containing cartridge to be accessed during an initial memory cycle with the microprocessor controller controlling the output terminal to change the cartridge-select signal for transparently accessing a second memory containing cartridge for a subsequent memory cycle. The cartridge slot may also provide a port for transferring and receiving information over a bi-directional communication link in which a communication cartridge allows communication over the internet, and allows for interactive play of a video game.

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16 Claims, 12 Drawing Sheets



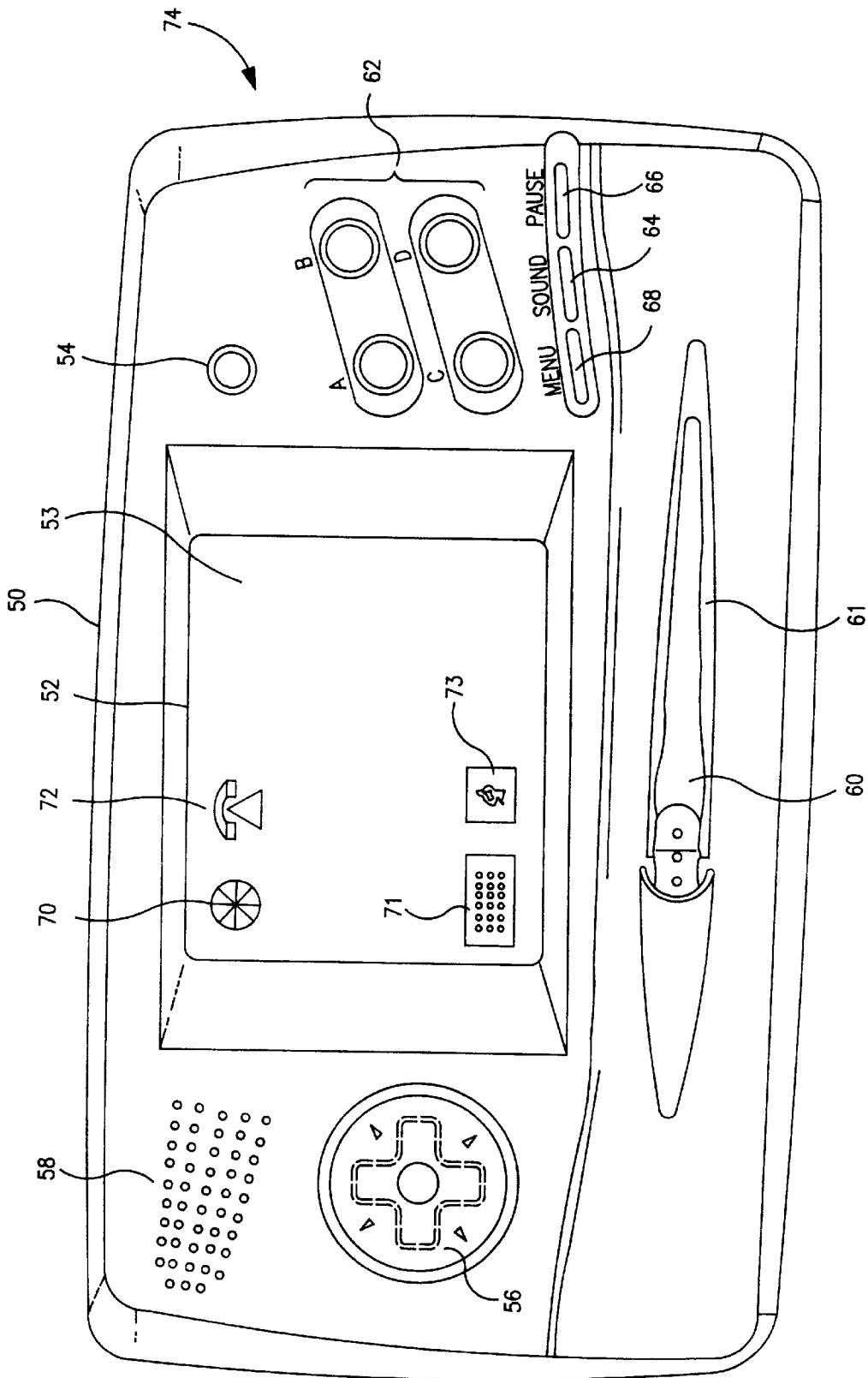


