



MOTOROLA

Motorola v. Apple

Apple Patents At Issue Tutorial, October 6, 2011

Judge Ursula Ungaro
District Court of Florida
Case No. 1:10cv023580-Civ-UU



MOTOROLA

U.S. Patent No. 7,657,849

Apple Patent

I. The Technology Of The '849 Patent

U.S. Patent No. 7,657,849



US007657849B2

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

(10) **Patent No.:** **US 7,657,849 B2**
(45) **Date of Patent:** **Feb. 2, 2010**

(54) **UNLOCKING A DEVICE BY PERFORMING GESTURES ON AN UNLOCK IMAGE**

5,907,327 A	5/1999	Ogura et al.	345/339
6,151,208 A	11/2000	Bartlett	361/683
6,160,555 A	12/2000	Kang et al.	345/358
6,192,478 B1	2/2001	Elledge	713/202
6,249,006 B1	6/2001	Kinly et al.	702/195
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(74) *Attorney, Agent, or Firm*—Morgan, Lewis & Bockius LLP

(57) **ABSTRACT**

A device with a touch-sensitive display may be unlocked via gestures performed on the touch-sensitive display. The device is unlocked if contact with the display corresponds to a predefined gesture for unlocking the device. The device displays one or more unlock images with respect to which the predefined gesture is to be performed in order to unlock the device. The performance of the predefined gesture with respect to the unlock image may include moving the unlock image to a predefined location and/or moving the unlock image along a predefined path. The device may also display visual cues of the predefined gesture on the touch screen to remind a user of the gesture.

23 Claims, 15 Drawing Sheets

(73) **Assignee:** **Apple Inc., Cupertino, CA (US)**

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 394 days.

(21) **Appl. No.:** **11/322,549**

(22) **Filed:** **Dec. 23, 2005**

(65) **Prior Publication Data**

US 2007/0150842 A1 Jun. 28, 2007

(51) **Int. Cl.** (2006.01)

G06F 3/033

(52) **U.S. Cl.** 715/063; 345/173; 345/179

(58) **Field of Classification Search** 713/154, 713/156, 182; 715/853, 863; 345/173, 179, 345/156

See application file for complete search history.

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

(54) **UNLOCKING A DEVICE BY PERFORMING GESTURES ON AN UNLOCK IMAGE**

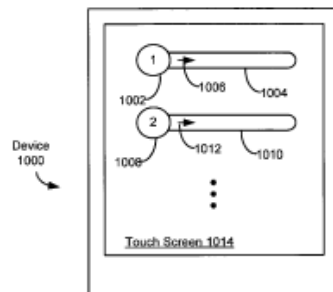
(75) **Inventors:** **Imran Chaudhri, San Francisco, CA (US); Bas Ording, San Francisco, CA (US); Freddy Allen Anzures, San Francisco, CA (US); Marcel Van Os, San Francisco, CA (US); Stephen O. Lemay, San Francisco, CA (US); Scott Forstall, Mountain View, CA (US); Greg Christie, San Jose, CA (US)**

(73) **Assignee:** **Apple Inc., Cupertino, CA (US)**

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 394 days.

(21) **Appl. No.:** **11/322,549**

(22) **Filed:** **Dec. 23, 2005**



'849 Patent: The Alleged Problems

- The '849 patent contended that the prior art procedures for unlocking a touch-screen device were limited to methods “such as pressing a predefined set of buttons (simultaneously or sequentially) or entering a code or password.”

'849 patent at 1:43-45

- The '849 patent described these prior-art procedures as “hard to perform” and “burdensome.”

'849 patent at 1:45-49

- The '849 patent also described the need for a unlock procedure that was “user-friendly” and provided “sensory feedback to the user regarding progress” towards completion.

'849 patent at 1:51-62

'849 Patent: The Disclosed Unlock Procedure

“A device with a touch-sensitive display may be unlocked via gestures performed on the touch -sensitive display. The device is unlocked if contact with the display corresponds to a predefined gesture for unlocking the device.”

'849 patent at Abstract

“The device may also display visual cues of the predefined gesture on the touch screen to remind a user of the gesture.”

'849 patent at Abstract

The Unlock Procedure Has Several Visual Cues

- 1. Movement of a graphical image from one location to another on a touch screen;**
- 2. Displaying a predefined path along which the graphical image must travel;**
- 3. Ignoring user input that does not correspond to a “predefined gesture;” and / or**
- 4. Other visual cues.**

The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

For Example:

From Here

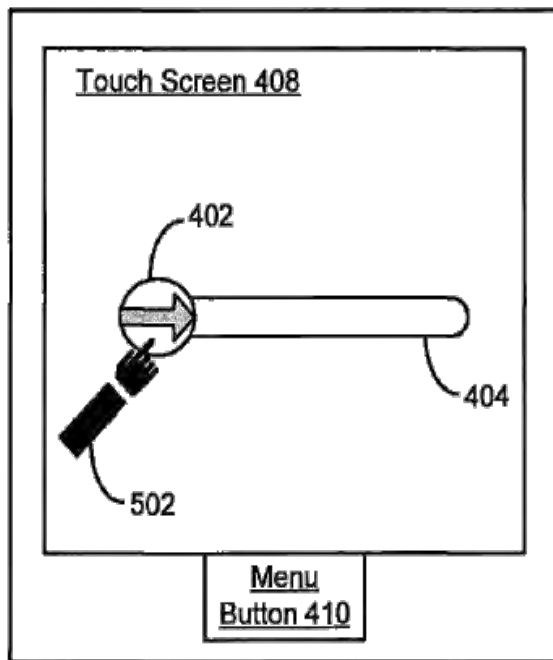


Figure 5A

To Here

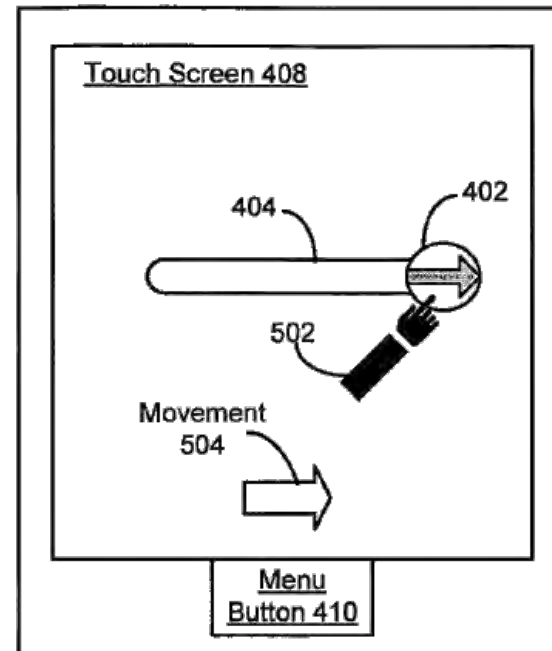


Figure 5C

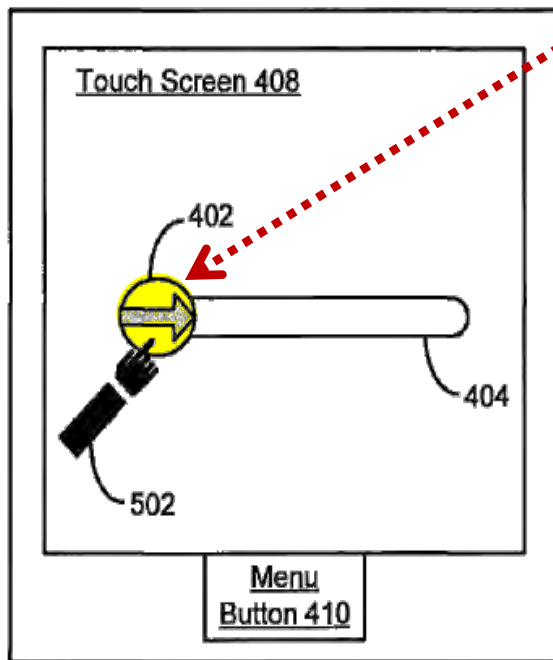
The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

For Example:

From Here



“unlock
image”
402

Figure 5A

To Here

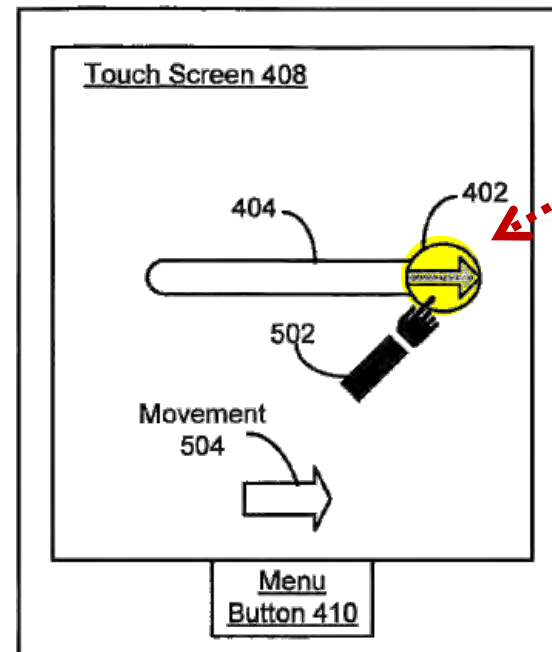


Figure 5C

The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

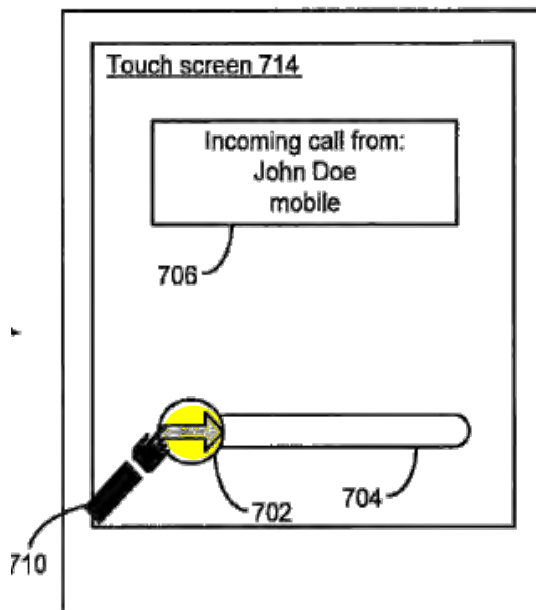


Figure 7A

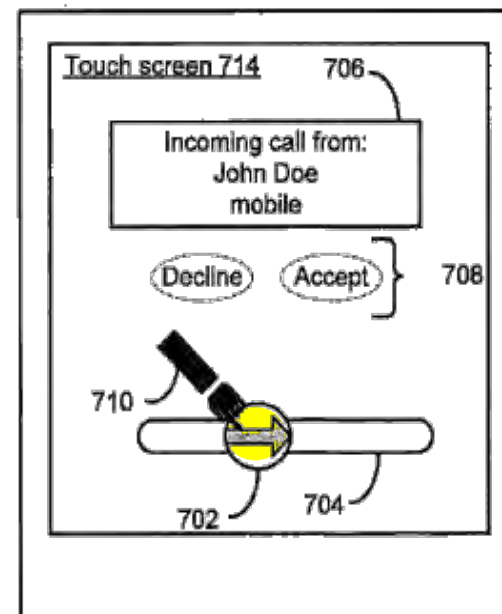


Figure 7B

The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

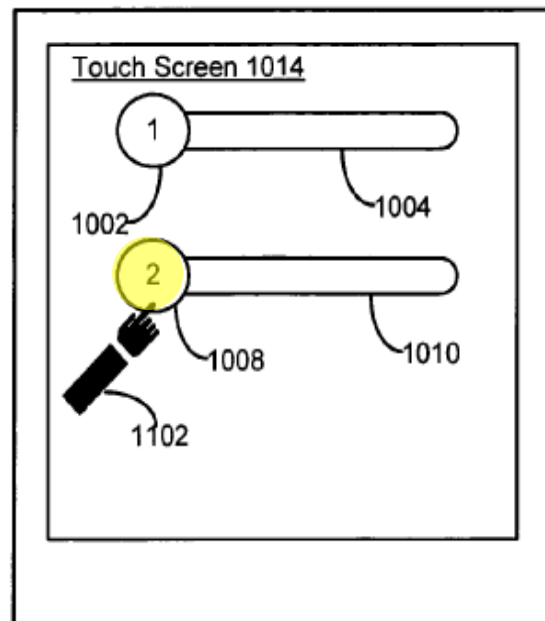


Figure 11A

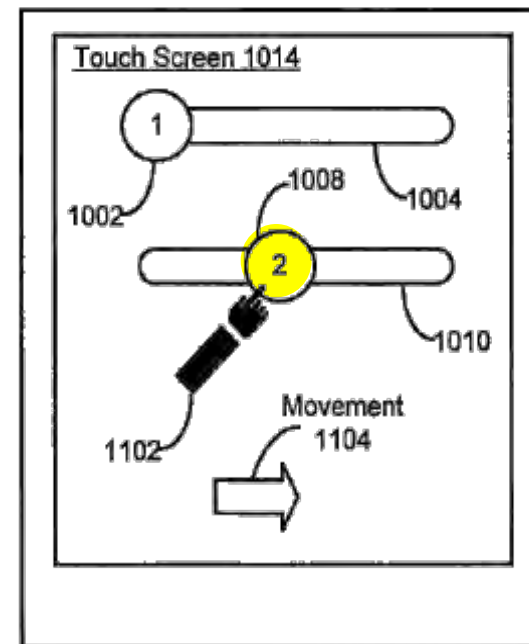


Figure 11B

The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

“[D]ragging the unlock image . . . moves the unlock image across the touch screen”

'849 patent at 10:50-53; see also 12:20-30, 11:57-12:3

The '849 Patent Technology

The Visual Cues

1. Moving a graphical image from one location to another on a touch screen.

If the user input condition includes dragging an image to a predefined location, then “indication of progress may be defined in terms of the distance between the initial location of the image and the predefined location to which the image is to be dragged.”

'849 patent at 15:27-32

The '849 Patent Technology

The Visual Cues

2. Displaying a predefined path along which the graphical image must travel;

For Example:

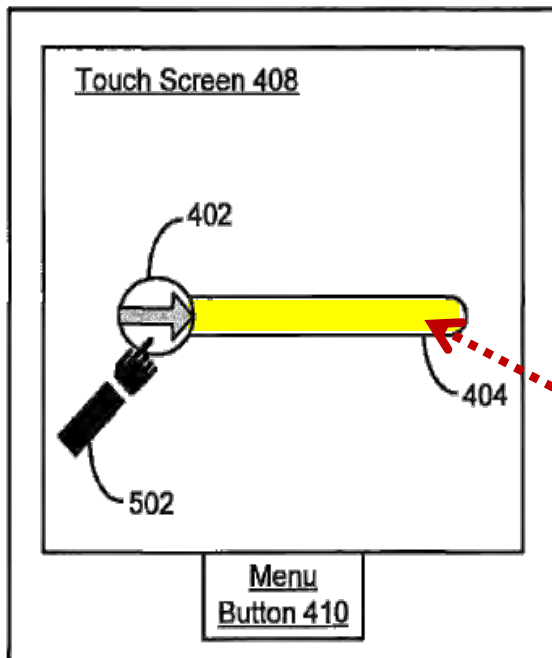


Figure 5A

“channel”
404

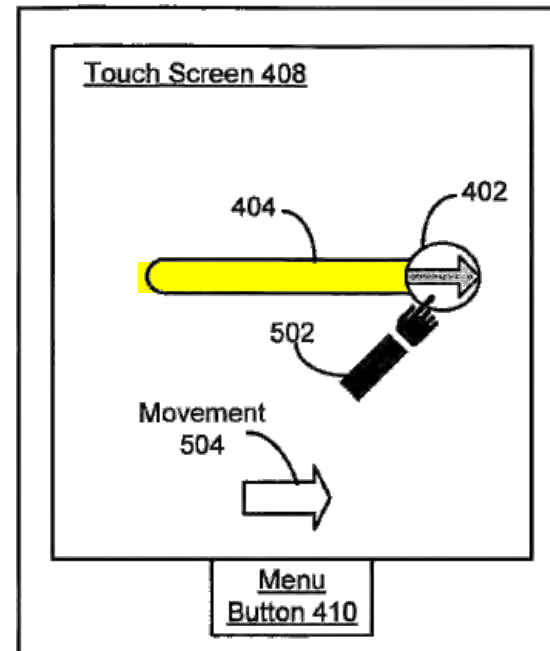


Figure 5C

The '849 Patent Technology

The Visual Cues

2. Displaying a predefined path along which the graphical image must travel;

“The visual cues shown include a channel [] indicating the path . . . which the unlock image is to be dragged, similar to a groove. . . . The end of the channel . . . also serves as a predefined location to which the unlock image is to be dragged.”

'849 patent at 12:24-27

The '849 Patent Technology

The Visual Cues

2. Displaying a predefined path along which the graphical image must travel;

“If the user input condition includes dragging an image along a predefined path, then the indication of progress may be defined in terms of the length of the predefined path.”

'849 patent at 15:32-35

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

“Gesture” is defined as “a motion of the object / appendage making contact with the touch screen.”

'849 patent at 9:26-28

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”
- Thus, a “predefined gesture” is “a predefined motion of the object / appendage making contact with the touch screen.”

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

“For example, the predefined gesture may include a contact of the touch screen on the left edge (to initialize the gesture), a horizontal movement of the point of contact to the opposite edge while maintaining continuous contact with the touch screen, and a breaking of the contact at the opposite edge (to complete the gesture).”

'849 patent at 9:28-33

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

For Example:

From Here

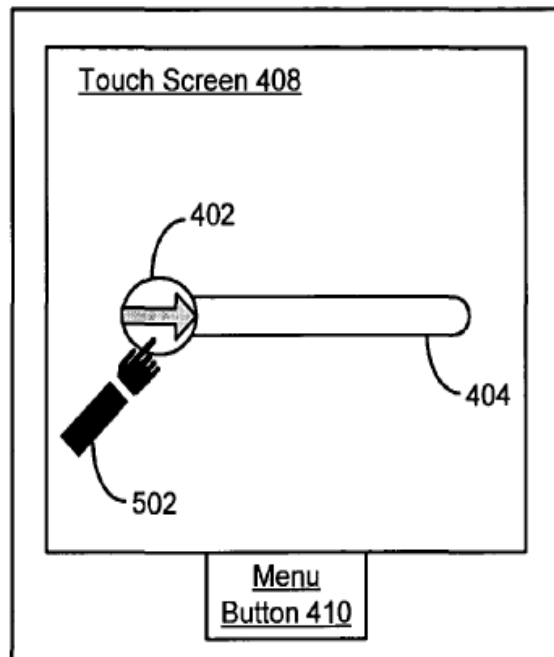


Figure 5A

To Here

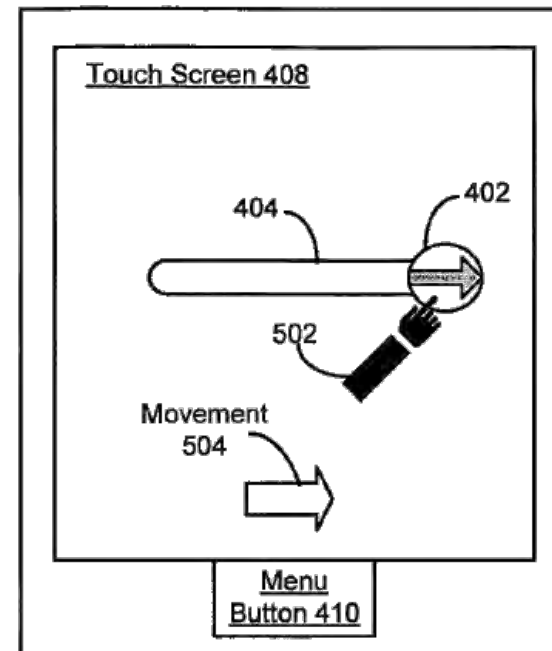


Figure 5C

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

For Example:

From Here

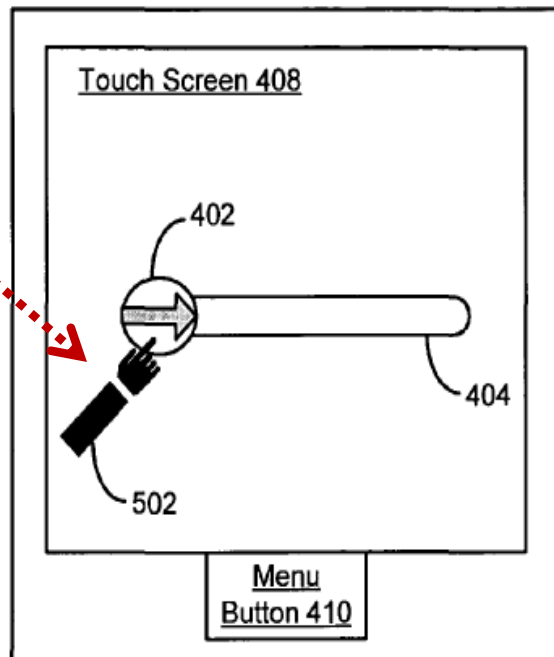


Figure 5A

To Here

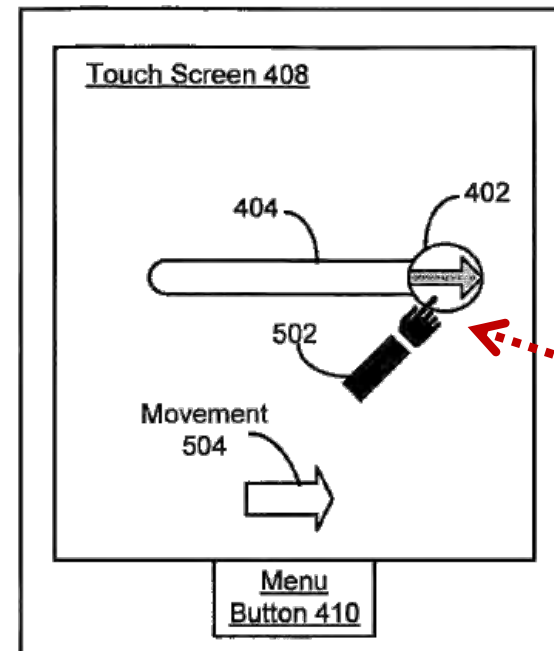


Figure 5C

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

For Example:

From Here

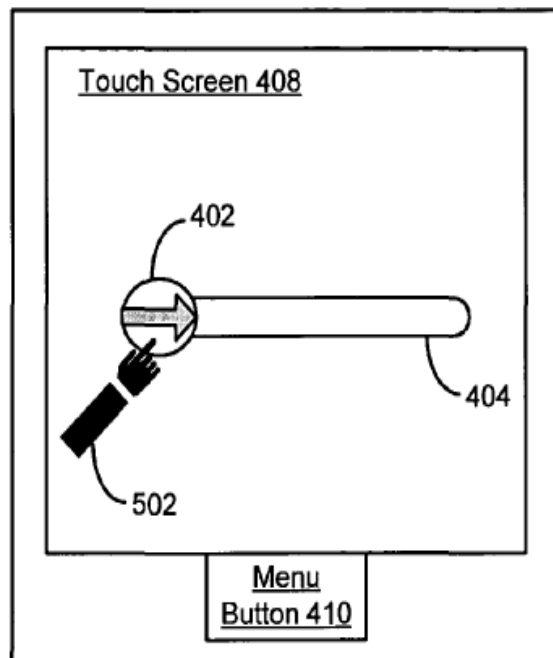


Figure 5A

To Here

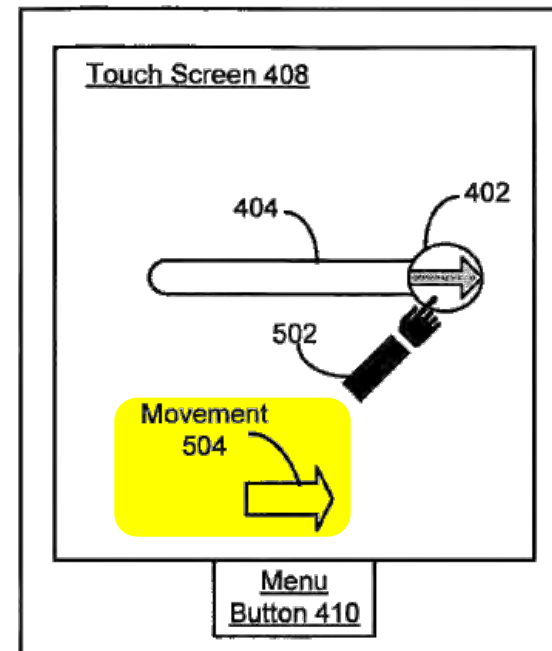


Figure 5C

The '849 Patent Technology

The Visual Cues

3. Ignoring user input that does not correspond to a “predefined gesture.”

The device will stay “in the user-interface lock state if the detected contact does not correspond to the predefined gesture.”

'849 patent at 2:6-8

The '849 Patent Technology

The Disclosed Sensory Feedback

3. Ignoring user input that does not correspond to a “predefined gesture.”

“If the user input condition includes a predefined gesture then the indication of progress of the gesture may be defined in terms of how much of the gesture is completed and how much of the gesture is remaining.”

'849 patent at 15:18-21

The '849 Patent

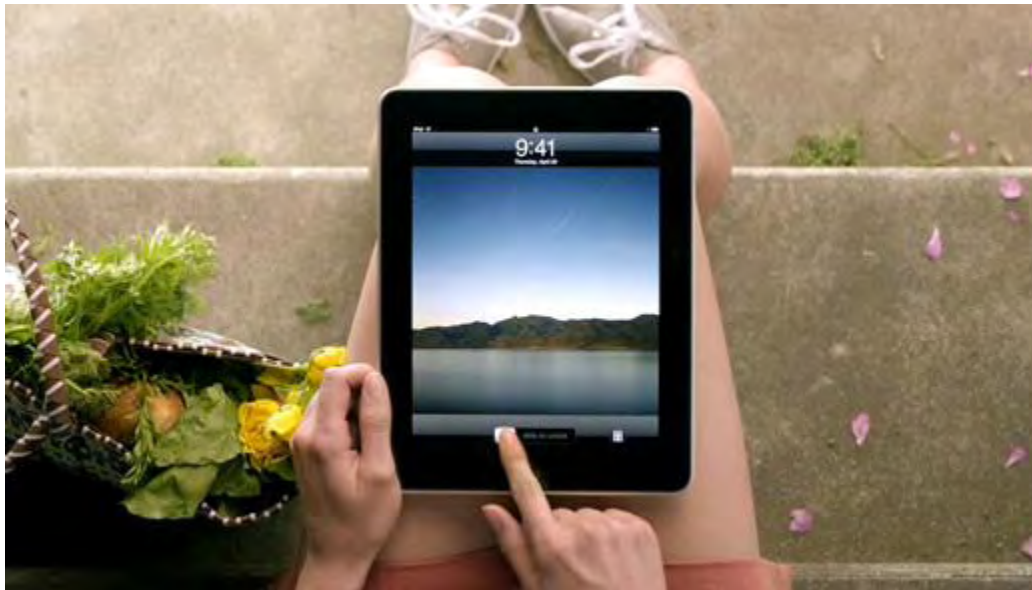
II. Apple's Embodiments: iPhones & iPads



Apple's Embodiments

iPhones & iPads

1. The “unlock image” moves its location across the touch screen.
2. A predefined path is displayed.
3. A predefined gesture is required to unlock to the device.



III. Accused Motorola devices

Accused Motorola devices

- Apple accuses 18 Motorola devices of infringing the '849 patent
- There is not a single, uniform process used to unlock all the accused devices.



Accused Motorola devices

- Apple accuses Motorola phones that do not have a user move an unlock image.
- Apple accuses Motorola phones that do not have a predefined displayed path.
- Apple accuses Motorola phones that do not require a user to input predefined gesture in order to unlock the phone.





MOTOROLA

U.S. Patent No. 6,282,646

and

U.S. Patent No. 7,380,116

Apple Patents

U.S. Patent No. 7,380,116



US007380116B2

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

(10) **Patent No.:** US 7,380,116 B2
(45) **Date of Patent:** *May 27, 2008

(54) **SYSTEM FOR REAL-TIME ADAPTATION TO CHANGES IN DISPLAY CONFIGURATION**
(75) **Inventors:** Ian Hendry, San Jose, CA (US); Eric Anderson, Los Gatos, CA (US); Fernando Urbina, Colorado Springs, CO (US)
(73) **Assignee:** Apple Inc., Cupertino, CA (US)

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(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 194 days.
This patent is subject to a terminal disclaimer.

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Primary Examiner—Thuan Du
(74) **Attorney, Agent, or Firm**—Buchanan Ingersoll & Rooney PC

(21) **Appl. No.:** 11/198,289
(22) **Filed:** Aug. 8, 2005

(57) **ABSTRACT**

A hot-plugging capability for video devices is achieved by shifting the responsibility for recognizing changes in the configuration of a display environment from a computer's operating system to a device manager. When an input/output device is added to or removed from the computer system, an interrupt signal informs a device manager of the fact that a change in configuration has occurred. In response thereto, the device manager determines whether the changed component relates to the computer's display function. If so, the device manager makes a call to the computer's display manager, to inform it of the fact that the display configuration has changed. In response to this call, the display manager reconfigures the display space for the computer system and notifies clients as appropriate, to accommodate display features associated with the added component. With this change in the configuration of the display space, the added component becomes immediately available for use.

(65) **Prior Publication Data**
US 2005/0273591 A1 Dec. 8, 2005

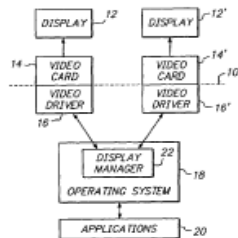
Related U.S. Application Data
(63) Continuation of application No. 09/927,411, filed on Aug. 13, 2001, now Pat. No. 6,928,543, which is a continuation of application No. 09/074,300, filed on May 8, 1998, now Pat. No. 6,282,646.

(51) **Int. Cl.** G06F 1/24 (2006.01)
(52) **U.S. Cl.** 713/100; 710/104; 345/545
(58) **Field of Classification Search** 713/100; 710/104; 345/545

See application file for complete search history.

(56) **References Cited**
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4,922,448 A 5/1990 Kuriishi et al.

43 Claims, 3 Drawing Sheets



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

(54) **SYSTEM FOR REAL-TIME ADAPTATION TO CHANGES IN DISPLAY CONFIGURATION**

(75) **Inventors:** Ian Hendry, San Jose, CA (US); Eric Anderson, Los Gatos, CA (US); Fernando Urbina, Colorado Springs, CO (US)

(73) **Assignee:** Apple Inc., Cupertino, CA (US)

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(21) **Appl. No.:** 11/198,289

(22) **Filed:** Aug. 8, 2005

U.S. Patent No. 6,282,646



US006282646B1

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

(10) **Patent No.:** US 6,282,646 B1
(45) **Date of Patent:** Aug. 28, 2001

(54) **SYSTEM FOR REAL-TIME ADAPTATION TO CHANGES IN DISPLAY CONFIGURATION** 5,682,529 * 10/1997 Hendry et al. 395,853
5,825,359 10/1998 Deby et al. 345,344

(75) **Inventors:** Ian Hendry, San Jose; Eric Anderson, Los Gatos, both of CA (US); Fernando Urbina, Colorado Springs, CO (US)

(73) **Assignee:** Apple Computer, Inc., Cupertino, CA (US)

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

(21) **Appl. No.:** 09/074,300

(22) **Filed:** May 8, 1998

(51) **Int. Cl.7** G06F 1/24

(52) **U.S. Cl.** 713/100

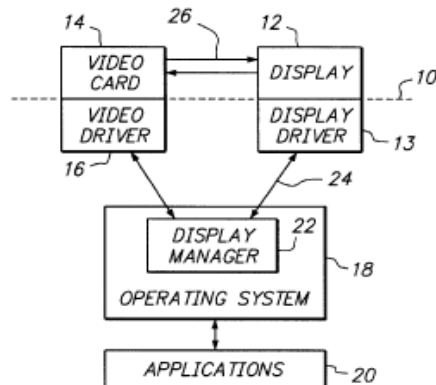
(58) **Field of Search** 713/100; 710/8, 710/30, 17, 46, 47, 48; 714/5, 7

(56) **References Cited**

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5,014,193 * 5/1991 Garner et al. 364/200
5,276,630 * 1/1994 Bakwin et al. 364/505
5,282,368 * 1/1994 Mieras et al. 395/164
5,469,223 * 11/1995 Kiem 348/581

33 Claims, 3 Drawing Sheets



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

(54) **SYSTEM FOR REAL-TIME ADAPTATION TO CHANGES IN DISPLAY CONFIGURATION**

(75) **Inventors:** Ian Hendry, San Jose; Eric Anderson, Los Gatos, both of CA (US); Fernando Urbina, Colorado Springs, CO (US)

(73) **Assignee:** Apple Computer, Inc., Cupertino, CA (US)

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

(21) **Appl. No.:** 09/074,300

(22) **Filed:** May 8, 1998

I. The Technology Of The Display Space Patents

The Display Space Patents: The Alleged Problem

The patents contend that prior-art computer systems required a restart to change the display configuration

“In the past, changes in the configuration of the computer system, such as the addition or removal of display devices, only became effective upon a restart, or reboot, of the computer system.”

‘646 patent at 1:40-43

US 6,282,646 B1

SYSTEM FOR REAL-TIME ADAPTATION TO CHANGES IN DISPLAY CONFIGURATION

FIELD OF THE INVENTION

The present invention is directed to computer display systems, and more particularly to a display system which is capable of instantaneously accommodating changes in the configuration of a computer system.

BACKGROUND OF THE INVENTION

As computers become more prevalent in everyday use, particularly personal type computers, users are employing them in a variety of different situations. Depending upon the particular situation, the user may desire to change the configuration of the display devices connected to the computer. For example, portable computers of the so-called laptop or notebook type have become increasingly popular because of their small size and light weight, making them suitable for use while traveling. Due to the need to keep their dimensions to a minimum, the display screens built into such computers are relatively small in size, and may offer only limited display capabilities. Therefore, when using one of these types of computers in an office environment, the user may connect it to a monitor having a larger display area and/or enhanced display capabilities. Such a connection might be made, for example, by means of a docking station which enables the portable computer to be conveniently connected to a variety of peripheral devices, or by inserting a video card in a PC Card slot.

Subsequently, the user might remove the added monitor, for example to take the computer home or to use it while traveling. In this situation, the built-in display screen must be used. In other words, the computer must route all information to be displayed to the built-in screen, rather than the port to which the external monitor was connected. In addition, the displayed information must be reformatted, or otherwise processed, to accommodate the display parameters of the built-in device.

In the past, changes in the configuration of the computer system, such as the addition or removal of display devices, only became effective upon a restart, or reboot, of the computer system. As part of its initial startup procedure, the computer's operating system detects the presence of each device driver loaded on the system, and registers each such detected device to permit communications to be carried out between the operating system and the device with which the driver is associated. If a new device and corresponding driver are added to the system after this initialization procedure, the driver is not registered with the operating system, and therefore communications do not take place until the operating system goes through its initialization procedure again, e.g. upon the next reboot of the computer.

Hence, if a user adds a monitor to the computer system, the monitor cannot be used to display information generated by the computer until it has been rebooted.

U.S. Pat. No. 5,085,529 discloses a system for dynamically accommodating changes in the display configuration of a computer, without the need to restart the computer. In the system of this patent, changes can be made to the display environment for a computer system while it is in a sleep mode, in which the computer's central processing unit is maintained in a minimal operating state. When the computer is "awakened" from this sleep state, the system of the '529 patent enables the changed configuration to be immediately recognized, and thereafter utilized in the display of information generated by the computer.

As the capabilities offered by a computer system expand, the opportunities for expansion of the system grow. In certain situations, users may desire to have the computer's display capabilities expanded. During the course of a meeting, for example, the user may wish to present the computer to a suitable video projection screen. It is an objective of the present invention to expand upon the capabilities of a computer system, by providing a display system which is capable of being immediately available to the user, in accordance with the principles of the invention.

SUMMARY OF THE INVENTION

In accordance with the present invention, a computer system is automatically reconfigured and reinitialized upon the addition or removal of a display device. When an expansion device is added to the computer system, an interface manager of the fact that a change has occurred. In response thereto, the interface manager makes a call to the computer system to reform the display space to accommodate the additional device with the added component. With the addition of the display space, the added device is immediately available for use.

By means of this approach, the user may begin to use the monitor as soon as the user wishes to add it to the system without the need to reboot the computer. Further features and advantages of the invention are explained in detail hereinafter in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an overall display system architecture.