FIG. 1

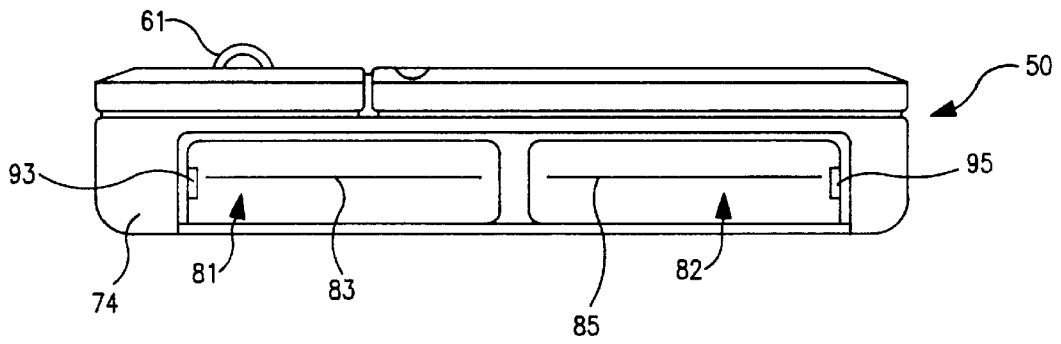


FIG. 2

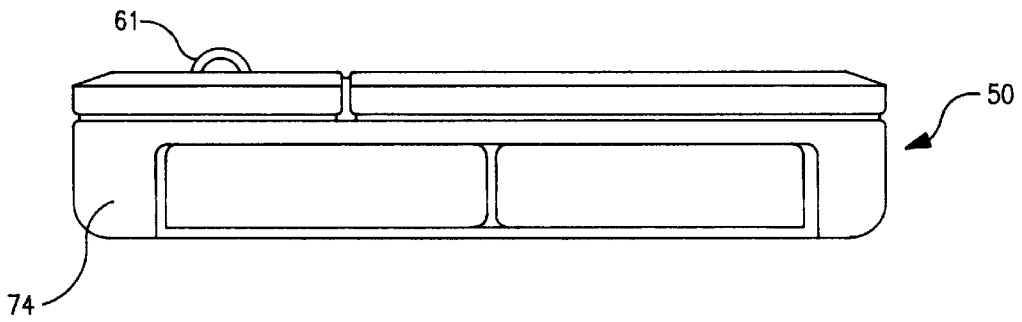


FIG. 3

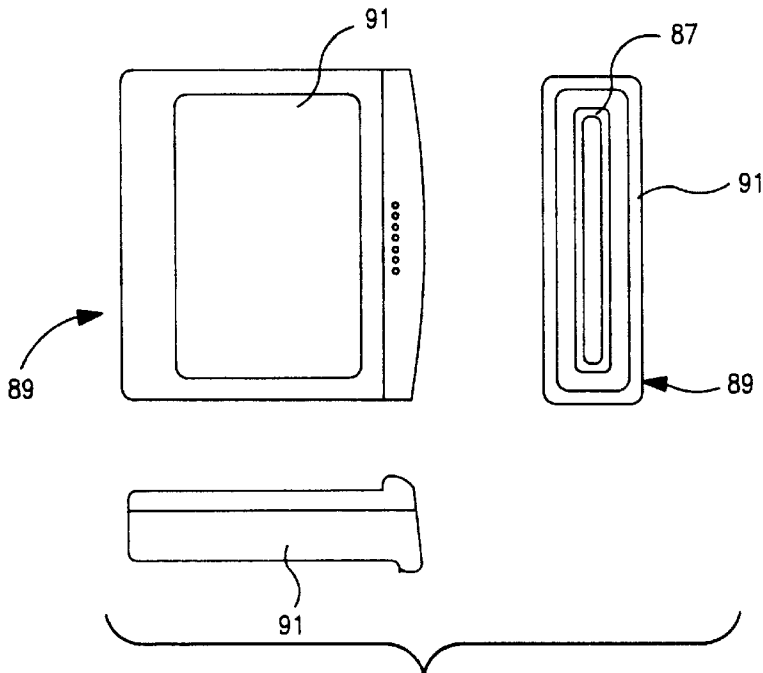


FIG. 4

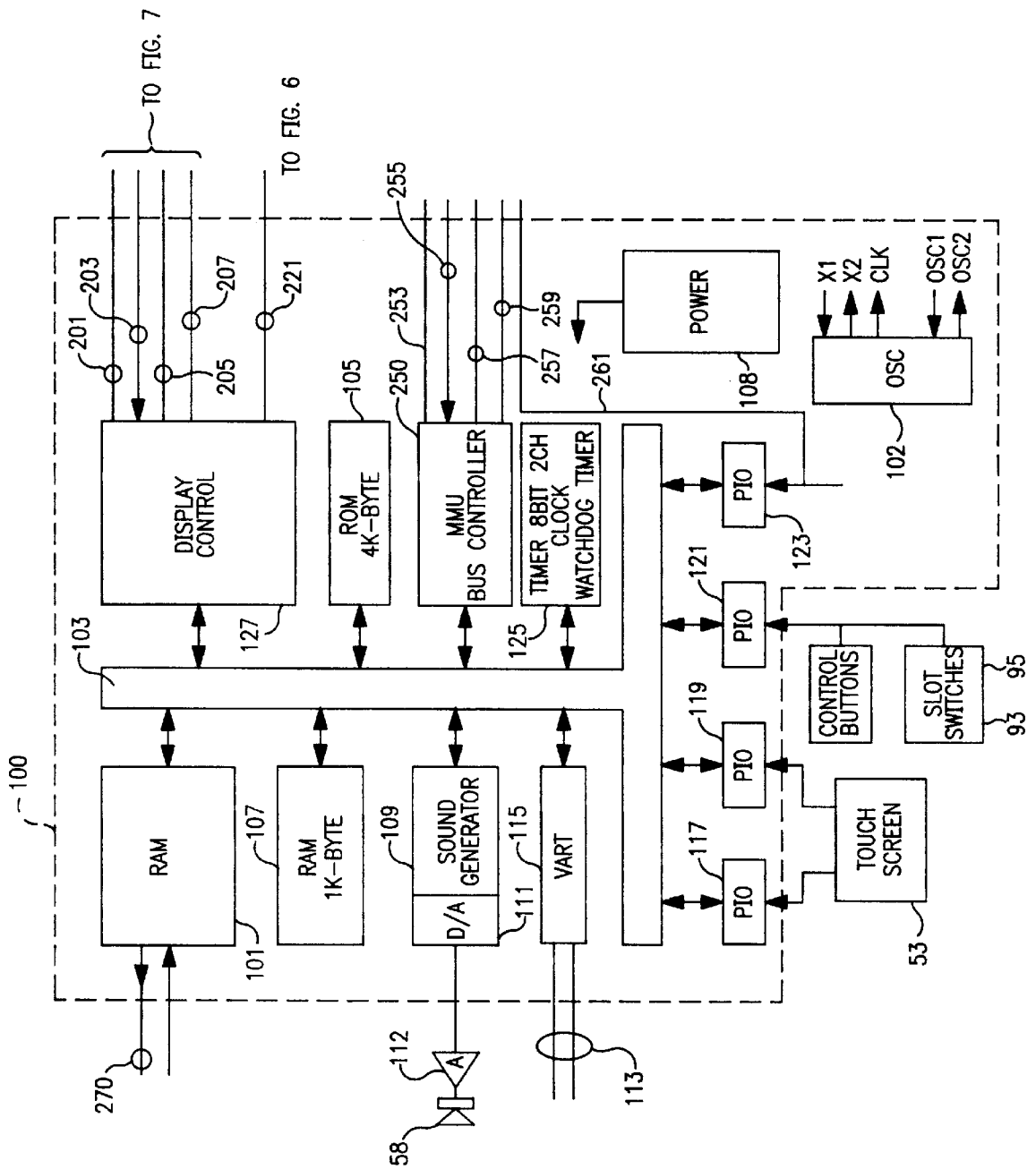


FIG. 5

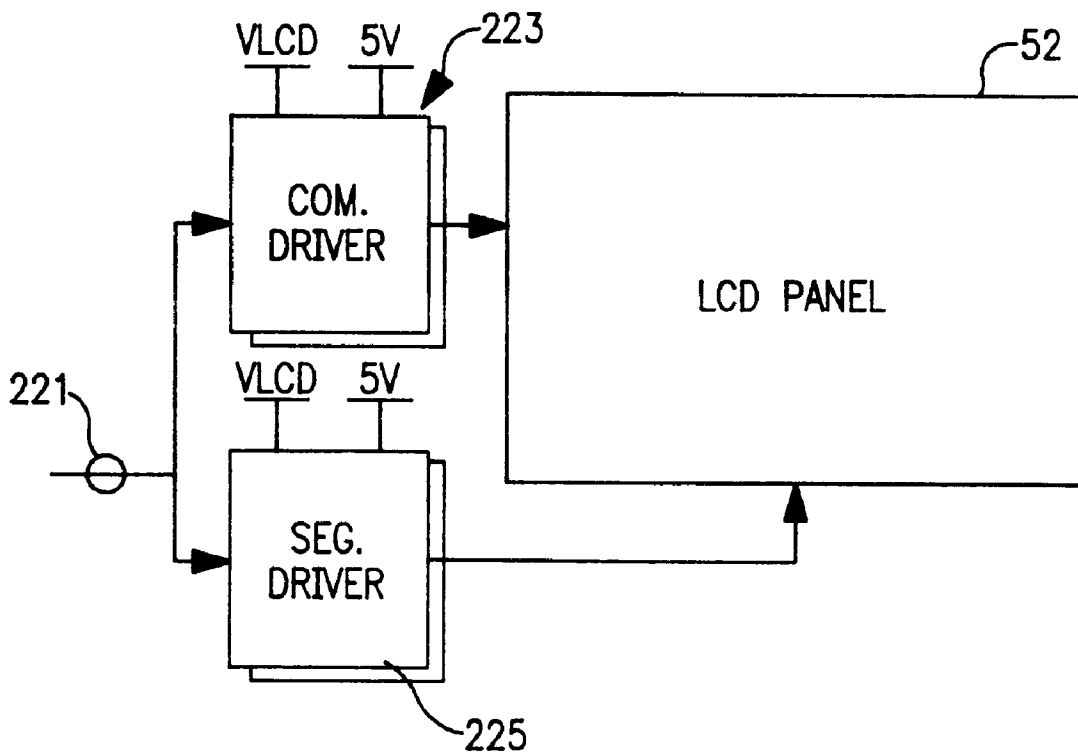


FIG. 6

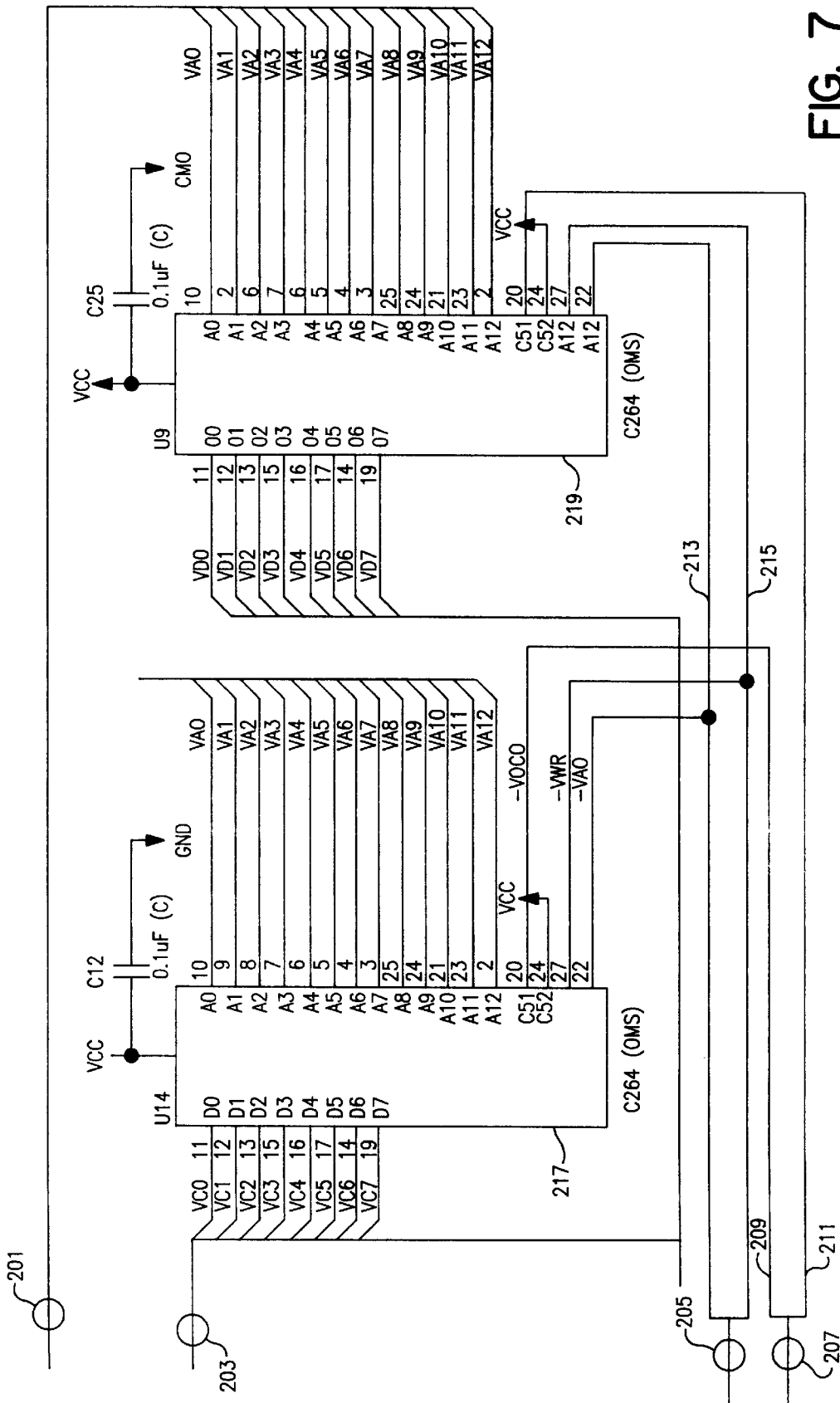


FIG. 7