FIG. 2 illustrates an example of a display environment, including plural video cards and display devices.

FIG. 3 is a block diagram of a display system architecture which includes plural video cards and display devices.

FIG. 4 is a block diagram illustrating the operation of the interface manager, and

FIG. 5 is a flowchart illustrating the process by which changes in the configuration of the display environment become immediately available to the user, in accordance with the principles of the invention.

The Display Space Patents: The Alleged Solution

To accomplish a “real-time reconfiguration of the display environment,” the Display Space patents use two operating system components:

1. A “Device Manager” to determine whether an attached device is a video device; and
2. A “Display Manager” to reconfigure the “Display Space.”

The Display Space Patents Technology

The Patents Disclose A “Device Manager” To Determine Whether A Device Is A Video Device

“The detection of the presence of such [video] devices, as well as their removal from the system, is handled by a portion of the computer's operating system that is referred to herein as a device manager.”

‘646 patent at 5:17-21

US 6,282,646 B

5
within the structure of the computer system, and may not be designed to be repeatedly inserted and removed by the user. Additional video cards, however, might be capable of being easily inserted into and removed from the computer system. For example, the video card might be implemented as a removable card that conforms to the PC Card standard. This standard defines the form factor for relatively small, credit-card shaped I/O devices, which are designed to be easily inserted into and removed from computer housings, to provide a computer with different capabilities. Included among the types of I/O devices that can be embodied in such a card are modems, facsimile devices, network interface cards, wireless communications devices and hard disk drives.

Devices of this type which conform to this standard, commonly known as PC Cards, are designed to be readily inserted and removed from the computer housing. The detection of the presence of such devices, as well as their removal from the system, is handled by a portion of the computer's operating system that is referred to herein as a device manager. Referring to FIG. 4, when a PC Card 44 is inserted into the housing of the computer, it activates a switch 46, or equivalent sensor device, which sends an interrupt signal IRQ to the device manager 48. In response to this interrupt, the device manager determines the type of device which has been inserted, and informs the operating system 18. In a similar manner, whenever the PC Card is removed from the computer housing, an interrupt is also sent to the device manager, which in turn notifies the operating system that the device is no longer available.

Another type of change which can be made to the display configuration of the computer is the addition or removal of a display device. In the example of FIG. 3, for instance, either one of the display devices 12 or 12' could be disconnected from its associated video card 14 or 14'. Furthermore, if only one display device is present, it could be disconnected from one of the video cards 14 and connected to the other video card 14'. Whenever a change of this nature occurs, an interrupt is sent to the device manager 48. For instance, the interrupt could be generated by the video card, upon detecting that a display device has been physically connected to or disconnected from it. Alternatively, the interrupt could be provided by a bus that is capable of detecting such a change.

The addition or removal of other types of hardware can also result in a change in the display configuration of the computer system. For example, a graphics accelerator card can be added to the system by means of a PC Card slot. Again, upon the addition or removal of such a device, an interrupt signal IRQ is sent to the device manager.

The present invention is particularly directed to the situation in which the device that is added to or removed from the computer system is related to the display function. In this case it is necessary to reconfigure the computer system in order for a change in video hardware to become effective. More particularly, unless a reboot occurred, the operating system was not prompted to undertake any action which would cause it to detect the presence of a new driver, resulting from the addition of an associated hardware device. Hence, it was necessary for the user to interrupt the operating state of the computer in order to utilize the additional functionality provided by a newly added hardware. Once the operating system became aware of the presence of the new device, it could notify the display manager to incorporate the presence of the new frame buffer.

In accordance with the present invention, however, the display system can be immediately responsive to the addi-

tion of a device which changes the display configuration of the computer system. To this end, the device manager provides a means for directly detecting the presence of a device which changes the display configuration of the computer system. Referring to FIG. 5, upon receipt of an indication that there has been a change in configuration, the device manager first determines at step 50 whether a device has been added or removed. If a device has been added to the system, the device manager communicates with the device to determine its type, at step 52, and stores data in a register regarding the identity and type of the device. If the device responds with an indication that it is a video device, the device manager issues a call to the display manager 22, at step 54. Appropriate parameters can be included with the call, to indicate the type of device, the size of its frame buffer (if applicable), its resolution, and the like.

In response to this information, the display manager carries out a number of operations, depicted in Steps 56-64. First, it registers the added hardware as a new device, along with the location of its associated drivers in memory, at step 56. In some cases, the driver may already be present in memory, but in an inactive state because the device was not connected to the system at the time of initial boot. In this case, the display manager switches the driver to an active state.

After registering the device, the display manager matches each display device with an available frame buffer at step 58. If a new video card is inserted, for example, the display manager assigns a portion of the global coordinate space 80 to the frame buffer in the video card. If a display device is connected to that video card, the display manager assigns that device to the frame buffer for that card, so that the proper data is displayed on the device. If a display device is disconnected from one video card and connected to a different video card, the display manager moves objects within the global space 80 so that they are presented to the appropriate frame buffer for the display device. For example, the display manager can move user interface control objects which are specific to that display, such as brightness and contrast controls, to the frame buffer associated with that display. Similarly, if the display has other attributes associated with it, such as a certain name or designation, the display manager causes that they are directed to the proper frame buffer.

Once the display devices and frame buffers are matched up, the display manager consults a preference file which indicates whether that device was connected to the system at some previous time. This file is preferably stored in permanent memory, such as a hard disk, and updated each time a

The Display Space Patents Technology

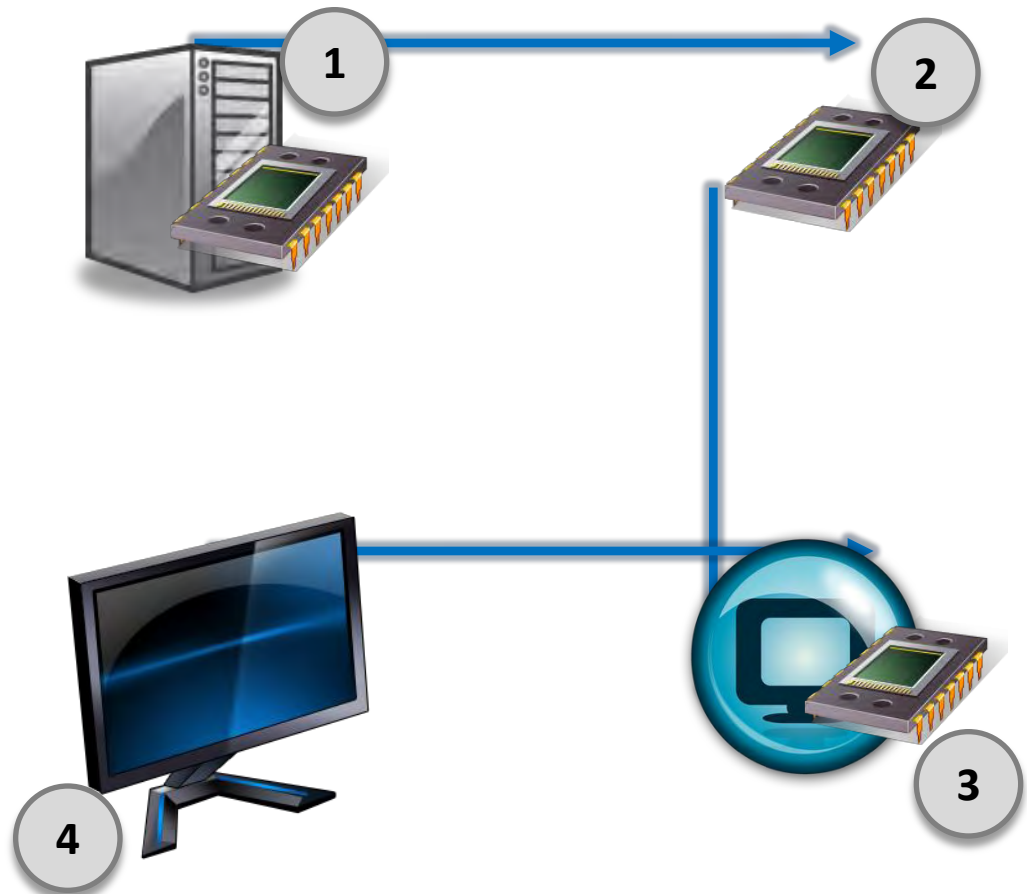
The Patents Disclose A “Display Manager” To Reconfigure The “Display Space”

“[T]he display manager reconfigures the display space for the computer system, to accommodate an additional frame buffer that is associated with the added component. With this change in the configuration of the display space, the added component becomes immediately available for use. By means of this approach, the user can add a second monitor or other hardware component to a computer and begin to use the monitor as soon as it has been connected, without the need to reboot the computer or otherwise interrupt its current operating state.”

The Display Space Patents Technology

Using A Display Space To Display Images

1. A computer system allocates memory (RAM) for the rendering of graphical images.
2. This allocated memory is a virtual “display space.”
3. The computer system will allocate the “display space” to a “frame buffer” of one or more video devices.
4. Images sent to the “display space” will be displayed on the video device(s).



The Display Space Patents Technology

Using A Display Space To Display Images

“The display environment can generally be considered to be defined by a global coordinate space 30, as depicted in FIG. 2. Objects and other information to be displayed can be positioned anywhere within this space, as determined by the user and/or the software program that generates the information.”

US 6,311,000

3

DETAILED DESCRIPTION

The present invention is directed to the display environment of a computer system. A block diagram of the overall architecture for a display environment is illustrated in FIG. 1. In this figure, hardware components of the computer system are illustrated above a dashed line 10, and software components are depicted below the line. These software components are stored in a suitable computer-readable medium, such as a magnetic disk, and loaded into the computer's working memory, i.e. RAM, for execution. The system can include display devices 12, e.g. monitors, LCD screens and/or plasma displays, although actual display devices need not be physically present in order for the principles of the invention to be operative. Each display device is connected to, and controlled by, a video card 14 which operates in accordance with video driver software 16. Although depicted as being on a separate substrate, such as a printed circuit board, the components of at least one video card could be incorporated with other components on single substrate, such as the computer's motherboard.

One or more software programs, such as application programs 20, generate information to be displayed on the display devices. Examples of such information include text, windows and other graphical objects, and control structures such as menus and dialog boxes. This information is presented to the display device through the computer's operating system 18, which also generates its own information to be presented on the display. The operating system communicates with the display device through an associated display driver 15, which constitutes a software component that corresponds to the hardware of the display device 12.

The operating system includes a display manager 22, which provides communication between each of the software components, and dynamically configures the display devices 12. The communication between the various software components and the hardware devices takes place via their associated drivers, e.g. the video driver and the display driver. In this regard, many video displays have the capability to provide information regarding their available modes of operation and/or timing specifications. Some displays, so-called "smart displays," are capable of providing information about their modes of operation directly, for example in response to inquiries. For these types of displays, the display manager 22 communicates directly with the display device, by means of the display driver 15, over a communication channel 24. This communication channel can be a bus within the computer, a serial line, or any other suitable path for exchanging information between the display manager and the display driver 15 of the display device.

In some cases, the display device may not be able to communicate its capabilities directly. However, through the use of a lookup table or the like, the display driver 15 can obtain information regarding the display's capabilities, and provide them to the display manager.

The display manager also communicates with other parts of the operating system 18 and the other software programs 20 that are running on the computer. For example, in response to operator commands, the operating system can instruct the display manager to add a new device to a list of active displays, or remove a device therefrom. In response thereto, the display manager informs the application programs 20 of the new display configuration, to enable them to update their displayed information accordingly.

In one known implementation for computer systems, the display environment can generally be considered to be defined by a global coordinate space 30, as depicted in FIG.

2. In the example illustrated in FIG. 2, the display environment consists of two display devices, 32 and 34, within the global display space 30. A menu bar 36 is displayed at the top of the screen for the device 32, which is therefore the main display device. Accordingly, the origin 38 of the display space coincides with the top left corner of the device 32. As illustrated in FIG. 2, the user has caused some objects, e.g. windows 40, to be displayed on the device 32, and another object 42 to be displayed on the device 34.

FIG. 3 illustrates the configuration of the computer system for the particular example illustrated in FIG. 2, which includes two display devices. Each display device is connected to an associated video card, which includes a corresponding video driver. For the sake of simplicity in FIG. 3, the display drivers are not separately illustrated, but are assumed to be present within the system, in a manner analogous to the arrangement shown in FIG. 1. The embodiment of FIG. 3 includes two video cards 14 and 14', respectively associated with the two video display devices 12 and 12'. Each of the video cards communicates with the display manager 22, by means of its associated video driver 16 and 16'.

Among other components, each video card includes a frame buffer, e.g. random access memory, which stores the data for the image that is displayed on its associated display device 12. In essence, the display manager 22 assigns the frame buffer to a corresponding portion of the global coordinate space 30. In the example of FIG. 2, the two frame buffers are assigned to mutually exclusive portions of the global space. However, some or all of the portion assigned to one of the frame buffers could overlap with the area assigned to the other frame buffer. In this case, the same image, or portion of an image, appears on both display devices.

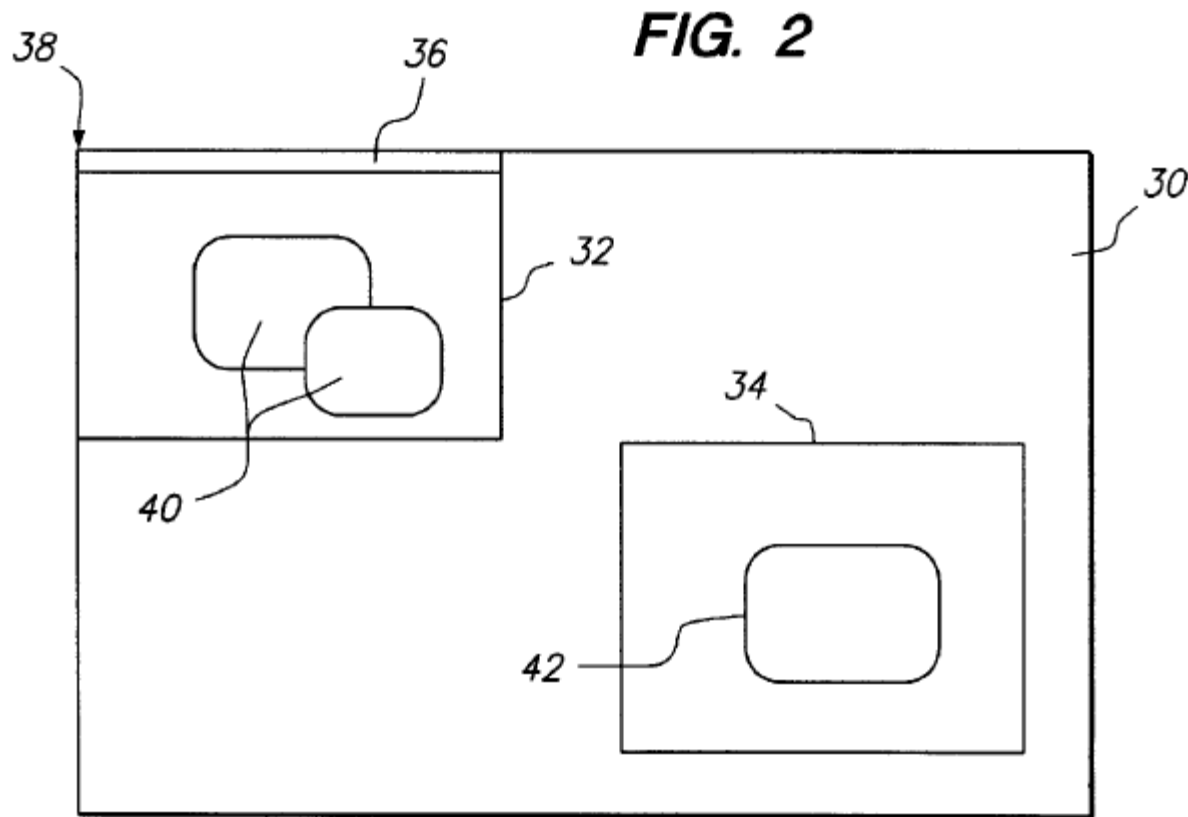
At any given time, there could be only one video card connected to the computer, or both cards could be connected. Furthermore, in the case of a network server or the like, it is possible that no video card would be present over certain periods of time. Even when both cards are present, only one of them may have a monitor or other display device connected to it at any particular point in time.