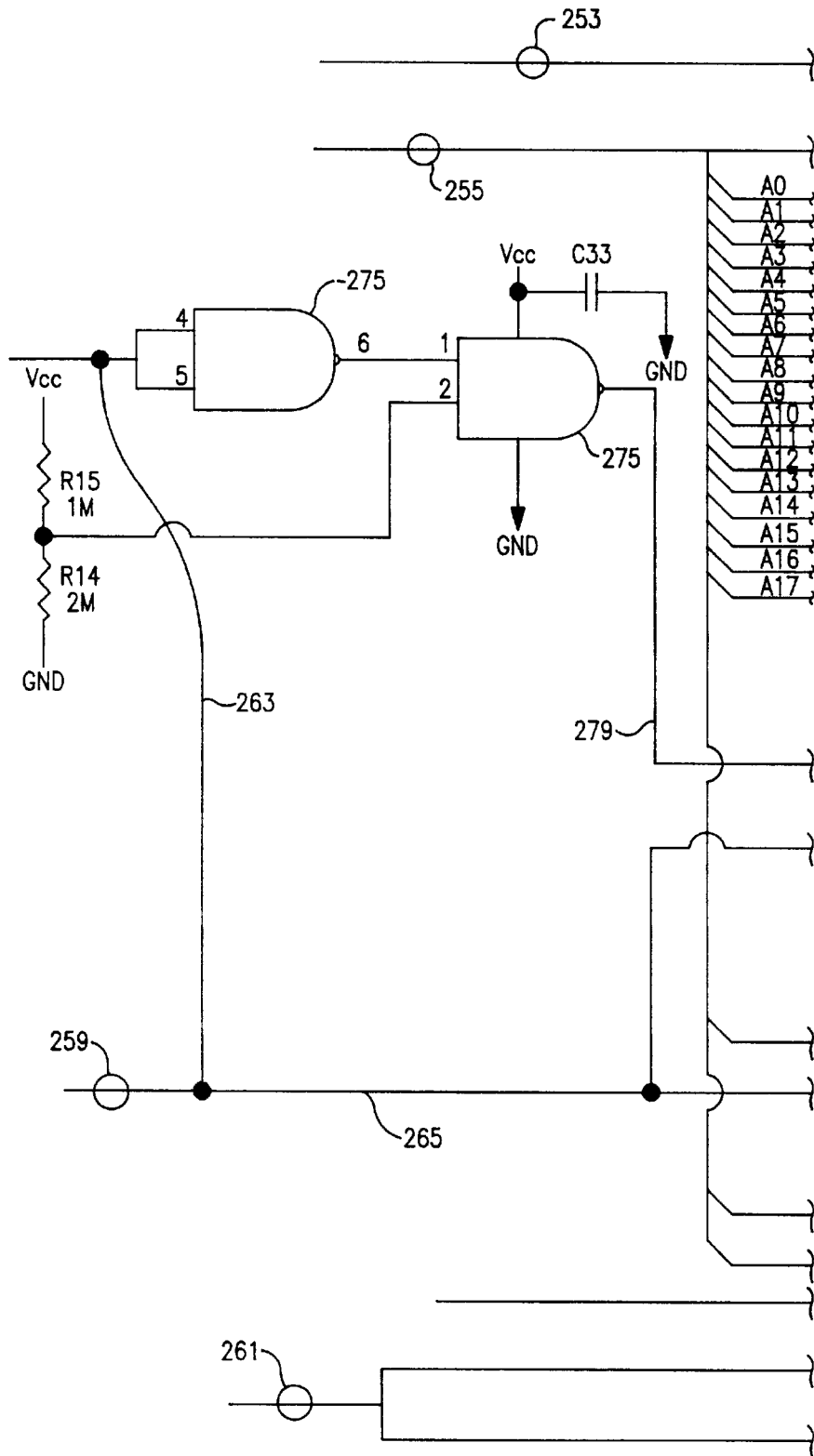


FIG. 8A

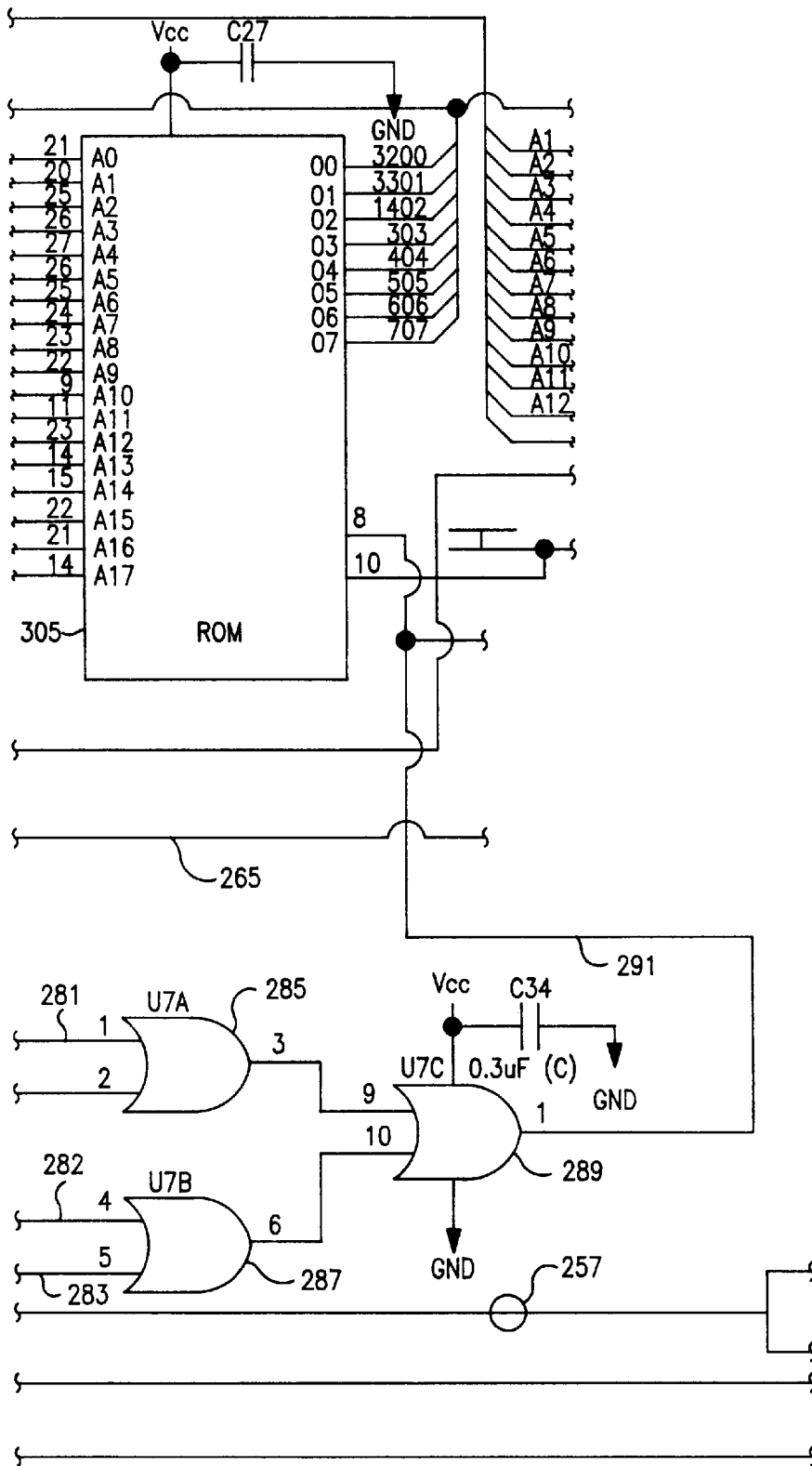


FIG. 8B

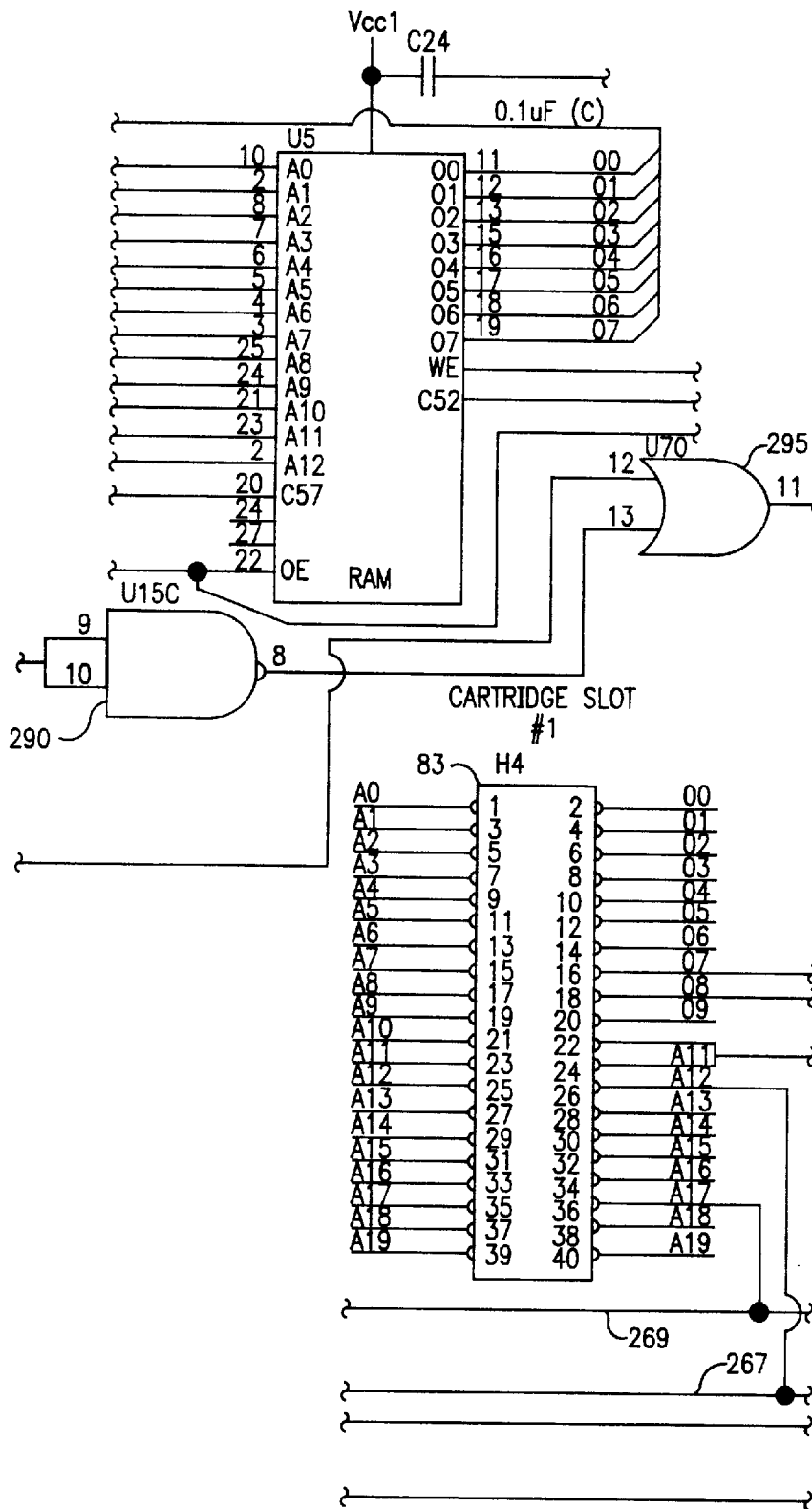


FIG. 8C

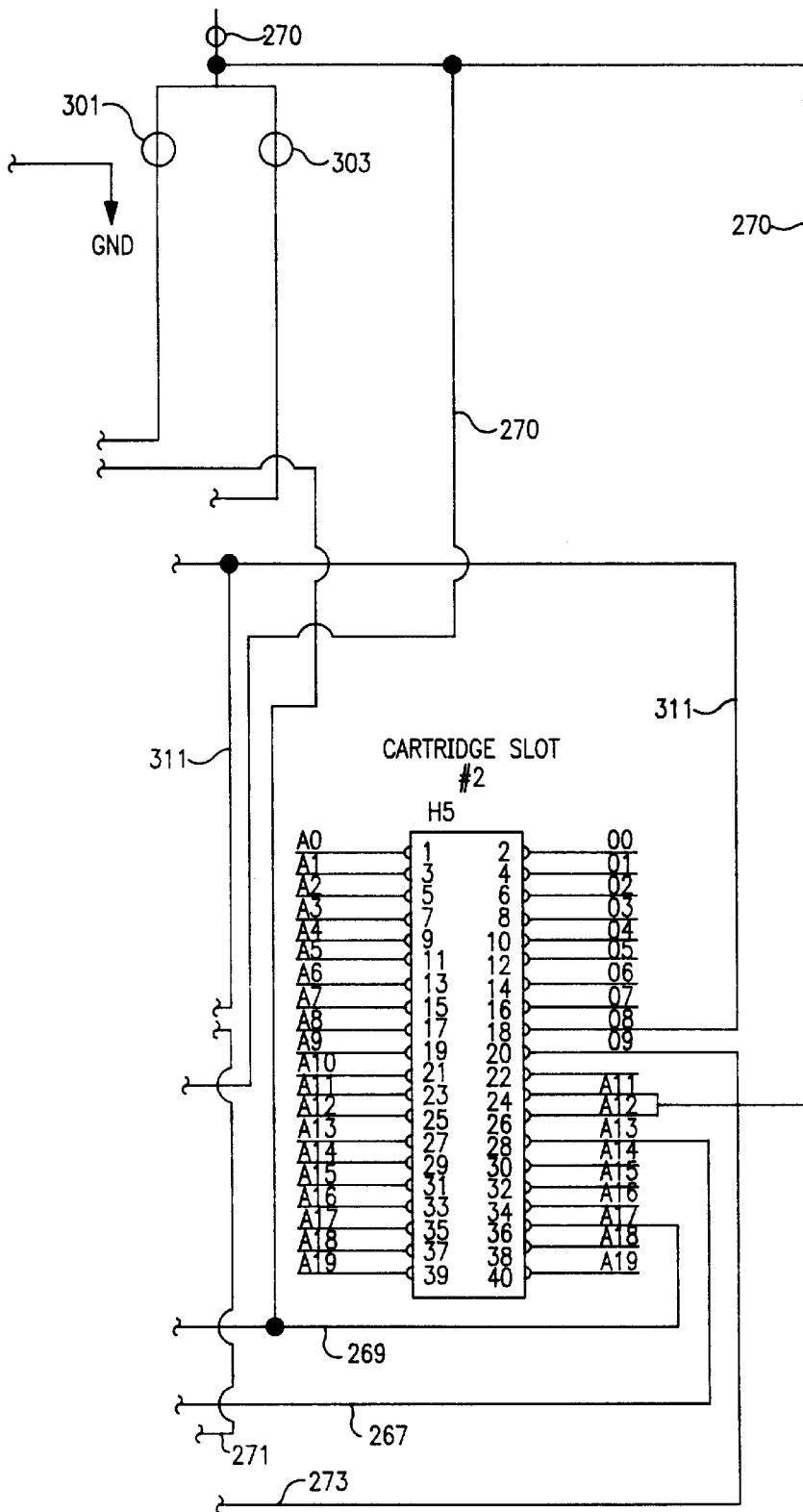


FIG. 8D

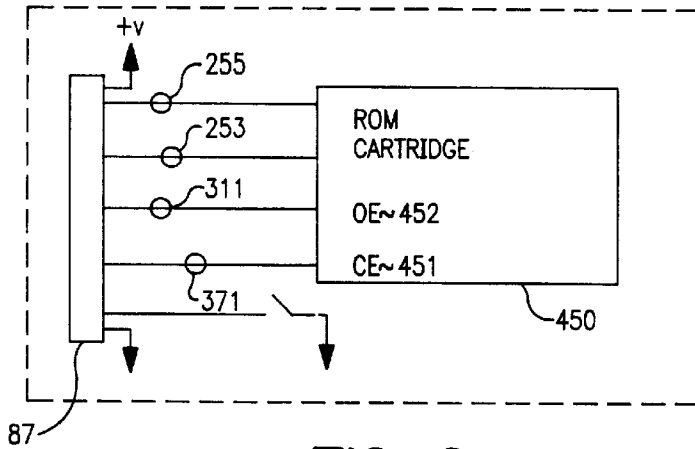


FIG. 9

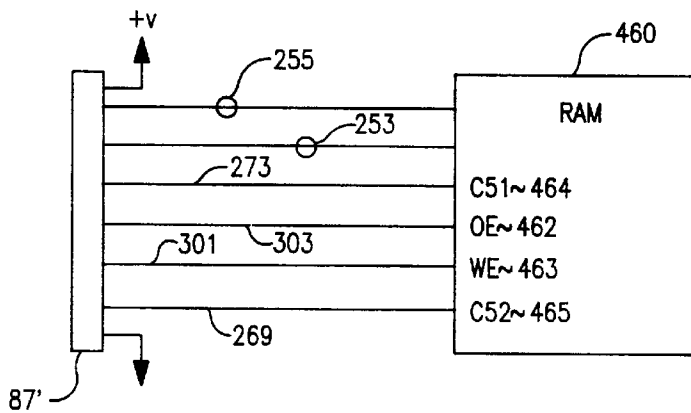


FIG. 10

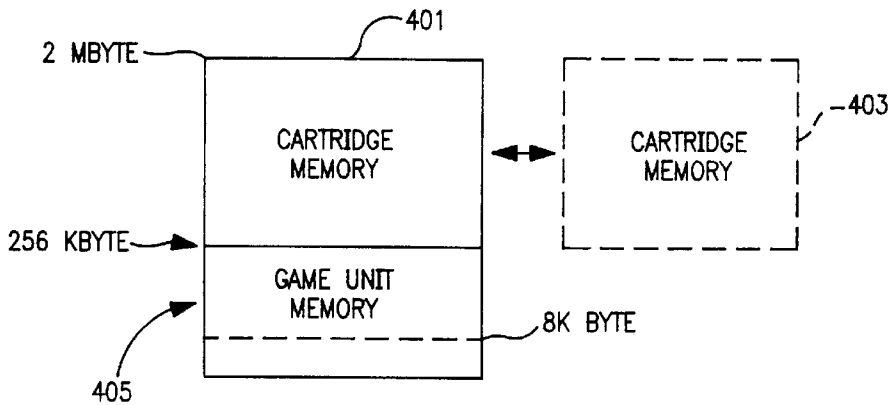