In the case of a conventional desktop or notebook computer system, one of the video cards might be incorporated

'646 patent at 3:65-4:4

The Display Space Patents Technology

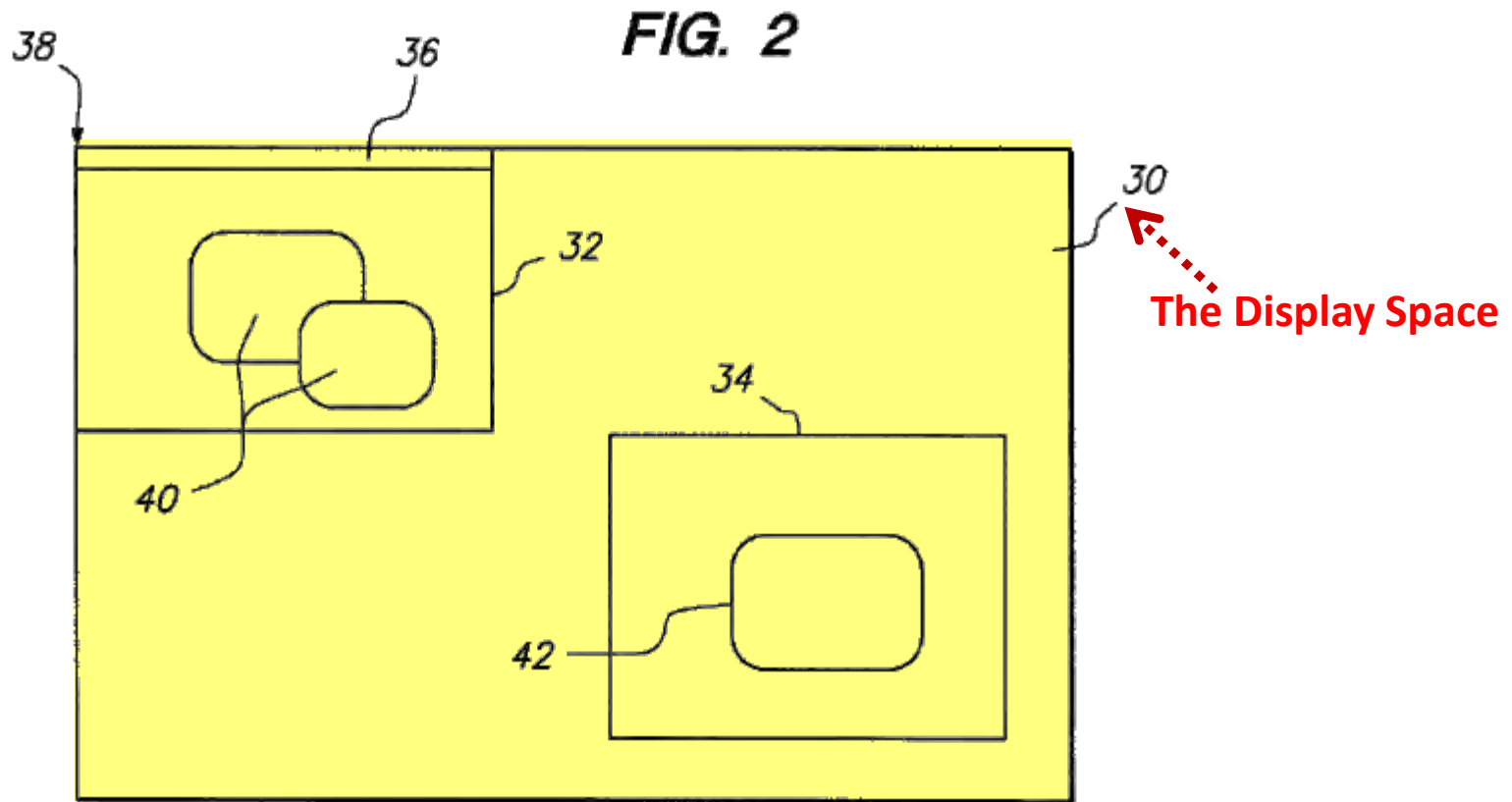
Using A Display Space To Display Images



'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

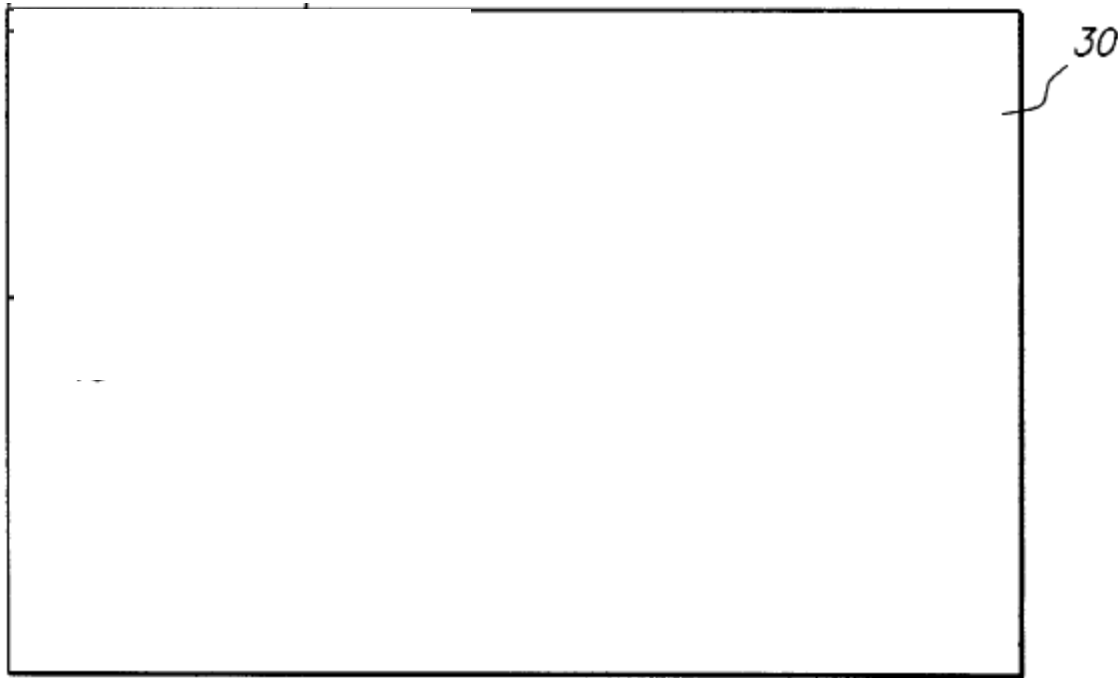


'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

FIG. 2



'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

“[E]ach video card includes a frame buffer, e.g. random access memory, which stores the data for the image that is displayed on its associated display.”

US 6,282,646 B1

DETAILED DESCRIPTION

The present invention is directed to the display environment of a computer system. A block diagram of the overall architecture for a display environment is illustrated in FIG. 1. In this figure, hardware components of the computer system are illustrated above a dashed line 10, and software components are depicted below the line. These software components are stored in a suitable computer-readable medium, such as a magnetic disk, and loaded into the computer's working memory, i.e. RAM, for execution. The system can include display devices 12, e.g. monitors, LCD screens and/or plasma displays, although actual display devices need not be physically present in order for the principles of the invention to be operative. Each display device is connected to, and controlled by, a video card 14 which operates in accordance with video driver software 16. Although depicted as being on a separate substrate, such as a printed circuit board, the components of at least one video card could be incorporated with other components on a single substrate, such as the computer's motherboard.

One or more software programs, such as application programs 20, generate information to be displayed on the display devices. Examples of such information include text, windows and other graphical objects, and control structures such as menus and dialog boxes. This information is presented to the display device through the computer's operating system 18, which also generates its own information to be presented on the display. The operating system communicates with the display device through an associated display driver 13, which constitutes a software component that corresponds to the hardware of the display device 12.

The operating system includes a display manager 22, which provides communication between each of the software components, and dynamically configures the display devices 12. The communication between the various software components and the hardware devices takes place via their associated drivers, e.g. the video driver and the display driver. In this regard, many video displays have the capability to provide information regarding their available modes of operation and/or timing specifications. Some displays, so-called "smart displays," are capable of providing information about their modes of operation directly, for example in response to inquiries. For these types of displays, the display manager 22 communicates directly with the display device, by means of the display driver 13, over a communication channel 24. This communication channel can be a bus within the computer, a serial line, or any other suitable path for exchanging information between the display manager and the display driver 13 of the display device.

In some cases, the display device may not be able to communicate its capabilities directly. However, through the use of a lookup table or the like, the display driver 13 can obtain information regarding the display's capabilities, and provide them to the display manager.

The display manager also communicates with other parts of the operating system 18 and the other software programs 20 that are running on the computer. For example, in response to operator commands, the operating system can instruct the display manager to add a new device to a list of active displays, or remove a device therefrom. In response thereto, the display manager informs the application programs 20 of the new display configurations, to enable them to update their displayed information accordingly.

In one known implementation for computer systems, the display environment can generally be considered to be defined by a global coordinate space 30, as depicted in FIG.

2. Object position user and origin; 5. coordinate some of instance; 10. menu bar; 15. base of display; 20. the co-ordinate system; 25. the (0,0) origin; 30. the top left corner of the display space; 35. the origin of the coordinate system; 40. for example, the information to be displayed on the screen; 45. position in the display space.

35. In the example illustrated in FIG. 2, the display environment consists of two display devices, 32 and 34, within the global display space 30. A menu bar 36 is displayed at the top of the screen for the device 32, which is therefore the main display device. Accordingly, the origin 38 of the display space coincides with the top left corner of the device 32. As illustrated in FIG. 2, the user has caused some objects, e.g. windows 40, to be displayed on the device 32, and another object 42 to be displayed on the device 34.

FIG. 3 illustrates the configuration of the computer system for the particular example illustrated in FIG. 2, which includes two display devices. Each display device is connected to an associated video card, which includes a corresponding video driver. For the sake of simplicity in FIG. 3, the display drivers are not separately illustrated, but are assumed to be present within the system, in a manner analogous to the arrangement shown in FIG. 1. The embodiment of FIG. 3 includes two video cards 14 and 14', respectively associated with the two video display devices 12 and 12'. Each of the video cards communicates with the display manager 22, by means of its associated video driver 16 and 16'.

Among other components, each video card includes a frame buffer, e.g. random access memory, which stores the data for the image that is displayed on its associated display device 12. In essence, the display manager 22 assigns the frame buffer to a corresponding portion of the global coordinate space 30. In the example of FIG. 2, the two frame buffers are assigned to mutually exclusive portions of the global space. However, some or all of the portion assigned to one of the frame buffers could overlap with the area assigned to the other frame buffer. In this case, the same image, or portion of an image, appears on both display devices.

At any given time, there could be only one video card connected to the computer, or both cards could be connected. Furthermore, in the case of a network server or the like, it is possible that no video card would be present over certain periods of time. Even when both cards are present, only one of them may have a monitor or other display device connected to it at any particular point in time.

In the case of a conventional desktop or notebook computer system, one of the video cards might be incorporated

'646 patent at 4:47-49

The Display Space Patents Technology

Using A Display Space To Display Images

“If a new video card is inserted, for example, the display manager assigns a portion of the global coordinate space 30 to the frame buffer in the video card.”

‘646 patent at 6:46-48

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within the structure of the computer system, a designed to be repeatedly inserted and removed. Additional video cards, however, might be easily inserted into and removed from the computer housing. For example, the video card might be implemented as a removable card that conforms to the PC Card standard defines the form factor for relatively card shaped I/O devices, which are designed to be inserted into and removed from computer housings. Such devices provide a computer with different capabilities among the types of I/O devices that can be connected to a computer. Examples of such devices are modems, facsimile devices, network cards, wireless communications devices and the like.

Devices of this type which conform to the standard, commonly known as PC Cards, are designed to be readily inserted and removed from the computer housing. The detection of the presence of such devices, as well as their removal from the system, is handled by a portion of the computer's operating system that is referred to herein as a device manager. Referring to FIG. 4, when a PC Card 44 is inserted into the housing of the computer, it actuates a switch 46, or equivalent sensor device, which sends an interrupt signal IRQ to the device manager 48. In response to this interrupt, the device manager determines the type of device which has been inserted, and informs the operating system 18. In a similar manner, whenever the PC Card is removed from the computer housing, an interrupt is also sent to the device manager, which in turn notifies the operating system that the device is no longer available.

Another type of change which can be made to the display configuration of the computer is the addition or removal of a display device. In the example of FIG. 3, for instance, either one of the display devices 12 or 13 could be disconnected from its associated video card 14 or 14'. Furthermore, if only one display device is present, it could be disconnected from one of the video cards 14 and connected to the other video card 14'. Whenever a change of this nature occurs, an interrupt is sent to the device manager 48. For instance, the interrupt could be generated by the video card, upon detecting that a display device has been physically connected to or disconnected from it. Alternatively, the interrupt could be provided by a bus that is capable of detecting such a change.

The addition or removal of other types of hardware can also result in a change in the display configuration of the computer system. For example, a graphics accelerator card can be added to the system by means of a PC Card slot. Again, upon the addition or removal of such a device, an interrupt signal IRQ is sent to the device manager.

The present invention is particularly directed to the situation in which the device that is added to or removed from the computer system is related to the display function. In the past, it was necessary to reboot the computer system in order for a change in video hardware to become effective. More particularly, unless a reboot occurred, the operating system was not prompted to undertake any action which would cause it to detect the presence of a new device, resulting from the addition of an associated hardware device. Hence, it was necessary for the user to interrupt the operating state of the computer in order to utilize the additional functionality provided by a newly added hardware. Once the operating system became aware of the presence of the new device, it could notify the display manager to incorporate the presence of the new frame buffer.

In accordance with the present invention, however, the display system can be immediately responsive to the add-

ition of new hardware. Such determination is made whenever an interrupt is generated that indicates some other type of hardware has been added or removed, e.g. a display monitor. In addition to, or in lieu of interrupts, other approaches can be employed to determine when a device has been added or removed. For example, the operating system can periodically poll all of the computer system's I/O ports, to determine which devices are present and which ones might have been removed.

Referring to FIG. 5, upon receipt of an indication that there has been a change in configuration, the device manager first determines at step 50 whether a device has been added or removed. If a device has been added to the system, the device manager communicates with the device to determine its type, at step 52, and stores data in a register regarding the identity and type of the device. If the device responds with an indication that it is a video device, the device manager issues a call to the display manager 22, at step 54. Appropriate parameters can be included with the call, to indicate the type of device, the size of its frame buffer (if applicable), its resolution, and the like.

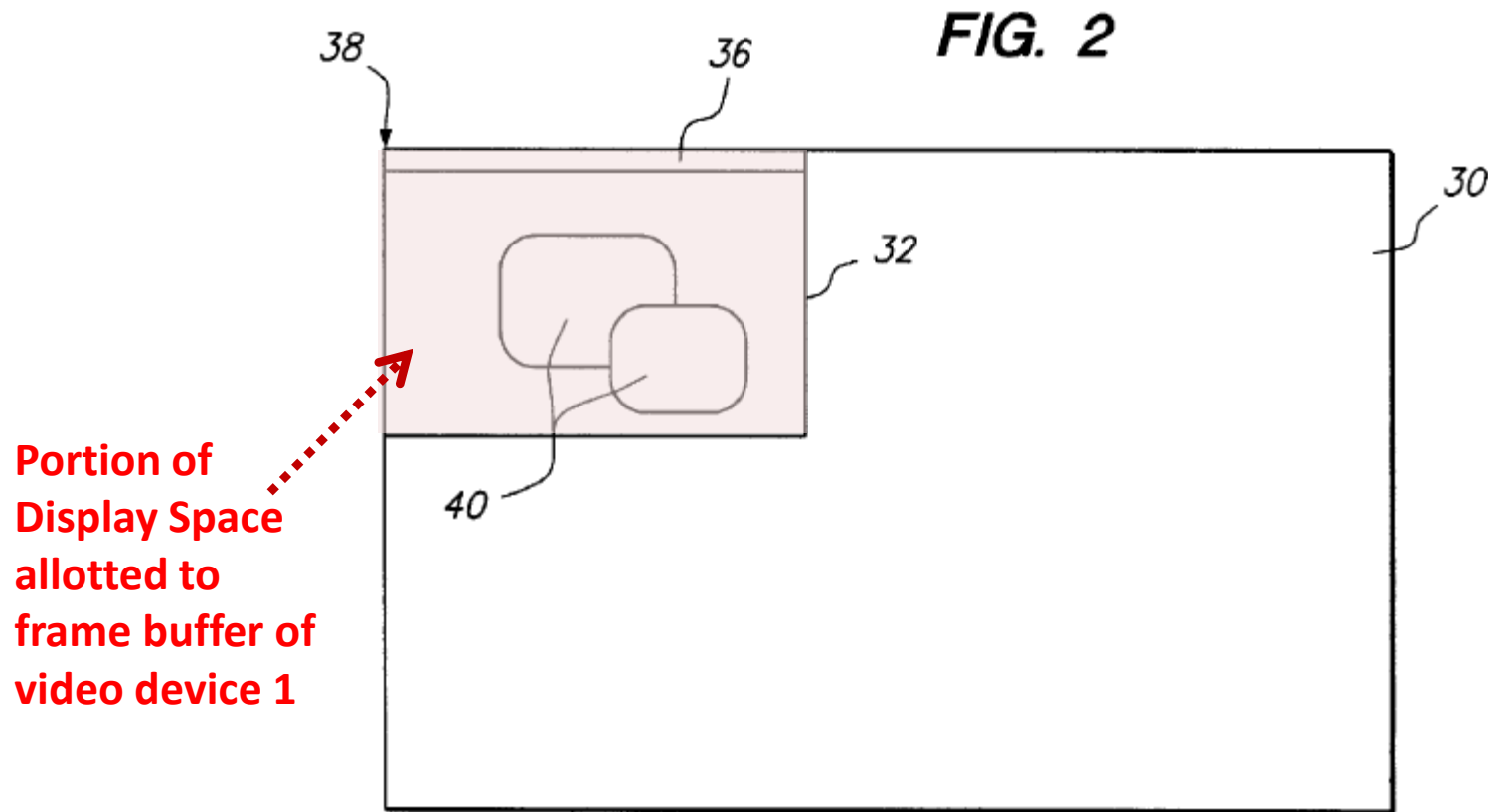
In response to this information, the display manager carries out a number of operations, depicted in Steps 56-64. First, it registers the added hardware as a new device, along with the location of its associated drivers in memory, at step 56. In some cases, the driver may already be present in memory, but in an inactive state because the device was not connected to the system at the time of initial boot. In this case, the display manager switches the driver to an active state.

After registering the device, the display manager matches each display device with an available frame buffer at step 58. If a new video card is inserted, for example, the display manager assigns a portion of the global coordinate space 30 to the frame buffer in the video card. If a display device is connected to that video card, the display manager assigns that device to the frame buffer for that card, so that the proper data is displayed on the device. If a display device is disconnected from one video card and connected to a different video card, the display manager moves objects within the global space 30 so that they are presented to the appropriate frame buffer for the display device. For example, the display manager can move user interface control objects which are specific to that display, such as brightness and contrast controls, to the frame buffer associated with that display. Similarly, if the display has other attributes associated with it, such as a certain name or designation, the display manager ensures that they are directed to the proper frame buffer.