FIG. 11

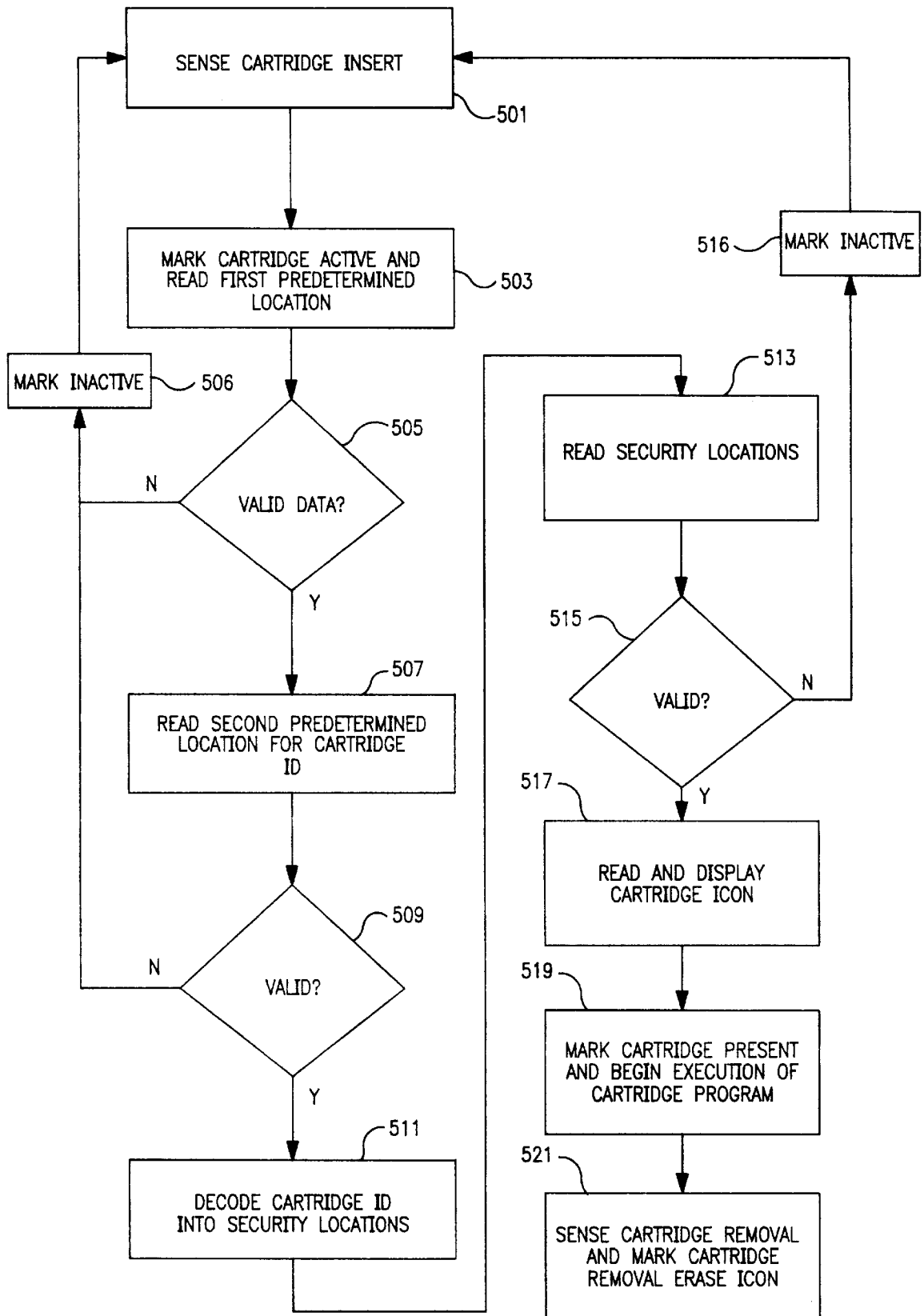


FIG. 12

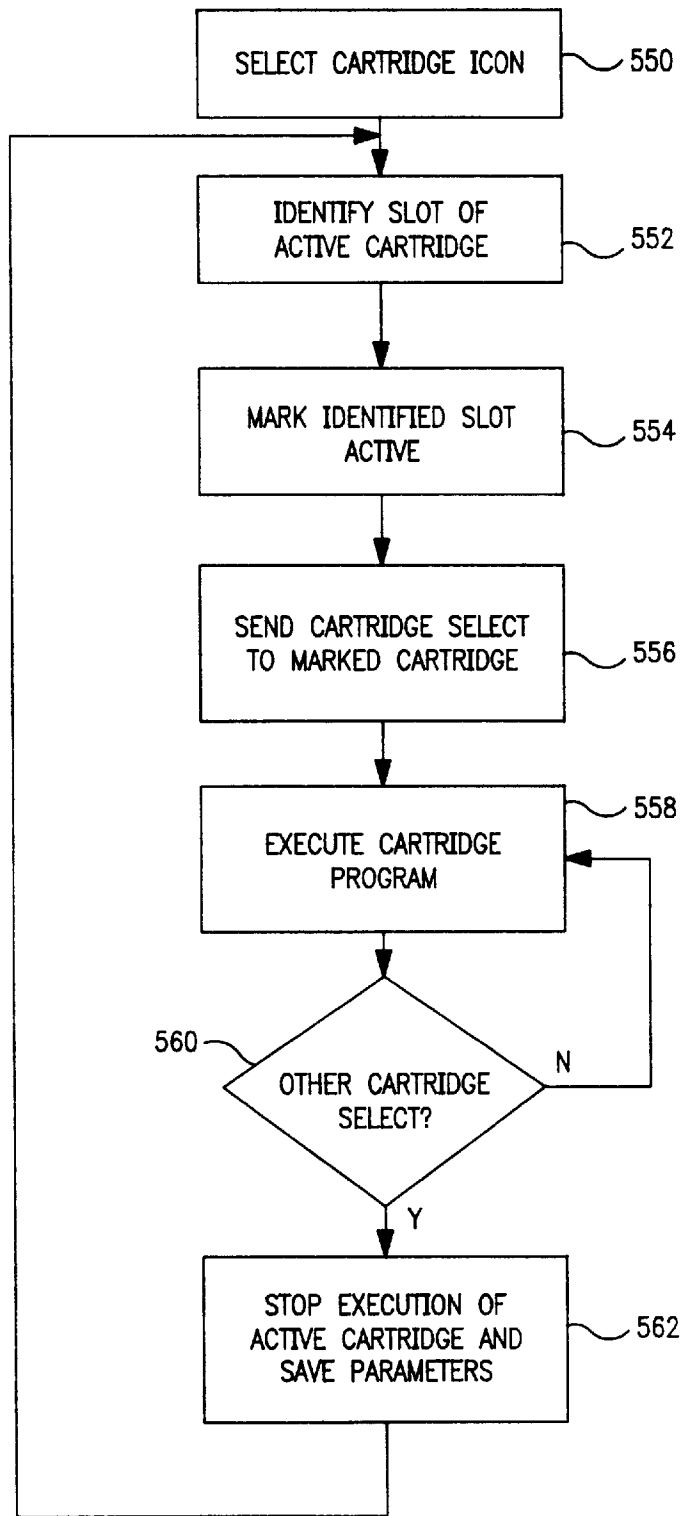


FIG. 13

HAND HELD VIDEO GAME**BACKGROUND OF THE INVENTION**

The present invention relates to hand held electronic game units and particularly to such game units which include removable program cartridges.