Once the display devices and frame buffers are matched up, the display manager consults a preferences file which indicates whether that device was connected to the system at some previous time. This file is preferably stored in permanent memory, such as a hard disk, and updated each time a

The Display Space Patents Technology

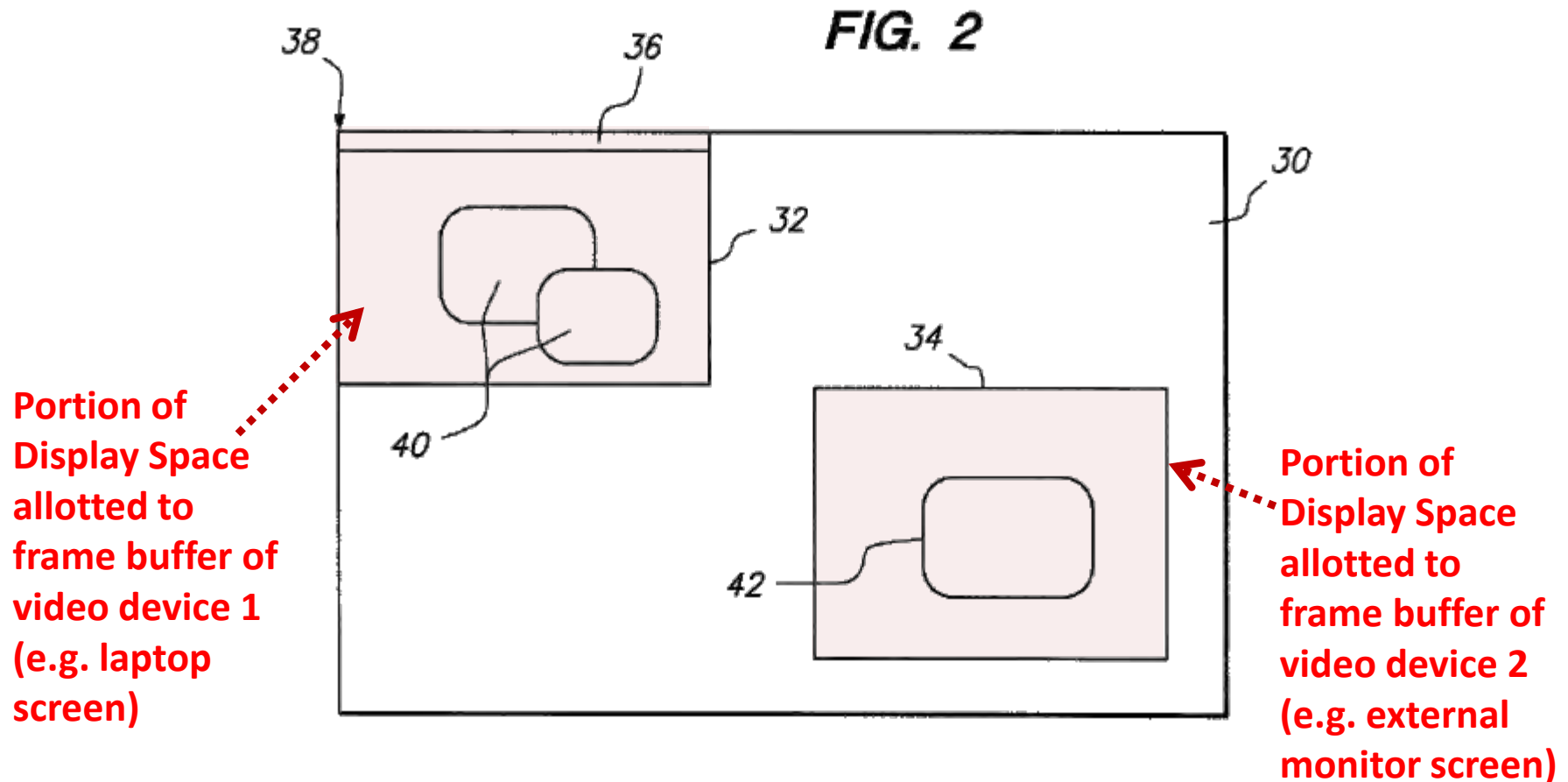
Using A Display Space To Display Images



'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

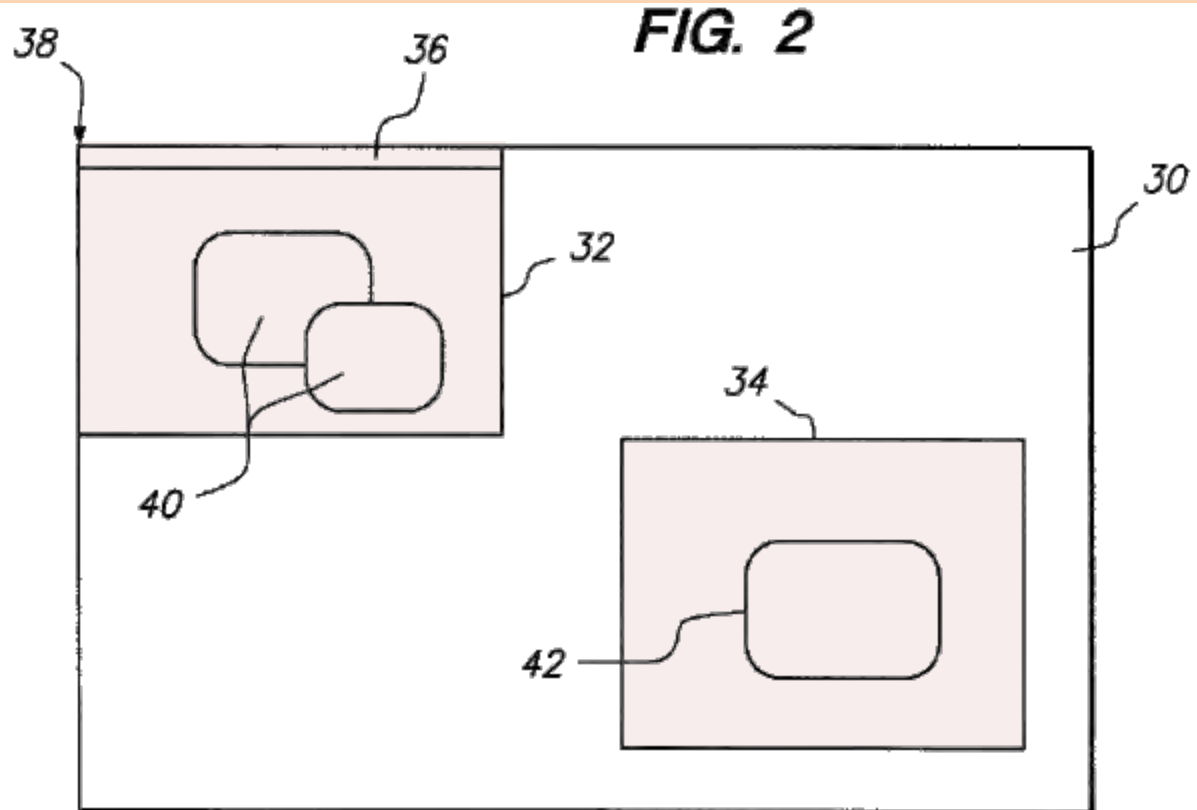


'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

- Not all of the Display Space is necessarily displayed on the attached video devices

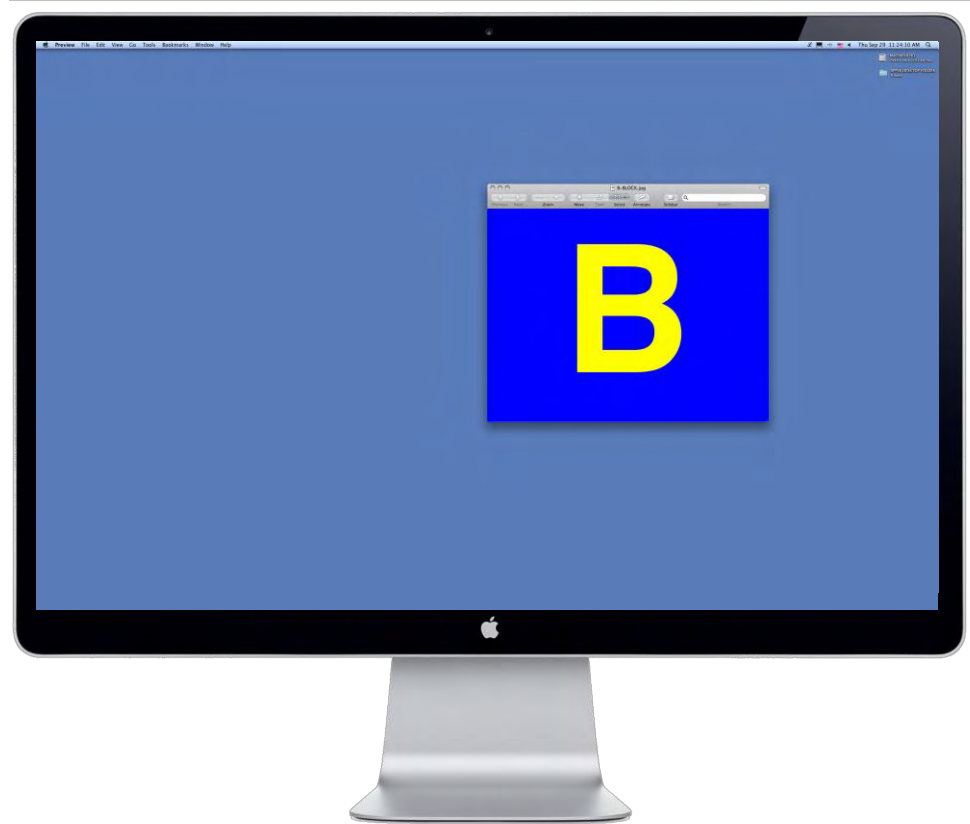


'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

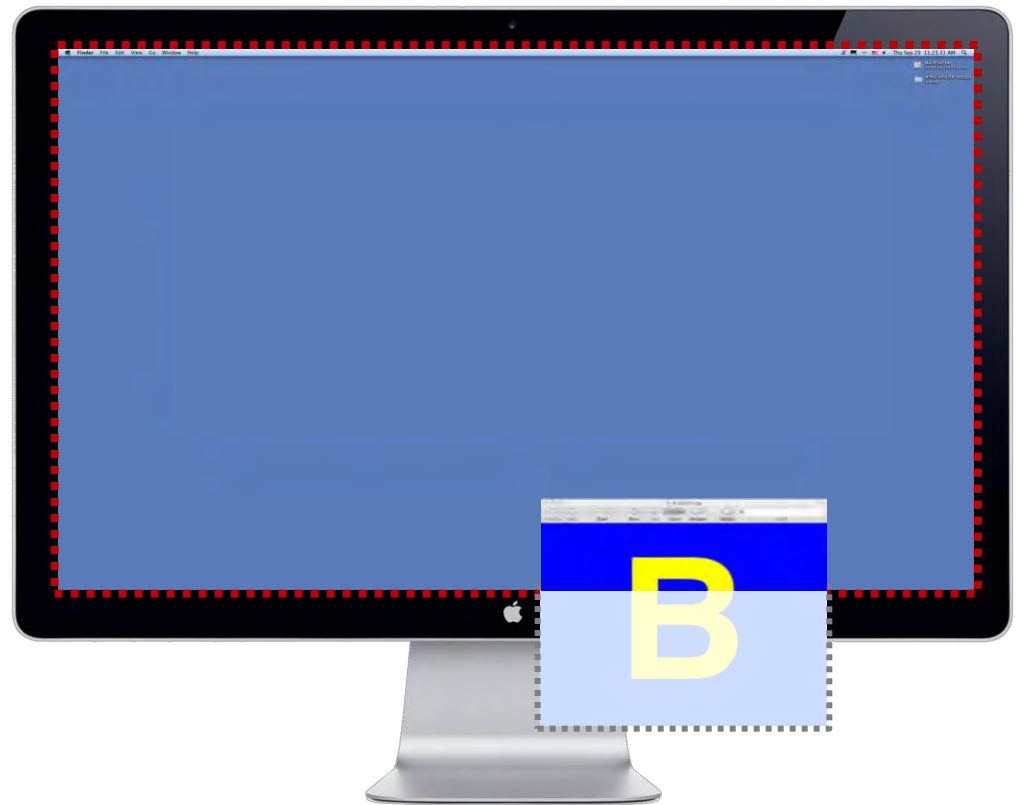
- Not all of the Display Space is necessarily displayed on the attached video devices



The Display Space Patents Technology

Using A Display Space To Display Images

- Not all of the Display Space is necessarily displayed on the attached video devices
- B not on screen, but still in display space.



The Display Space Patents Technology

Using A Display Space To Display Images

“[I]f the removed device is a video card, the display manager deletes the assignment of a portion of the display space to the now-removed frame buffer.”

‘646 patent at 7:56-58

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within the structure of the computer system designed to be repeatedly inserted and removed. Additional video cards, however, might be easily inserted into and removed from the system. For example, the video card might be a removable card that conforms to the PC Card standard defines the form factor for relatively card shaped I/O devices, which are designed to be easily inserted into and removed from computer housings, to provide a computer with different capabilities. Included among the types of I/O devices that can be embodied in such a card are modems, facsimile devices, network interface cards, wireless communications devices and hard disk drives.

Devices of this type which conform to this standard, commonly known as PC Cards, are designed to be readily inserted and removed from the computer housing. The detection of the presence of such devices, as well as their removal from the system, is handled by a portion of the computer's operating system that is referred to herein as a device manager. Referring to FIG. 4, when a PC Card 44 is inserted into the housing of the computer, it actuates a switch 46, or equivalent sensor device, which sends an interrupt signal IRQ to the device manager 48. In response to this interrupt, the device manager determines the type of device which has been inserted, and informs the operating system 18. In a similar manner, whenever the PC Card is removed from the computer housing, an interrupt is also sent to the device manager, which in turn notifies the operating system that the device is no longer available.

Another type of change which can be made to the display configuration of the computer is the addition or removal of a display device. In the example of FIG. 3, for instance, either one of the display devices 12 or 13 could be disconnected from its associated video card 14 or 14'. Furthermore, if only one display device is present, it could be disconnected from one of the video cards 14 and connected to the other video card 14'. Whenever a change of this nature occurs, an interrupt is sent to the device manager 48. For instance, the interrupt could be generated by the video card, upon detecting that a display device has been physically connected to or disconnected from it. Alternatively, the interrupt could be provided by a bus that is capable of detecting such a change.

The addition or removal of other types of hardware can also result in a change in the display configuration of the computer system. For example, a graphics accelerator card can be added to the system by means of a PC Card slot. Again, upon the addition or removal of such a device, an interrupt signal IRQ is sent to the device manager.

The present invention is particularly directed to the situation in which the device that is added to or removed from the computer system is related to the display function. In the past, it was necessary to reboot the computer system in order for a change in video hardware to become effective. More particularly, unless a reboot occurred, the operating system was not prompted to undertake any action which would cause it to detect the presence of a new device, resulting from the addition of an associated hardware device. Hence, it was necessary for the user to interrupt the operating state of the computer in order to utilize the additional functionality provided by a newly added hardware. Once the operating system became aware of the presence of the new device, it could notify the display manager to incorporate the presence of the new frame buffer.

In accordance with the present invention, however, the display system can be immediately responsive to the addi-

tion of a new device to the display manager, so that it can directly account for the presence or absence of a particular video device.

To this end, whenever a PC Card is added to or removed from the computer system, the device manager determines whether the card relates to a display function. A similar determination is made whenever an interrupt is generated that indicates some other type of hardware has been added or removed, e.g. a floppy monitor. In addition to, or in lieu of, interrupts, other approaches can be employed to determine when a device has been added or removed. For example, the operating system can periodically poll all of the computer system's I/O ports, to determine which devices are present and which ones might have been removed.

Referring to FIG. 8, upon receipt of an indication that there has been a change in configuration, the device manager first determines at step 50 whether a device has been added or removed. If a device has been added to the system, the device manager communicates with the device to determine its type, at step 52, and stores data in a register regarding the identity and type of the device. If the device responds with an indication that it is a video device, the device manager issues a call to the display manager 22, at step 54. Appropriate parameters can be included with the call, to indicate the type of device, the size of its frame buffer (if applicable), its resolution, and the like.

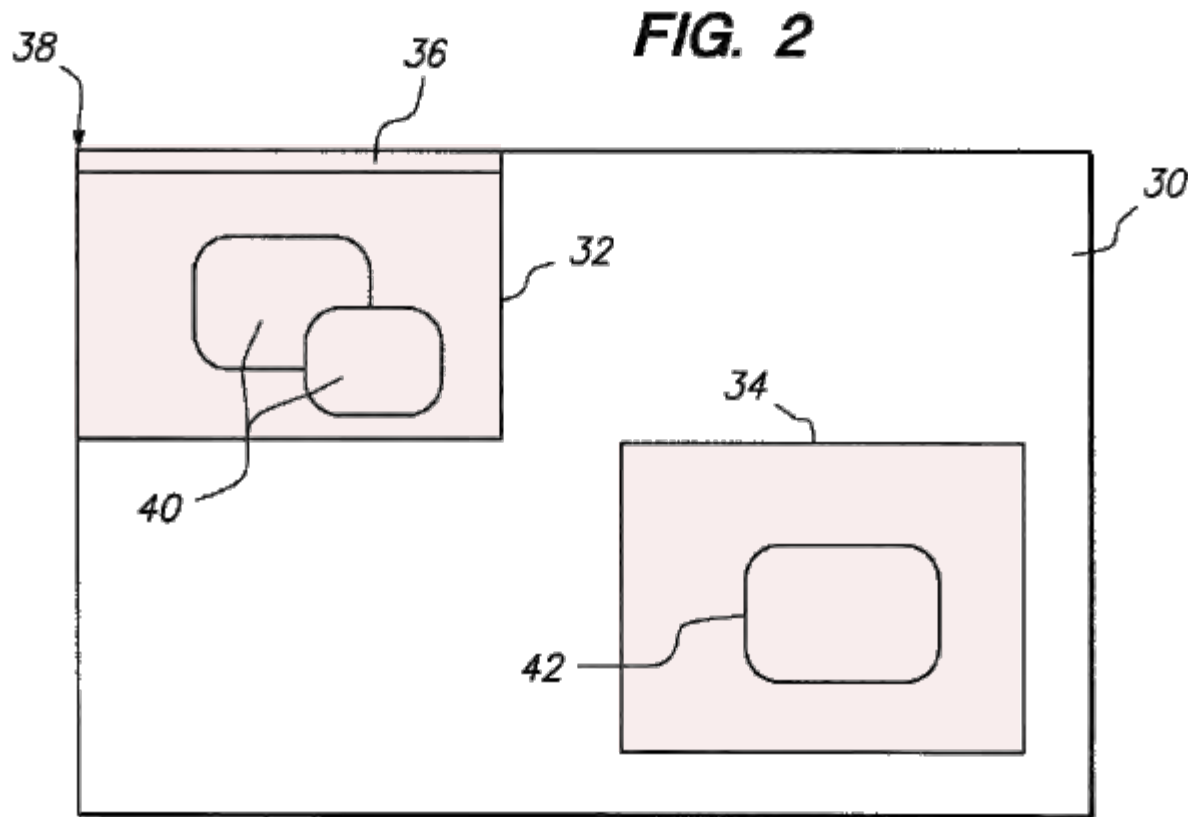
In response to this information, the display manager carries out a number of operations, depicted in steps 56-64. First, it registers the added hardware as a new device, along with the location of its associated drivers in memory, at step 56. In some cases, the driver may already be present in memory, but in an inactive state because the device was not connected to the system at the time of initial boot. In this case, the display manager switches the driver to an active state.

After registering the device, the display manager matches each display device with an available frame buffer at step 58. If a new video card is inserted, for example, the display manager assigns a portion of the global coordinate space 30 to the frame buffer in the video card. If a display device is connected to that video card, the display manager assigns that device to the frame buffer for that card, so that the proper data is displayed on the device. If a display device is disconnected from one video card and connected to a different video card, the display manager moves objects within the global space 30 so that they are presented to the appropriate frame buffer for the display device. For example, the display manager can move user interface control objects which are specific to that display, such as brightness and contrast controls, to the frame buffer associated with that display. Similarly, if the display has other attributes associated with it, such as a certain name or designation, the display manager ensures that they are directed to the proper frame buffer.

Once the display device and frame buffers are matched up, the display manager consults a preferences file which indicates whether that device was connected to the system at some previous time. This file is preferably stored in permanent memory, such as a hard disk, and updated each time a

The Display Space Patents Technology

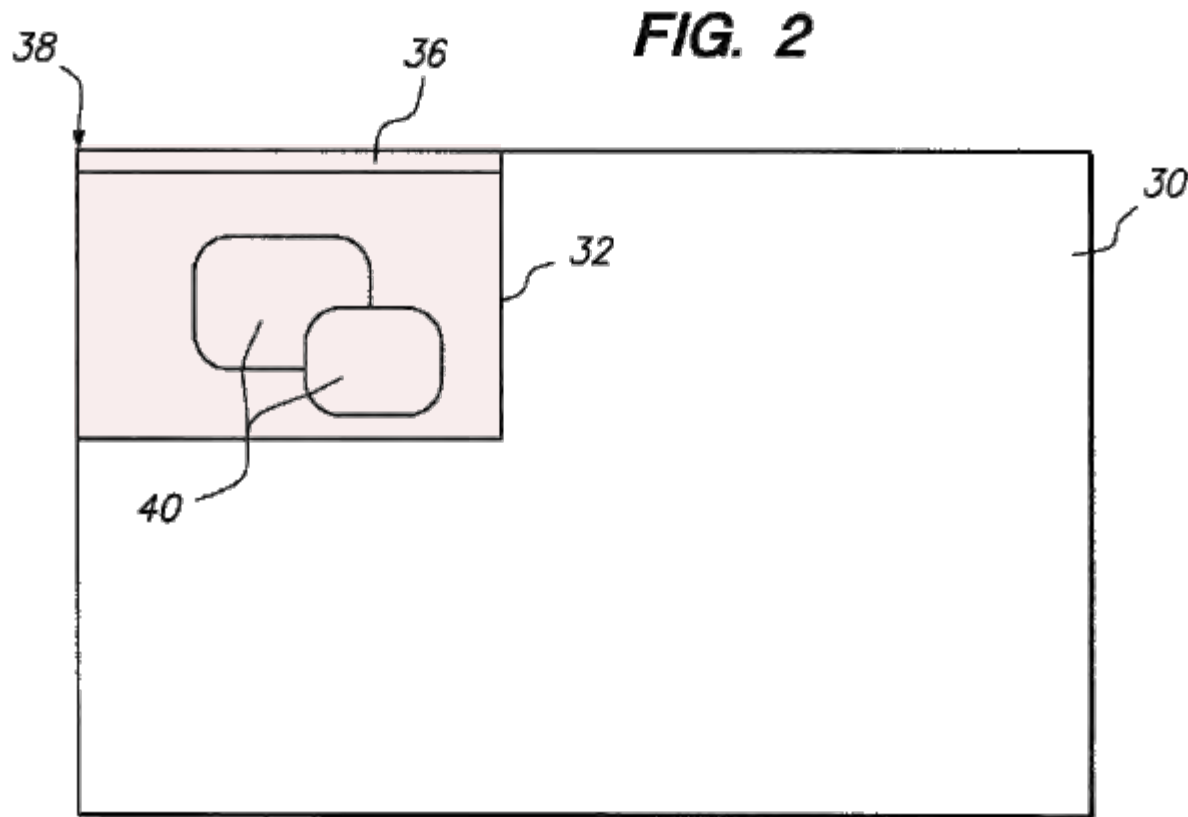
Using A Display Space To Display Images



'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images



'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

“If a display device is disconnected from one video card and connected to a different video card, the display manager moves objects within the global space 30 so that they are presented to the appropriate frame buffer for the display device.”

‘646 patent at 6:51-55

5
within the structure of the computer designed to be repeatedly inserted and removed. Additional video cards, however, may be inserted into and removed from the system. For example, the video card might be a standard desktop form factor for a PC, which is inserted into and removed from the computer with different among the types of video cards that are used as modems, facsimile devices, wireless communications devices.

Devices of this type, which are commonly known as "PC Cards," are inserted and removed from the system, and the detection of the presence of such a card is handled by the computer's operating system that is connected to the device manager. Referring to FIG. 4, inserted into the housing of the computer 40, or equivalent sensor device, which sends an interrupt signal 180 to the device manager 48. In response to this interrupt, the device manager determines the type of device which has been inserted, and informs the operating system 18. In a similar manner, whenever the PC Card is removed from the computer housing, an interrupt is also sent to the device manager, which in turn notifies the operating system that the device is no longer available.

Another type of change which can be made to the display configuration of the computer is the addition or removal of a display device. In the example of FIG. 3, for instance, either one of the display devices 12 or 14 could be disconnected from its associated video card 14 or 14. Furthermore, if only one display device is present, it could be disconnected from one of the video cards 14 and connected to the other video card 14. Whenever a change of this nature occurs, an interrupt is sent to the device manager 48. For instance, the interrupt could be generated by the video card, upon detecting that a display device has been physically connected to or disconnected from it. Alternatively, the interrupt could be provided by a bus that is capable of detecting such a change.

The addition or removal of other types of hardware can also result in a change in the display configuration of the computer system. For example, a graphics accelerator card can be added to the system by means of a PC Card slot. Again, upon the addition or removal of such a device, an interrupt signal 180 is sent to the device manager.

The present invention is particularly directed to the situation in which the device that is added to or removed from the computer system is related to the display function. In the past, it was necessary to reboot the computer system in order for a change in video hardware to become effective. More particularly, unless a reboot occurred, the operating system was not prompted to undertake any action which would cause it to detect the presence of a new device, resulting from the addition of an associated hardware device. Hence, it was necessary for the user to attempt the operating state of the computer in order to utilize the additional functionality provided by a newly added hardware. Once the operating system became aware of the presence of the new device, it could notify the display manager to incorporate the presence of the new frame buffer.

In accordance with the present invention, however, the display system can be immediately responsive to the addi-

tion of an I/O device. Upon detecting that there has been a change in configuration, the device manager first determines at step 50 whether a device has been added or removed. If a device has been added to the system, the device manager communicates with the device to determine its type, at step 52, and stores data in a register regarding the identity and type of the device. If the device responds with an indication that it is a video device, the device manager issues a call to the display manager 22, at step 54. Appropriate parameters can be included with the call, to indicate the type of device, the size of its frame buffer (if applicable), its resolution, and the like.

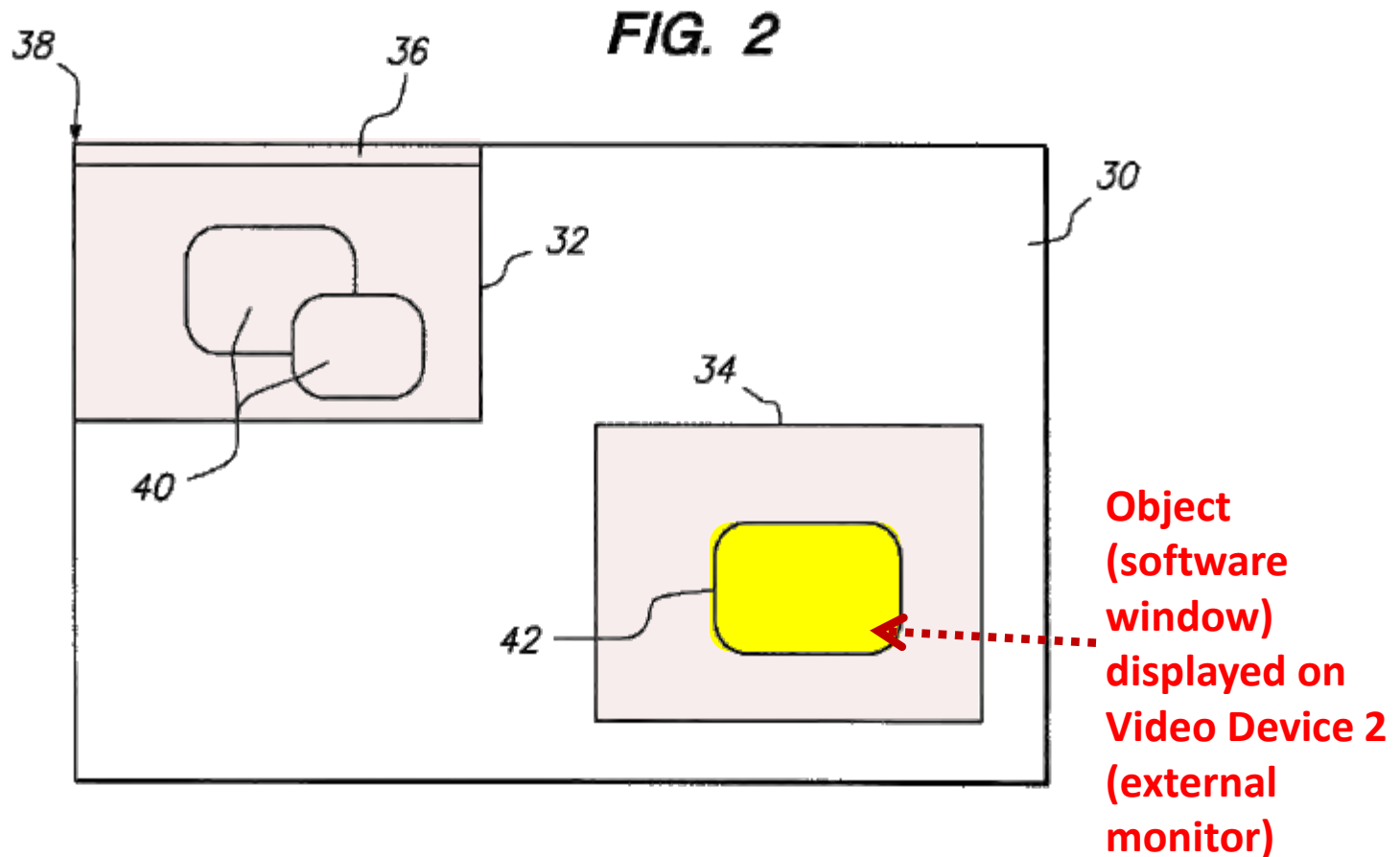
In response to this information, the display manager carries out a number of operations, depicted in Steps 56-64. First, it registers the added hardware as a new device, along with the location of its associated drivers in memory, at step 56. In some cases, the driver may already be present in memory, but in an inactive state because the device was not connected to the system at the time of initial boot. In this case, the display manager switches the driver to an active state.

After registering the device, the display manager matches each display device with an available frame buffer at step 68. If a new video card is inserted, for example, the display manager assigns a portion of the global coordinate space 30 to the frame buffer at the video card. If a display device is connected to that video card, the display manager assigns that device to the frame buffer for that card, so that the proper data is displayed on the device. If a display device is disconnected from one video card and connected to a different video card, the display manager moves objects within the global space 30 so that they are presented to the appropriate frame buffer for the display device. For example, the display manager can move user interface control objects which are specific to that display, such as brightness and contrast controls, to the frame buffer associated with that display. Similarly, if the display has other attributes associated with it, such as a certain name or designation, the display manager ensures that they are directed to the proper frame buffer.

Once the display devices and frame buffers are matched up, the display manager consults a preferences file which indicates whether that device was connected to the system at some previous time. This file is preferably stored in permanent memory, such as a hard disk, and updated each time a

The Display Space Patents Technology

Using A Display Space To Display Images

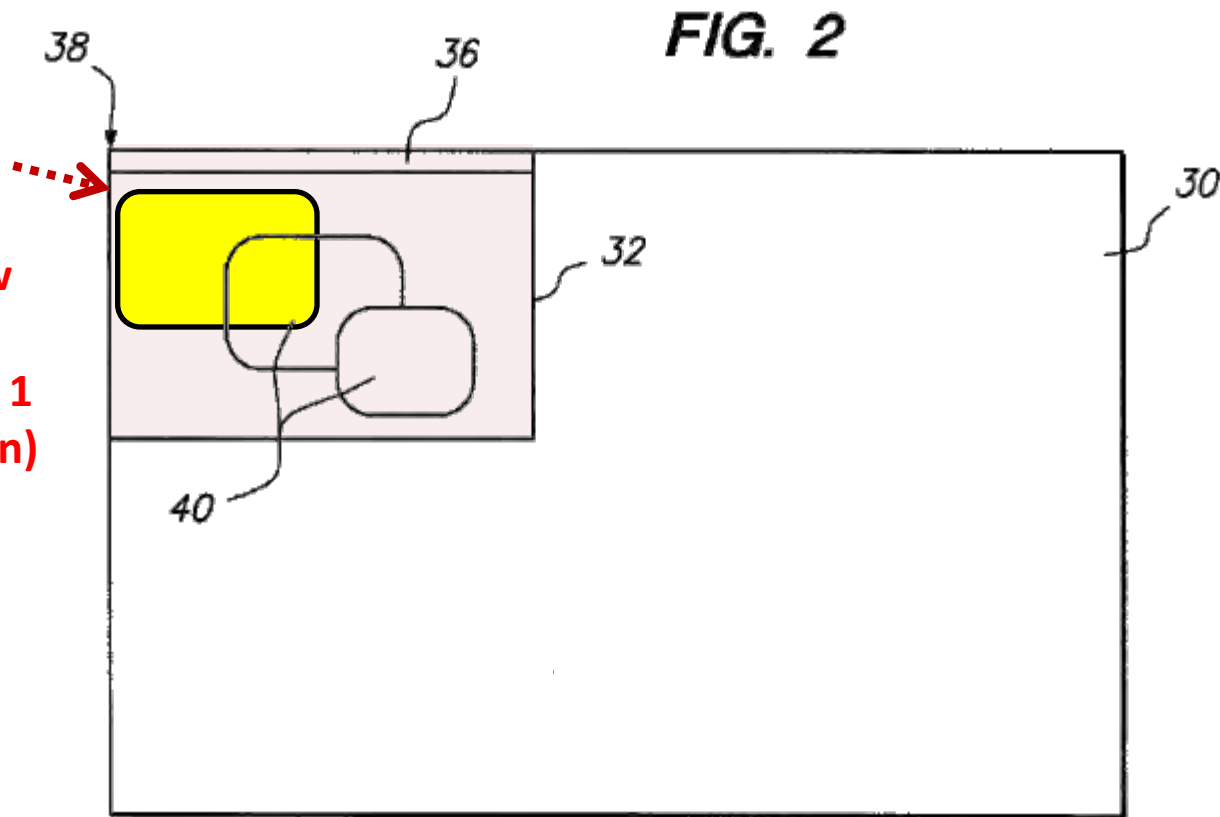


'646 patent at Figure 2

The Display Space Patents Technology

Using A Display Space To Display Images

**Object
(software
window) now
displayed on
Video Device 1
(laptop screen)
After Video
Device 2 was
removed**



'646 patent at Figure 2

The Display Space Patents Technology

The Patents Reconfigure A “Display Space”

- **The patents do not disclose or suggest reserving separate portions of memory for each video device.**
- **Rather, the Display Space patents disclose reconfiguring the shared “Display Space” through the use of a “Device Manager” and “Display Manager.”**

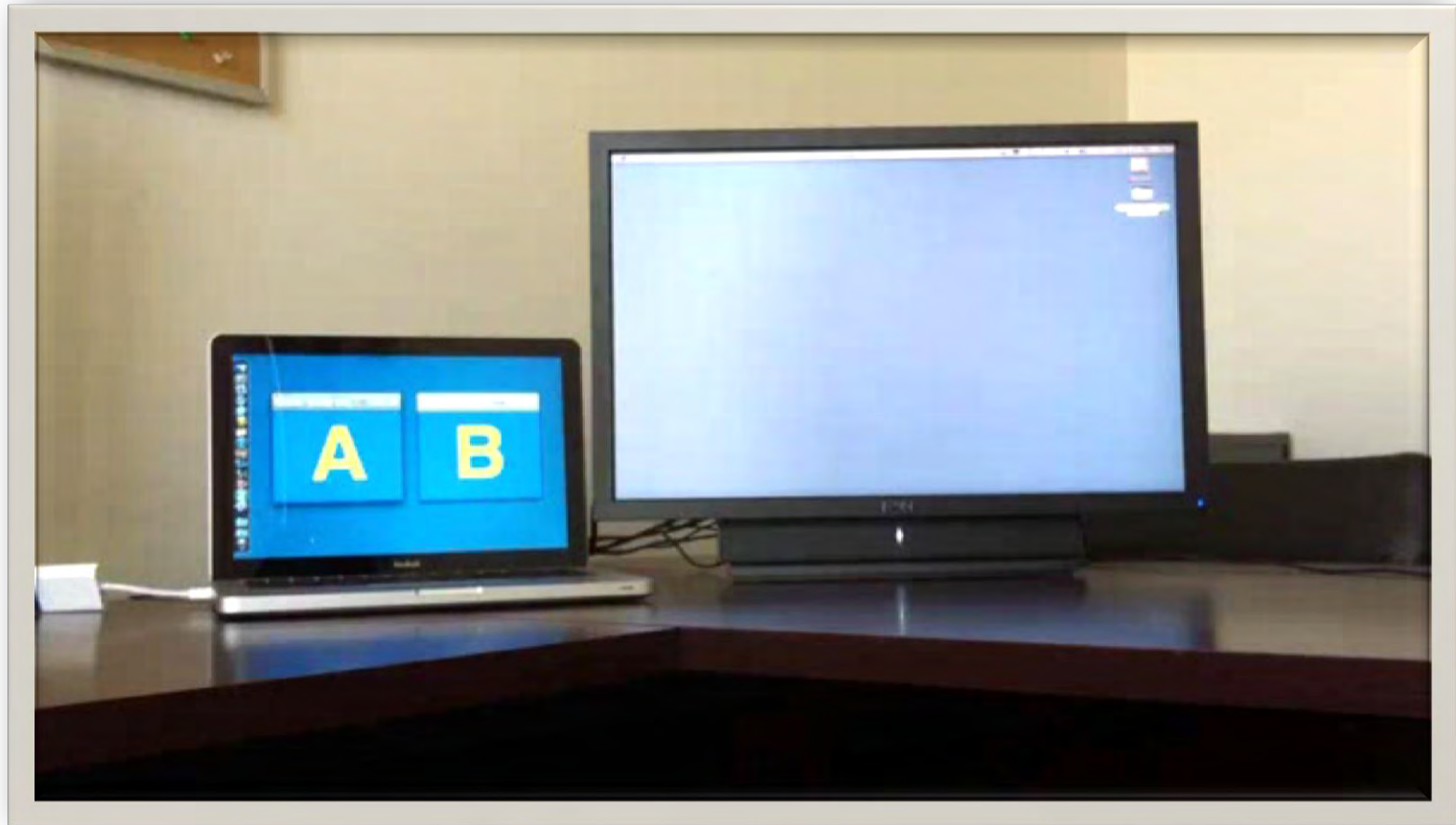
The Display Space Patents

II. Apple's Embodiments: Apple Computers

Apple's Embodiments

- 1. All video devices can share the Display Space, so that all attached video devices share a global coordinate system.**
- 2. When a video device is added or removed to the computer system, the allocation of the Display Space is modified.**
- 3. Because all video devices share the Display Space, icons and other graphical objects can be moved among the attached video devices.**