Hand held electronic games are known which include a display screen, control switches and buttons and a microprocessor controller to control the various functions of the game when powered by a storage battery. The microprocessor controller may include a memory for storing a program to control the basic function of the microprocessor such as memory reading and writing and proper control of the display device which is frequently a Liquid Crystal display (LCD) panel. Known hand held video game units include an electrical connector by means of which memory containing program cartridges can be connected to the microprocessor. Replaceable cartridges -which generally store one application program in read only memory are thus used to add a new program, perhaps a video game, to the system.

When a cartridge is installed, its memory provides an additional program and data which becomes the application program of the device. Once a cartridge is installed, the program defined by the cartridge memory can be played repeatedly to the exclusion of other programs. When another program is to be run on the game unit, the prior cartridge is replaced with a new cartridge and a new program can be run until replaced. Although, such a system provides an almost unlimited number of programs which can be run one at a time, it does not allow multiple programs to be available in the unit at the same time. For example, it may be desirable to play a video game interactively over the internet. To do so requires a video game program and an internet access program. Such cannot be done on today's hand held video game units which provide only a single cartridge slot and thus the ability to run only one application program at a time. A need exists for a cartridge-based hand held electronic game unit which contemporaneously accommodates multiple cartridges for application programs.

Another problem which exists with known cartridge-based hand held game units is that the amount of memory available, even when the cartridge is present, is too limited due to the limited address spectrum of the control microprocessor. For example, when a game controller can access only 2 megabytes of memory the application program is limited to 2 megabytes minus the memory address spectrum portion needed for other parts of the hand held game operation. In order to increase the available memory, systems, such as that disclosed in U.S. Pat. No. 4,432,067 to Nielsen, have been proposed in which a cartridge of the system includes a plurality of groups of memory locations which in total comprise more memory than is available in the memory spectrum of the controller. Particular memory addresses are then used to select one or the other of the groups of memory locations in the single cartridge so that the particular group for access can be identified.

The Nielsen system has been found to provide some advantages but also to possess problems. For example, at least one extra access memory cycle is needed when memory group selection changes must be made. When frequent memory group changes are required, much memory access overhead may be incurred with the extra memory access cycles needed to switch between groups of locations. This slows down system operation. Also, the additional memory can be used only with the application program of the single cartridge and separate such systems require their

own memory group switching capability. Even with expanded memory addressing capability, when the RAM provided in a cartridge fills with data no additional RAM can be provided. These shortcomings identify a problem and a need exists for an arrangement which is capable of providing additional memory for use by cartridge-contained application programs of a hand held video game.

It is also desirable for the hand held game to be able to identify the source of cartridges inserted into the system. Some cartridges, perhaps knock-off copies of proprietary cartridges, can then be denied access to hand held game units. Also, knowledge of the source of the game cartridge may permit the game controller to account for known incompatibilities. Thus, a further problem exists in marking, identifying and validating cartridges for hand held game units which is both accurate and secure.

SUMMARY OF THE INVENTION

The problems of the art are solved in accordance with the present invention in which a hand held video game unit is provided having the capability of operating with a plurality of application program cartridges having, in total, a greater amount of memory than the address spectrum of the controller of the video game unit. Switching between cartridges is performed by controlling signal levels on normally non-address bearing conductors. Further, the address spectrum occupied by the plurality of cartridges is also shared with memory internal to the game unit and storing programs and data to which access is needed regardless of the presence or absence of application program cartridges. An efficient and universal arrangement is employed to separate memory accesses to the internal and cartridge memories in a manner transparent to which of the plurality of cartridges may be in active control of the game unit. Also provided is a method and apparatus for identifying the insertion and removal of cartridges and determining the validity of inserted cartridges.

The cartridges of the disclosed embodiment are inserted into cartridge slots of the game unit. Advantageously, each cartridge slot includes a connection to one of a plurality of I/O pins of a microcontroller and by applying a cartridge select signal to a selected I/O pin, the memory of a single cartridge can be enabled to respond to both memory reads and writes. Simply changing the particular I/O pin receiving the cartridge select signal selects the cartridge memory which will be permitted to respond to subsequent memory access operations.

Also an advantage is the use of memory in the lowest part of the address spectrum for internal game unit memory, the switchable cartridge memory can occupy the highest portion of the address spectrum. Within the game unit, the high order address bits are used to enable and disable the internal memory while, conversely, disabling and enabling the high order cartridge memory. In this way, regardless of which cartridge is in active control of the unit memory address are properly responded to by the internal and external memory.

The presence or absence of a cartridge in the provided cartridge slots is determined by reading the state of mechanical switches which change state depending on the presence or absence of a cartridge. When a newly inserted cartridge is discovered, predetermined memory locations in the cartridge memory are read and checked for validity. Additionally, the contents of at least one of the memory locations so read is decoded to identify a plurality of additional cartridge memory locations which may be distributed anywhere in the cartridge memory spectrum. The

identified memory locations are then read and their contents combined to form a value known to the game unit controller. When and only when favorable comparison is obtained the cartridge is identified as present and usable and an icon representing the cartridge is displayed on a LCD display of the game unit. The particular cartridge in active control of the game unit can be specified by an operator who touches a touch sensitive screen overlaying the LCD display.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a hand held game unit embodying the present invention;

FIG. 2 is an end view of the game unit without program cartridges;

FIG. 3 is an end view of the game unit with program cartridges;

FIG. 4 includes a top, side and end views of a program cartridge;

FIG. 5 is a block diagram of a controller for the hand held game unit;

FIG. 6 is a block diagram of an LCD panel and video driver;

FIG. 7 is a schematic diagram of video RAM;

FIG. 8 is a schematic diagram of the extended memory of the controller;

FIG. 9 is a block diagram of a ROM containing program cartridge;

FIG. 10 is a block diagram of a RAM containing program cartridges;

FIG. 11 represents the memory spectrum of extended memory;

FIG. 12 is a flow diagram of cartridge recognition and validation; and

FIG. 13 is a flow diagram of the switch between active cartridges.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

FIG. 1 is a plan view of a hand held video game unit **50** in accordance with the preferred embodiment. Game unit **50** comprises an on-off button **54**, a group of play buttons **62** labeled A-D, and a multiposition switch **56** (joystick) for user control of application programs run on the game unit. An LCD display screen **52** is provided capable of presenting 160x200 pixels of 4 gray level information to the user. Overlaid on the display screen is a transparent touch screen input device **53** having 10x13 individual touch sensitive switches. In combination, the underlying LCD display **52** and transparent touch sensitive screen provide a software changeable input device for the user. In order to provide precise contact with the touch screen **53**, a stylus **60** is provided in a permanent holder **61**. To increase enjoyment of use, a sound speaker **58** is also provided.

FIG. 2 is a plan view of an end **74** of the game unit **50** and includes two cartridge receptacles (slots) **81** and **82**. Cartridge slots **81** and **82** are provided to receive memory containing cartridges as shown in top, end and side view in FIG. 4. Each receptacle contains a two sided electrical connecting strip **85** for electrically mating with a two sided electrical connector **87** carried by each memory cartridge **91** (FIG. 4). In all, the connecting strip, e.g. **85**, and mating connector **87**, provide 40 electrical connections between the game unit **50** and each cartridge **91**. The cartridges **91** are sized to fit within the receptacles **81** and **82** for a non-

obtrusive fit as shown in FIG. 3. Game unit **50** also includes a small electrical switch **93** and **95** in each receptacle **81** and **82**, respectively. The positions of switches **93** and **95** are moved when a cartridge is inserted or removed from the slot and are used to indicate the presence or absence of a memory cartridge to the game unit **50**.

Game unit **50** is controlled by a microprocessor controller **100** (FIG. 5) which in the preferred embodiment is a SM8521 by Sharp. Controller **100** includes a CPU **101** which controls the overall functions of the system and is connected to other units of the controller by a bus **103**. A ROM **105** is used to provide the CPU **101** with system control information including instructions for operation. Data used by CPU **101** is primarily exchanged with a RAM **107**. CPU **101** provides system sound via a digital sound generator **109** which drives speaker **58** via a D/A converter **111** and an amplifier **112**. Controller **100** has an external bi-directional communication link **113** which is provided by a UART **115**. The communication link **113** is connected by a suitable connector to the exterior of game unit **50** to provide telephone/modem communication. CPU **101** is also connected to a plurality of 8 bit input output (I/O) registers **117**, **119**, **121** and **123**. The registers can be set by the programmer to be either input or output devices each having 8 individual leads. I/O registers **117** and **119** are connected to the touch screen **53** to provide appropriate inputs to the controller in response to touch of the video screen. I/O register **121** is connected to the control buttons **56**, **62**, **64**, **66** and **68** on the unit **50** and to switches **93** and **95** which, it will be remembered, identify the presence or absence of a cartridge in the cartridge slots **81** and **82**. Timer function, as needed, may be performed by an 8 bit timer **125**.