Apple's Embodiments



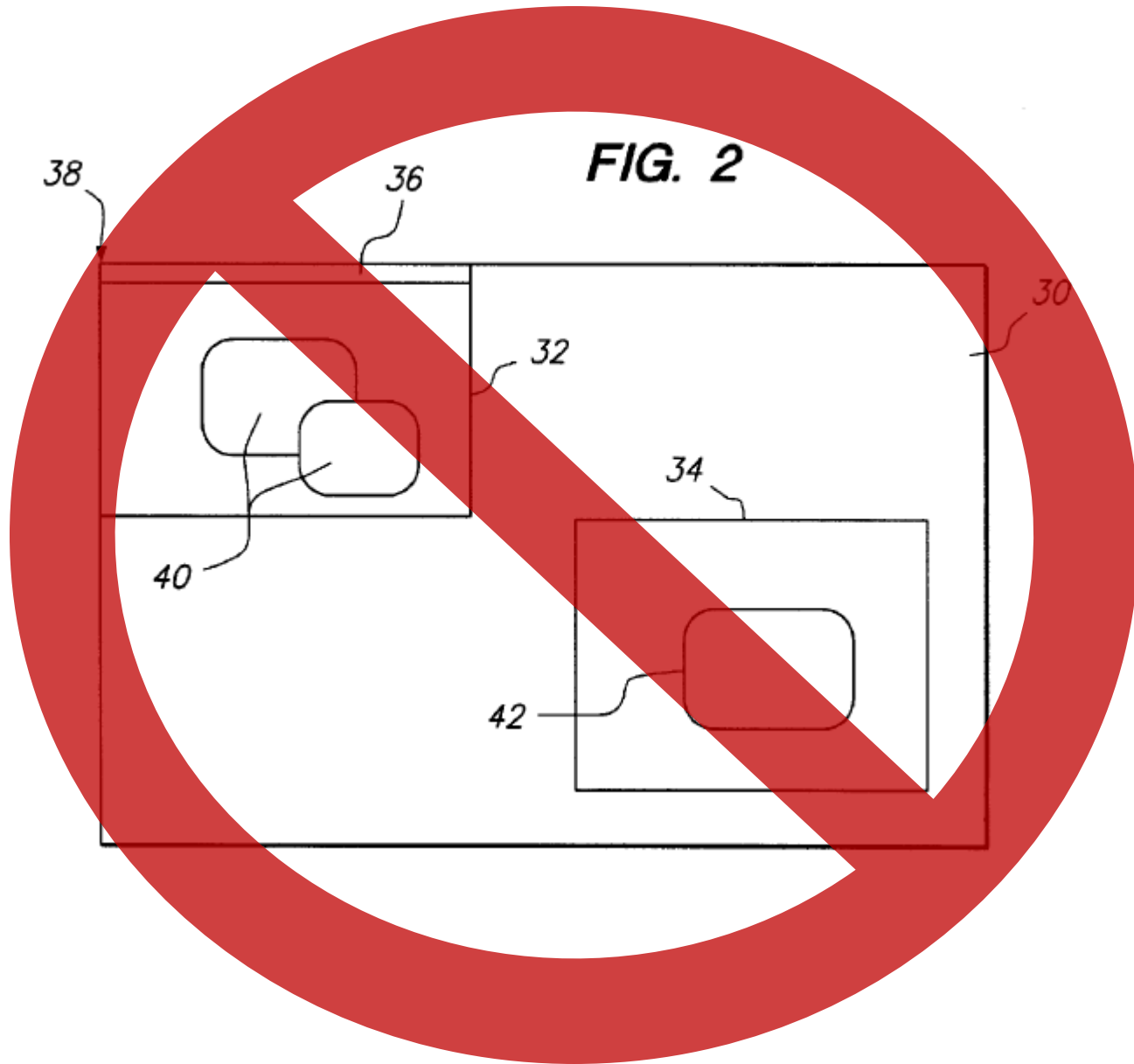
III. Accused Motorola devices

Accused Motorola devices

- Apple accuses 3 Motorola devices of infringing the Display Space patents.



Accused Motorola devices



Accused Motorola devices

- **Apple accuses Motorola devices that do not create or modify the allocation of a display space.**
- **Instead, Motorola devices reserve separate, distinct portions of memory for each video device.**



MOTOROLA

U.S. Patent No. 5,621,456

U.S. Patent No. 5,594,509

U.S. Patent No. 5,583,560

Apple Patents
(the “Florin patents”)

The Florin set-top box interface patents



US005583560A

United States Patent [19] **Patent Number:** 5,583,560
Florin et al. [45] **Date of Patent:** Dec. 10, 1996

[54] **METHOD AND APPARATUS FOR AUDIO-VISUAL INTERFACE FOR THE SELECTIVE DISPLAY OF LISTING INFORMATION ON A DISPLAY** 48879 2/1990 Japan H04N 5/445
 8601962 3/1986 WIPO .
 (List continued on next page.)

[75] **Inventors:** Fabrice Florin, Mill Valley; Michael Buettner, Burlingame; Glenn Corey, San Rafael; Janey Fritsche, Mill Valley; Peter Maresca, Palo Alto; Peter Miller, Los Altos Hills; Bill Purdy, San Anselmo; Stuart Sharpe; Nick West, both of San Francisco, all of Calif. 42nd Annual Convention and Exposition of the National Cable Television Association, Jun. 6, 1993, SF, CA, pp. 82-89, Mack Daily "Addressable Decoder With Downloadable Operation".
 (List continued on next page.)

[73] **Assignee:** Apple Computer, Inc., Cupertino, Calif. *Primary Examiner*—John K. Peng
Assistant Examiner—Chris Grant
Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman

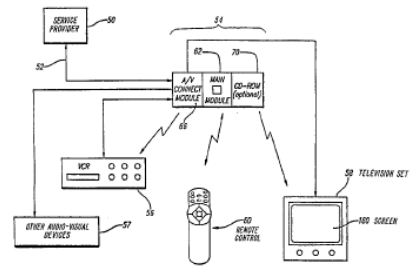
[21] **Appl. No.:** 82,081
 [22] **Filed:** Jun. 22, 1993
 (Under 37 CFR 1.47)

[51] **Int. Cl.:** H04N 7/173
 [52] **U.S. Cl.:** 348/7; 348/12; 348/13; 455/5.1; 455/4.2
 [58] **Field of Search:** 348/7, 10, 12, 348/734, 906, 563, 564, 565, 566, 567, 455/4.2, H04N 7/16, 7/173, 5/44, 5/445, 5/100

[56] **References Cited**
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 Re. 34,340 8/1993 Freeman 358/86
 4,290,142 9/1981 Schnee et al. 455/3
 (List continued on next page.)

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 393555 10/1990 European Pat. Off. H04N 7/087
 420123 4/1991 European Pat. Off. H04N 5/782
 74476 4/1986 Japan H04N 5/445

16 Claims, 50 Drawing Sheets



U.S. Patent No. 5,583,560
Method and Apparatus for Audio-Visual Interface for the Selective Display of Listing Information on a Display

U.S. Pat. No. 5,594,509
Method and Apparatus for Audio-Visual Interface for the Display of Multiple Levels of Information on a Display

U.S. Pat. No. 5,621,456
Methods and Apparatus for Audio-Visual Interface for the Display of Multiple Program Categories

The Florin set-top box interface patents

United States Patent [19]
Florin et al.

[11] Patent Number: 5,583,560
[45] Date of Patent: Dec. 10, 1996



[54] METHOD AND APPARATUS FOR AUDIO-VISUAL INTERFACE FOR THE SELECTIVE DISPLAY OF LISTING INFORMATION ON A DISPLAY

48879 2/1990 Japan H04N 5/445
8601962 3/1986 WIPO .

(List continued on next page.)

OTHER PUBLICATIONS

42nd Annual Convention and Exposition of the National Cable Television Association, Jun. 6, 1993, SF, CA, pp. 82-89, Mack Daily "Addressable Decoder With Downloadable Operation".

(List continued on next page.)

Primary Examiner—John K. Peng
Assistant Examiner—Chris Grant
Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman

[57] ABSTRACT

An interactive audio-visual (A/V) transceiver is advantageously coupled to a television and/or telephone (T/T) cable, a TV, a video recorder (VCR), and other A/V devices. The A/V transceiver switches data between a program/service provider and the connected A/V devices. In one embodiment, the transceiver includes three primary modules, a main module including a CPU, a system bus, system memory, an infra-red (IR) control unit, an audio-visual bus, an A/V decoder, an A/V processor, and an A/V encoder, an A/V connect module including a number of tuner/demodulators and a switch, and an optional CD ROM module. The A/V transceiver hardware is complemented with an operating system and software program which supports the functions provided in the A/V user interface. Additionally, a remote control device is provided to communicate with the A/V transceiver to interactively manage selection of program and service sources, selection program and service offerings from any selected source, viewing of selected program offerings, and interaction with selected service offerings. The remote control device is advantageously provided with a basic A/V control button group, an interactive control button group, an auxiliary control button group and a numeric key pad to facilitate control of the transceiver. The interactive control button group includes an info button, a list button, a categories button, a pix button, a mark button, a jump button, and a pointing device consisting of up, down, left, and right arrow buttons, and a center select button.

[75] Inventors: Fabrice Florin, Mill Valley; Michael Buettner, Burlingame; Glenn Corey, San Rafael; Janey Fritsche, Mill Valley; Peter Maresca, Palo Alto; Peter Miller, Los Altos Hills; Bill Purdy, San Anselmo; Stuart Sharpe; Nick West, both of San Francisco, all of Calif.

[73] Assignee: Apple Computer, Inc., Cupertino, Calif.

[21] Appl. No.: 82,081

[22] Filed: Jun. 22, 1993

(Under 37 CFR 1.47)

[51] Int. Cl.⁶ H04N 7/173

[52] U.S. Cl. 348/7; 348/12; 348/13; 455/5.1; 455/4.2

[58] Field of Search 348/7, 10, 12, 348/734, 906, 563, 564, 565, 566, 567; 455/4.2; H04N 7/16, 7/173, 5/44, 5/445, 5/00

[56] References Cited

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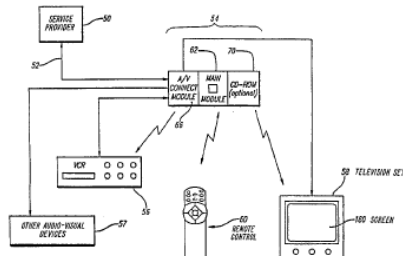
Re. 32,632 3/1988 Adkinson 340/709
Re. 34,340 8/1993 Freeman 358/86
4,290,142 9/1981 Schnee et al. 455/3

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0239884 10/1987 European Pat. Off. .
393555 10/1990 European Pat. Off. H04N 7/087
420123 4/1991 European Pat. Off. H04N 5/782
74476 4/1986 Japan H04N 5/445

16 Claims, 50 Drawing Sheets



'560, '456 and '509 patents

- Inventors: Fabrice Florin, et al.
- Priority date: June 22, 1993
- Identical patent specifications and drawings in all patents

I. Set-top Box and Related Technology

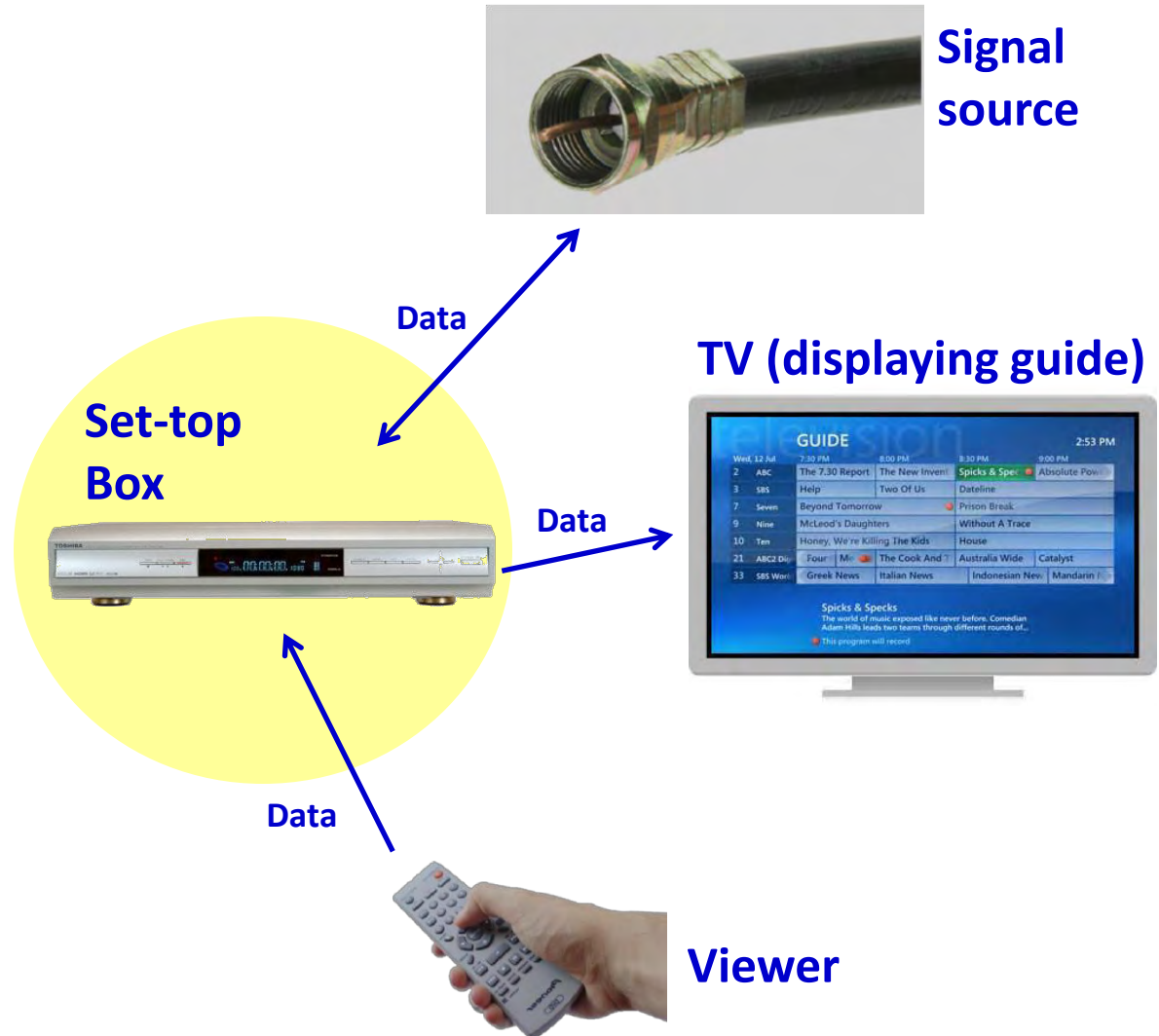
Set-top box technology

Set-top box

A computerized device that lets audio-visual programs and graphics display on TV

Where?