Controller **100** also includes a display controller **127** which includes DMA capabilities and interacts with the display system of FIG. 6 and the video RAM of FIG. 7 to provide images on the LCD display. Video RAM comprises two 8 kilobyte memories **217** and **219**. Bus **201** connects output addresses from display controller **127** to the memories **217** and **219** in parallel. Similarly, 8 bit data is conveyed bi-directionally via bus **203**. Memory control buses **205** and **207** convey memory control information from display controller **127** to the memories **217** and **219**. When either memory **217** or **219** is to be read, a read strobe signal is conveyed on a conductor **213** of bus **205** and when either is to be written, a write strobe signal is conveyed via conductor **215** of bus **205**. The particular memory, i.e. **217** or **219**, which is to react to a provided address, is determined by an enable transmitted signal on either conductor **209** or conductor **211** of bus **207**.

The data used from the video RAM of FIG. 7 is transmitted to the display system of FIG. 6 via bus **221** where it is connected to a common driver **223** and segment driver **225**. Common driver **223**, which may be an LH1527 by Sharp, and segment driver **225**, which may be an LH1528 by Sharp, respond to the received data by controlling the gray levels of the 160x200 pixels making up the LCD panel display **52**.

The data stored in the video RAM is provided to display control **127** unit over bus **103** and can come from any device with access to that bus. A primary source of such data is external memory which includes memory in cartridges installed in the game unit **50**. Such data is accessed via memory management unit **250** in cooperation with read and write strobe signals from CPU **101** on bus **270** and cartridge select signals from I/O port **123** on bus **261**. The extended memory is shown in FIG. 8 to include a 256 kilobyte ROM **305** and an 8 kilobyte RAM **307** which is augmented by the

memory of cartridges placed in cartridge slots **83** and **85**, examples of which are shown in FIGS. **9** and **10**. The 2 megabyte extended memory spectrum is represented in FIG. **11**. Memories **305** and **307** are internal to the game unit and share the lowest **256** kilobytes (**405**) of address spectrum. The inserted cartridges share the highest 1.75 megabytes of the address spectrum as represented by cartridge memories **401** and **403** in FIG. **11**.

When an external memory access is to occur, an address is sent in parallel on bus **253** and control signals are sent from MMU **250**, the CPU **101** and I/O port **123** to assure that the proper memory, which may be cartridge memory, is accessed. The lowest order 13 bits of all addresses are applied to 8 kilobyte RAM **307**, the lowest order 18 bits of address are applied to 256 kilobyte ROM **305** and all 21 address bits **A0-A20** are sent to the cartridges via connectors **83** and **85**. Internal to game unit **50**, the three highest order address bits **A18**, **A19**, and **A20** of the provided address are used by OR gates **285**, **287** and **289**, NAND gate **290** and OR gate **295** to guarantee that any access to the high order 1.75 megabytes of storage is responded to only by the memory of the cartridges. Similarly, the address bits **A18**, **A19** and **A20** assure that only the ROM **305** or RAM **307** respond when the address is in the lowest 256 kilobyte of memory range.

OR gates **285** and **287** receive as inputs the addresses **A18**, **A19** and **A20** on conductors **281**, **282** and **283**. The outputs of OR gates **285** and **287** are combined in OR gate **289** which generates a memory control output on a conductor **291**. Whenever any of the three highest order address bits is a logical **1**, which occurs only when the upper 1.75 megabytes of memory is being accessed, a logical **1** memory inhibit signal is applied via conductor **291** to inhibit response by ROM **305**. The signal on conductor **291** is also inverted by NAND gate **290** and connected by an OR gate **295** to a cartridge output enable terminal of the cartridge connectors **83** and **85** via a conductor **311**. Thus, when any of the top three address bits are set, ROM **305** is inhibited from responding while the cartridge memories are enabled. Conversely, when none of the highest three address bits are set, the cartridge memories are inhibited from responding while the ROM **305** is enabled to respond. The read or write response by the memories is controlled by the read or write strobe signals from CPU **101** on bus **270**, which signals are individually connected to the cartridge slots **83** and **85** and memories **305** and **307** by conductors **301** and **303**.

The contents of ROM **305** include a program by which the game unit **50** is interfaced with the information received from the cartridges in slots **83** and/or **85**. The interface program is referred to herein as the kernel. Whenever a cartridge is inserted into the game unit, the CPU **101**, operating in response to instructions from the kernel, identifies and validates the cartridge and also tracks which cartridge is considered to be active. When only a single cartridge is present, that cartridge will be marked active in a predetermined location of RAM **307**. When two cartridges are present only one will be marked active at a time in the RAM **307**, however, the active and inactive status of the cartridges can be changed whenever needed by the game unit **50**. The cartridge slot which contains the active cartridge receives from I/O port **123** an exclusive cartridge select signal on conductor **271** (cartridge slot **83**) or conductor **273** (cartridge slot **85**). Thus, whenever the cartridge in slot **83** is active, it will receive the cartridge active signal on conductor **271** while no cartridge active signal will be sent to cartridge slot **85**. Conversely, when the cartridge in slot **85** is active it will receive the cartridge active signal on

conductor **273** while cartridge slot **83** will not be sent a cartridge active signal.

FIG. **9** represents a ROM containing cartridge having memory fabric **450** connected by a connector **87** to a cartridge slot connector, e.g. **83**. The memory addresses are connected to ROM **450** via bus **253** and data from the ROM **450** is connected to data bus **255**. Proper read timing is assured by the connection of the output enable terminal **452** of ROM **450** to the read strobe from CPU **101** on conductor **311**. ROM **450** also receives the cartridge select signal on conductor **271** at its chip enable input. Thus, when no cartridge select signal is present from the I/O port **123** on conductor **271**, ROM **450** cannot respond to memory accesses. FIG. **10** represents a RAM containing cartridge connected to the cartridge slot connector **85**. Address and data are supplied to RAM fabric **460** by address and data buses **253** and **255**, respectively. The read and write strobes from CPU **101** are also connected to the output enable **462** and write enable **463** pins RAM fabric **460** by respective conductors **303** and **301**. The cartridge select signal on conductor **373** is applied to a first chip select **464** while an IO enable on conductor **269** is connected to chip select input **465**.

RAM **307** shares memory spectrum with the ROM **305** and, accordingly, apparatus is provided to select RAM **307** to the exclusion of ROM **305**. When RAM **305** is to be accessed, a memory chip enable signal is applied by MMU **250** to a conductor **263** of a bus **259** and no such signal is sent on a memory chip enable conductor **265** of that bus. By properly alternating the enable signals on conductors **263** and **265**, RAM **307** and the remainder of the extended memory can be alternately accessed. The memory chip enable signal is applied to ROM **305** and the cartridge connectors **83** and **85** by its connection as an input to OR gate **285**. The memory chip enable signal on conductor **263** is connected to RAM **307** by a pair of NAND gates **275** and **277** connected in series and a connection from the output of NAND gate **277** to the chip select input of RAM **307**.

When game unit **50** is initially turned on, power is supplied to the various components from a power supply **108** which may be a combined battery and/or adapter power supply. In response to power up, the controller **100** performs an initialization routine in which the status of the unit is checked. After initialization is completed, the kernel is accessed to establish the necessary interface to possible cartridge provided programs and to present to the user any application programs which are a part of the kernel. In the present example the kernel includes a calendar application program and a solitaire application program. To announce the availability of these applications, the kernel writes into video RAM **217**, **219** an icon **72** representing a calendar page and an icon **73** representing a playing card. By normal operation the icons **72** and **73** are displayed on LCD display **52** as shown in FIG. **1**. The CPU under the control of the kernel periodically reads the state of the touch sensitive screen **53** by accessing I/O ports **117** and **119**. Should either of the icons **71** or **73** be touched by the user, the program flow will begin the performance of the touched application program. The user can change the active application simply by touching the other icon. At some time the user may insert a cartridge into either of the cartridge slots **81** or **82** of the game unit. The controller **100** periodically scans the status of cartridge switches **93** and **95** and when a change of state is detected indicating the insert of a cartridge, a cartridge authentication procedure begins at block **501** as shown in FIG. **12**. After a cartridge is detected in block **501**, a block **503** is performed in which the cartridge is marked active and

the contents of a first predetermined location is read from the cartridge. As described above, marking the cartridge active results in a cartridge select signal being generated on the cartridge select conductor of bus 261 corresponding to the newly active cartridge enabling its memory fabric to respond to such a read request. The contents read from the first predetermined location may comprise an ASCII string of characters which are compared in a block 505 to a known string of characters stored in a kernel data file. If the read string of characters does not match the kernel's string, access is denied causing the flow to proceed to block 506 to mark the cartridge inactive and thereafter to revert to block 501 to await a change of state at a cartridge slot.

When the read string of characters matches the kernel's string flow proceeds from block 505 to block 507 where a cartridge ID is read from a second predetermined location. The second predetermined location may comprise 4 bytes of data with the fourth being a check sum for the first three. The accuracy of the first three bytes are then compared with known ID types to determine whether the ID type is valid in a block 509. If the ID type is not valid or if the check sum is improper, the flow reverts to block 501. If the cartridge ID is found to be valid in block 509 it is decoded in block 511 to identify three byte locations within the cartridge memory which in combination contain a security code. The type of decoding, although not critical to the present invention, must be known prior to the preparation of the kernel and must be adhered to in the preparation of all cartridges. One type of decoding might involve using every third bit of the three byte cartridge ID to identify an 8 bit address for use in accessing a memory location table. The table would then provide three memory addresses to read from the cartridge.

After block 511 flow proceeds to block 513 in which the three locations are read and compared to expected results in a block 515. When block 513 finds the result to be invalid, the cartridge is marked inactive in block 516 and flow returns to block 501. Alternatively, when the security bytes are determined to be valid, flow proceeds to block 517 where the icon for the cartridge is read from the cartridge and written into video RAM 217, 219 and displayed. FIG. 1 represents such a display at 70 for a game of chance cartridge program. After displaying the icon 70, flow proceeds to block 519 in which the cartridge is marked valid and present and in which execution of the application program begins. By means of the I/O ports the controller 100 continues to read the status of the switches 93 and 95 and when a formerly present cartridge is removed, the process variables for the application and any indication of its presence are removed so that the game unit will not attempt to access an unavailable program.

After the successful validation of a first cartridge a second cartridge may be inserted into the second cartridge slot. When such occurs, the cartridge will be validated as described above and a second cartridge icon, e.g. 72, will be presented on the display of the game unit 50. When two icons, e.g. 70 and 72, are presented the user can switch the active application program back and forth by touching the icons on display 52. Changing the active program causes the controller 100 to issue an I/O command to remove a cartridge select signal from one cartridge slot and apply the cartridge select signal to the other cartridge slot. The user can also revert to performance of one or the other of the kernel provided applications by touching an icon 71 or 72.

The change of accessing from one cartridge is transparent to the user and may occur in response to program events not known to the user, such as a command from the program of a first cartridge to access the memory of the second car-

tridge. FIG. 13 is a flow diagram of cartridge select changing in response to icon selection by a user. For purposes of the example, the cartridge associated with icon 70 is in cartridge slot 81 connected by connector 83 and cartridge associated with icon 72 is in cartridge slot 82 connected by connector 85. Further, neither cartridge is active and thus no cartridge select signal is being sent to either cartridge connector 83 or 85.

Block 550 of FIG. 13 represents a user touching an icon 70 on the touch screen. The touch is detected via I/O ports 117, 119 and a block 552 is performed to identify the cartridge connector 83 connected to the touched cartridge. After such identifying, the cartridge and slot are marked active in block 554 and flow proceeds to block 556. The active cartridge, and thus the memory storing the application to be executed, is connected to cartridge connector 83 and must be enabled to respond to memory accesses from controller 100. Accordingly, CPU 101 commands I/O 123 to connect the cartridge connect signal to cartridge connector 83 via conductor 271.

After the cartridge connect signal is applied, all subsequent high order memory accesses will be responded to by the memory of the newly active cartridge and the program contained thereby will begin execution (block 558).

The CPU continues to survey the touch screen 53 via I/O ports 117, 119, and when icon 72 is touched it will be detected in a block 560 and flow proceeds to a block 562 in which execution of program 70 is stopped and the parameters of its execution are saved for possible later use. Flow then proceeds to block 552 and continues as before so that cartridge slot 85 is marked active and the cartridge select signal is applied via I/O port 123 and conductor 273 to the memory connected to cartridge slot 85. After the cartridge selection signal is applied to cartridge connector 85, high order memory accesses will be responded to by the cartridge connected via connector 85.

The cartridge connectors 83 and 85 connect the cartridge select signals, read and write strobes and output enables to memory within the cartridge. Other signals are present at the connector to further broaden cartridge use. For example, an interrupt lead 601, 602 to the CPU 101 from a cartridge mounted switch such as switch 451 may be used to signal cartridge related data to the CPU. Further, a pair of input/output enable leads are present at each cartridge connector on conductors 269 and 267. Signals on conductors 269 and 267 may be further used to control memory responses from within each cartridge.

While there have been illustrated and described particular embodiments of the present invention, it will be appreciated that numerous changes and modifications will occur to those skilled in the art, and it is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

What is claimed is:

1. A hand held video game system comprising:

- a microprocessor controller having address and data buses for providing memory accesses during each of a plurality of memory cycles;
- a plurality of cartridge slots for electrically connecting cartridges containing memory to the address and data buses;
- a plurality of memory containing cartridges each electrically connected to the address and data buses;
- at least one output terminal of the microprocessor controller providing a cartridge-select signal, said signal identifying a first memory containing cartridge to be accessed during the memory cycle; and

said microprocessor controller controlling the output terminal to change the cartridge-select signal for transparently accessing a second memory containing cartridge in a subsequent memory cycle.

2. A hand held video game system in accordance with claim 1 wherein at least one output terminal is an I/O terminal of the microprocessor.

3. A hand held video game system in accordance with claim 1 wherein microprocessor accessible memory of the game unit comprises a plurality of low order addressable memory locations separate from the memory contained by the cartridges and connected to the address and data buses and the system comprises circuitry responsive to high order bit positions of a memory address for inhibiting response by the low order addressable memory of the game unit.

4. A hand held video game system in accordance with claim 3 comprising circuitry for enabling response by the memory of the cartridges when response is inhibited to the low order addressable memory.

5. The hand held video game of claim 1, where an instruction in the first memory containing cartridge commands the microprocessor controller to change the cartridge-select signal for subsequent memory cycles.

6. The hand held video game of claim 1 where a user commands the microprocessor controller to change the cartridge-select signal for subsequent memory cycles.

7. The hand held video game of claim 1 where a program instruction commands the microprocessor controller to change the cartridge-select signal for subsequent memory cycles.

8. The hand held video game system of claim 1, said system further having a port for transferring and receiving information over a bi-directional communication link whereby a remote user is able to play a video game on said system.

9. The hand held video game system of claim 8, where the bi-directional communication link is over the internet.

10. The hand held video game system of claim 8, where the remote user is able to interactively play a video game on said system.

11. A hand held video game unit comprising:

- a controller having a plurality of controller memory locations for the storage of programs and data;
- a video display unit responsive to the operation of the controller for displaying images on the video display unit;
- a first cartridge connection circuit for electrically connecting a cartridge containing computer memory to the controller;
- a second cartridge connection circuit for electrically connecting a second cartridge containing computer memory to the controller;

apparatus for sensing the connection of a cartridge to the first and second cartridge connectors;

the controller responds to the sensed presence of a cartridge by controlling the video display unit to display an indication of the connected cartridge; and said controller transparently changes from one cartridge to another cartridge accessed in a subsequent memory cycle.

12. A hand held video game unit in accordance with claim 11 wherein the connected cartridge includes memory location storing an icon representative of the connected cartridge; and the controller reads the icon from the connected cartridge and causes the video display unit to display the read icon.

13. A hand held game unit in accordance with claim 11 comprising:

- a first cartridge containing a first video icon defined in memory connected to the first connection circuit;
- a second cartridge containing a second video icon defined in memory connected to the second connection circuit; and

apparatus for reading the first and second icons from the memories of the first and second cartridges and displaying both the first and second icons on the video display unit.

14. In a hand held game unit a method of marking a memory containing cartridge connected to the unit for subsequent access in response to a user selection or a program instruction, comprising the steps of:

- first reading data from a first predetermined memory location of the cartridge;
- first determining the validity of the data in the first predetermined memory location;
- second reading cartridge identity data from a second predetermined memory location of the cartridge;
- decoding the cartridge identity data to determine a plurality of memory location addresses;
- reading security data from the memory locations determined in the decoding step;
- second determining the validity of the security data; and
- marking a valid cartridge for subsequent access including via transparent switching.

15. In a hand held unit a method in accordance with claim 14 wherein the game unit comprises a display apparatus method comprising reading from the cartridge memory data representing a cartridge icon and displaying the icon on the display apparatus.

16. In a hand held game unit a method of identifying a memory containing cartridge in accordance with claim 14 comprising determining the validity of the cartridge identity data before the decoding step.

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