Generally, in the viewer's home, it connects a signal source (cable, satellite, etc.) to the television

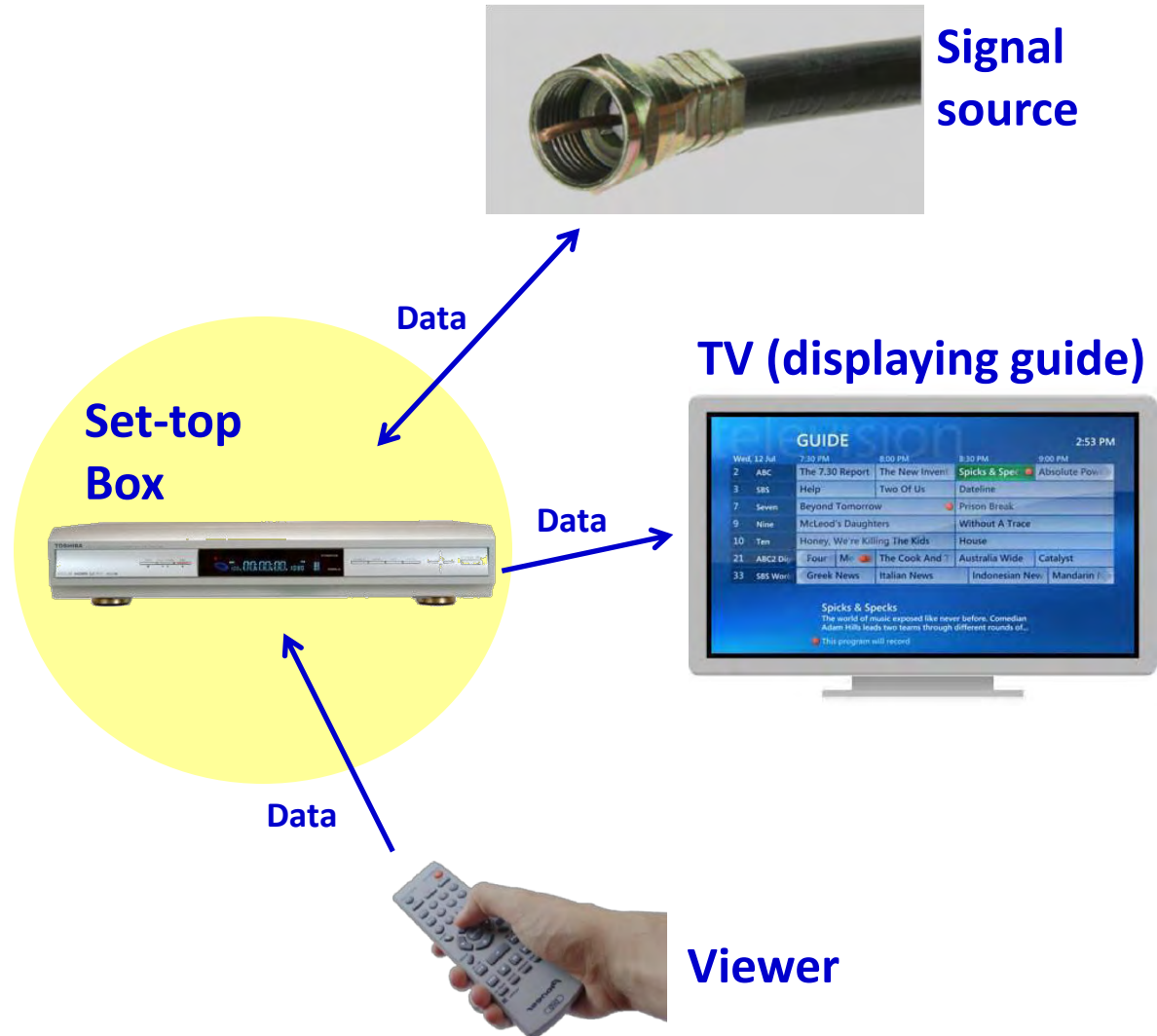


Set-top box technology

How used

Viewer uses remote control to order set-top box to:

- Select TV content
- View program info
- Record content
- Other (pay bills, order movies, etc.)



Set-top box hardware

Includes:

- CPU (central processing unit)
- System memory (stores data)
- Connections (switches, ports, bus wires, etc.)



Interior of Phillips DVDR 3460 set-top box



Connector ports on Sharp TU-T2HR32 set-top box

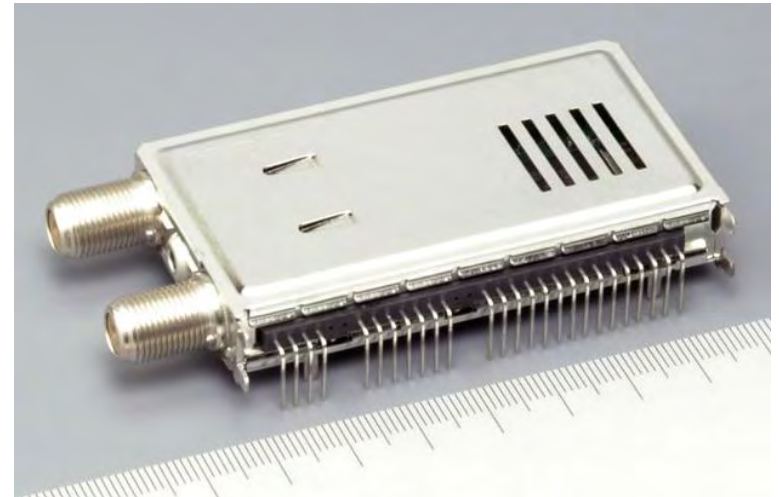


An Intel CPU

Set-top box hardware

Specialized A/V equipment

- Tuner (receives A/V signal, such as from a fiber cable)
- Demodulator (processes signal from the tuner into demodulated “bits”)
- Signal “decoder” (makes demodulated bits viewable on TV)



Alps Electric DVB-S2 Digital television tuner and demodulator (circa 2007)

Software: Graphical User Interface (“GUI”)

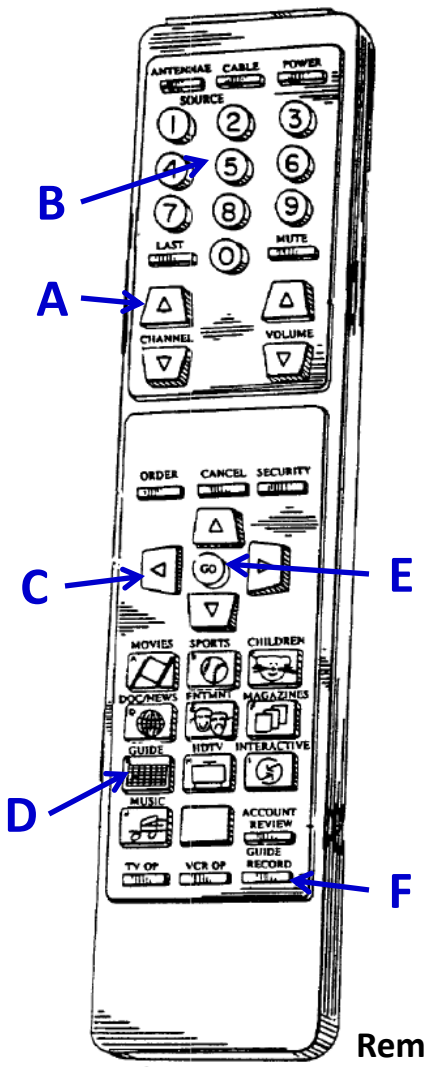
- **GUI:** a type of user interface generated by hardware and software



A set-top box GUI from Apple's EZTV prototype incorporated into Florin patents

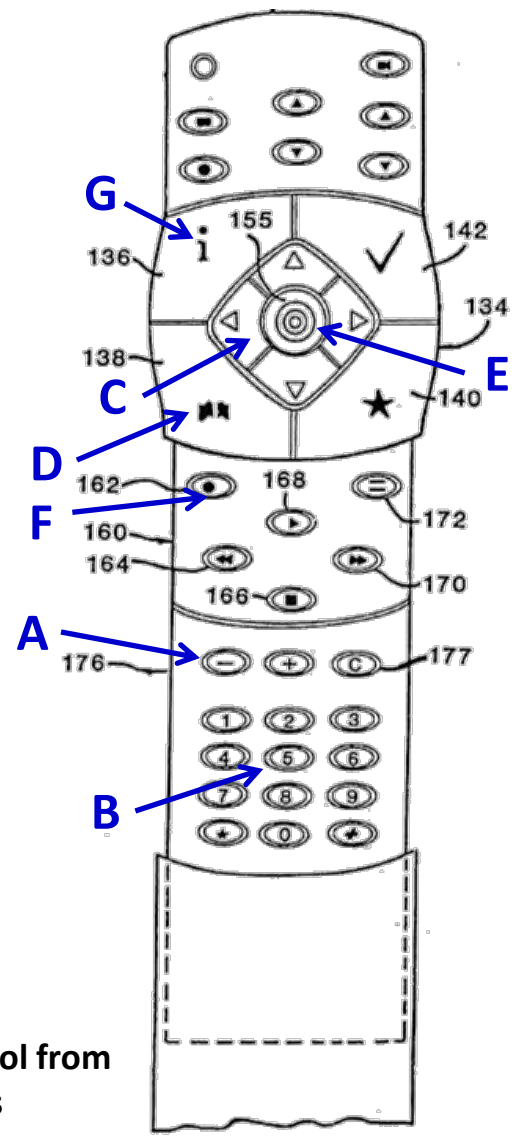
Remote control

Typical command buttons



Remote control from Hendricks patent application (1992)

- A) TV commands (channel up/down, volume, etc.)
- B) Numeric keypad
- C) Arrow keys
- D) TV guide
- E) Enter (or go, select, etc.)
- F) Record
- G) "Info"



Remote control from Florin patents

Prior art solutions

Set-top boxes and GUIs existed in 1993

1. The hardware existed

- Remote controls, tuners and demodulators, CPUs, etc.

2. The software existed

- GUIs let viewers interact with on-screen content using remotes

3. Interactive TV guides existed

- Viewers could highlight and select programs to watch or record

4. Picture-in-picture existed

- TVs were capable of both “split screen” and miniature windows

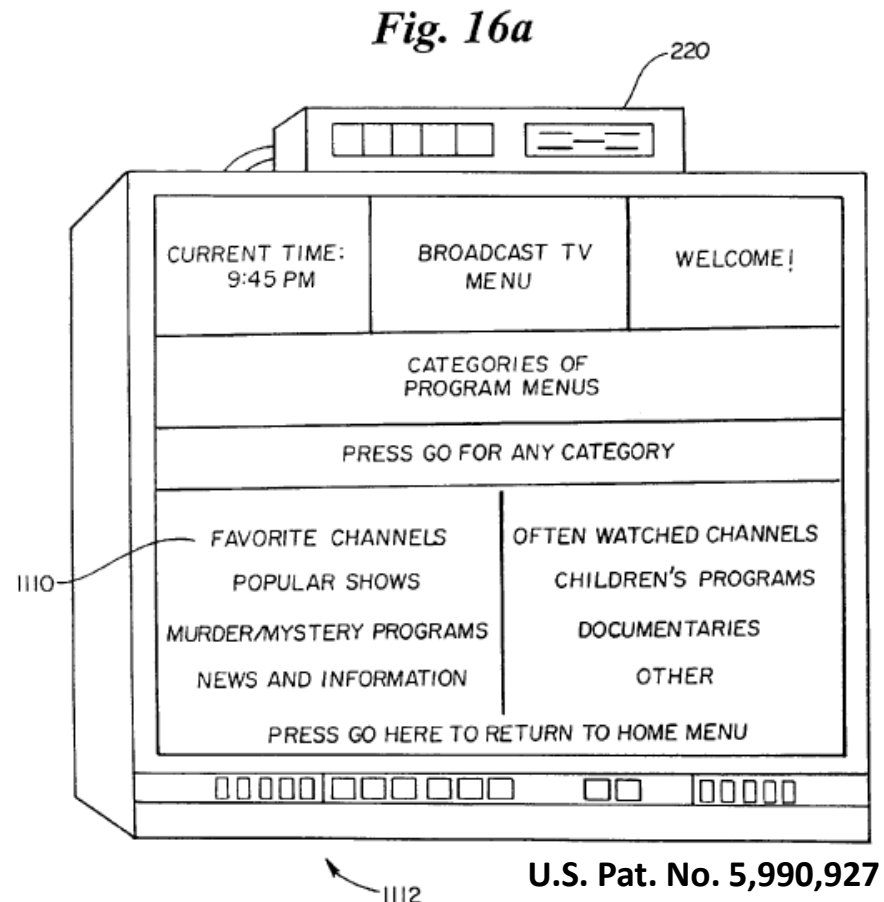
5. Several set-top systems were patented

- Discovery Channel (Hendricks), Starlight Telecast (Young), etc.

Prior art solutions

Example 1. U.S. Patent No. 5,990,927

- Priority date: December 9, 1992
- Interactive set-top box GUI developed by Discovery Channel
- GUI lets viewer highlight, select items from TV listing guide
- “Incremental levels of menu options” (‘927 patent at 12:53-54) let user get more information on selected items

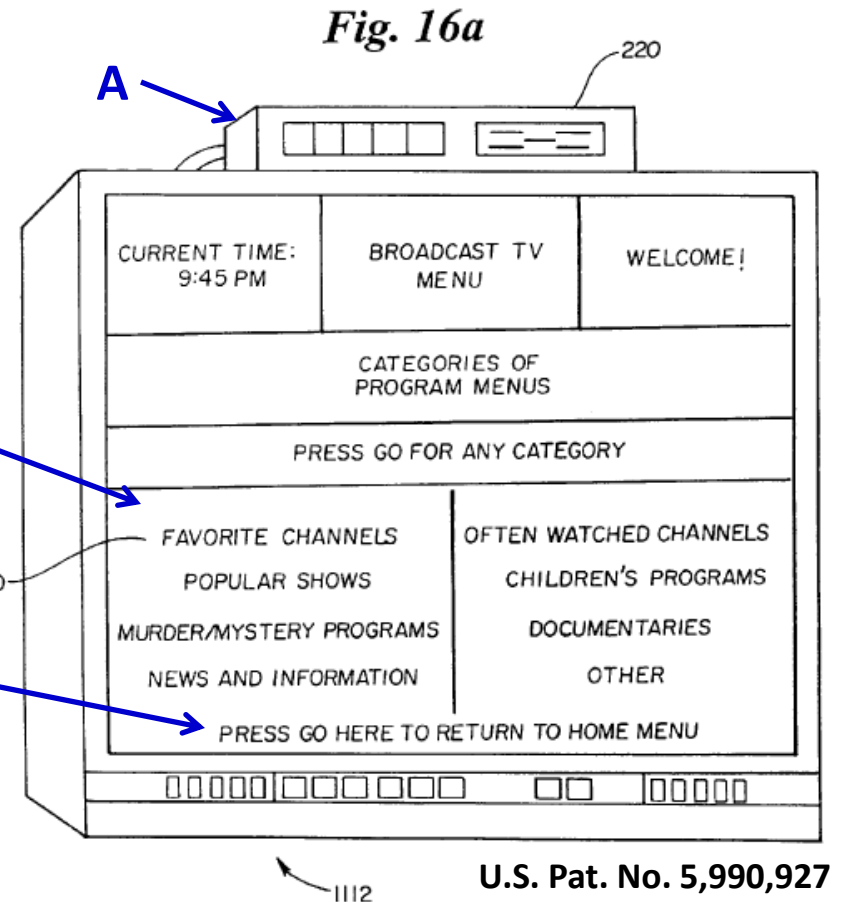
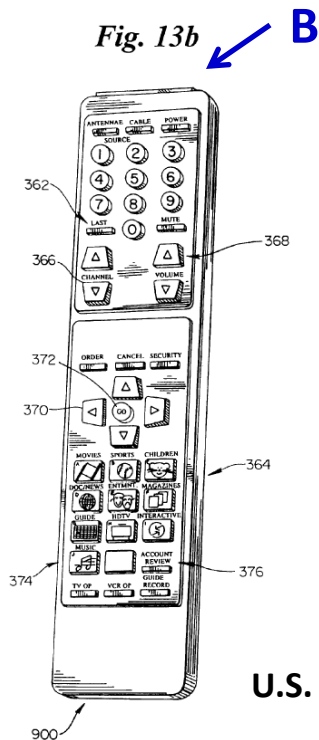


Prior art solutions

Example 1. U.S. Patent No. 5,990,927

How it worked:

- A) Set-top box hardware
- B) Remote control
- C) Interactive TV guide menu
- D) Pressing remote buttons selects highlighted menu items



Prior art solutions

Example 2. Canadian Pat. No. 2,553,384

- Priority date: 9/10/1990
- Interactive set-top box GUI developed by Starsight Telecast, Inc.
- GUI lets viewer highlight, select and mark items from TV listing guide
- Multiple levels let viewer get more information on selected items

	11:00 AM	11:30 AM	12:00 PM
[2]	JUDGE(PART 1)	JUDGE(PART 2)	AT NOON
[4]	GOLDEN GIRLS	NEWS ²⁶ ₄₆	INSIDE EDITION
[5]	YOUNG & RESTLESS		NEWS ²⁶
[7]	PERFECT STRA	LOVING	ALL MY CHILD
[9]	SESAME STREET ²⁶		
[13]	ALL MY CHILDREN		NEWS ²⁶
[44]	EVERYDAY		MOVIE
[A&E]	LORNE GREEN'S WORLD OF S		FUGITIVE
[CNN]	NEWS ²⁶		NEWS →
[DIS]	WALT DISNEY PRESENTS		LUNCH BOX
[LIF]	JANE WALLACE		FRUGAL GOURM
[TNT]	→ MOVIE ²⁶		
[CH 2]	[KNTV-FOX]	[CBL 2]	[11:25A] [TUE APR 3]

FIG. -5

Can. Pat. No. 2,553,384

Prior art solutions

Example 2. Canadian Pat. No. 2,553,384

- A) Set-top box displays on-screen TV guide
- B) Viewer uses remote control to select channels
- C) GUI highlights currently selected show
- D) Arrow buttons let user mark shows for recording, etc.

	11:00 AM	11:30 AM	12:00 PM
2	JUDGE(PART 1)	JUDGE(PART 2)	AT NOON
4	GOLDEN GIRLS	NEWS 26	INSIDE EDITION
5	YOUNG & RESTLESS	NEWS 26	NEWS 26
7	PERFECT STRA	LOVING	ALL MY CHILD
9	SESAME STREET 26		
13	ALL MY CHILDREN		NEWS 26
44	EVERYDAY		MOVIE
A&E	LORNE GREEN'S WORLD OF S		FUGITIVE
CNN	NEWS 26		NEWS
DIS	WALT DISNEY PRESENTS		LUNCH BOX
LIF	JANE WALLACE		FRUGAL GOURM
TNT	MOVIE 26		
CH 2	KNTV-FOX	CBL 2	11:25A TUE APR 3

5/25

Can. Pat. No. 2,553,384 FIG.-5

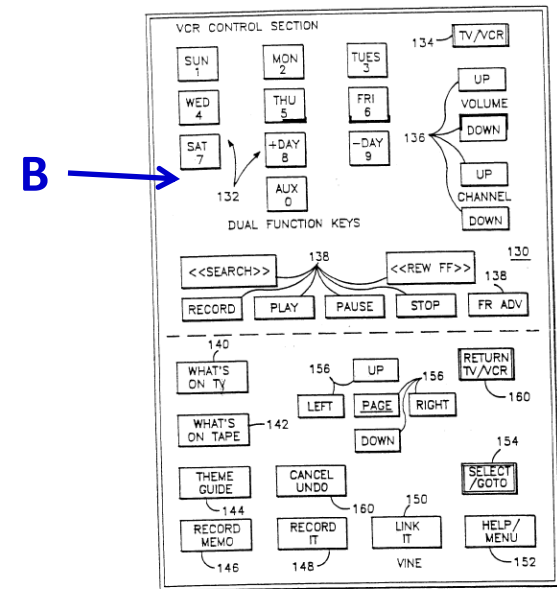


FIG.-21

Can. Pat. No. 2,553,384

II. The Florin Set-Top Box Patents

Purpose of Florin patents: Improved GUI

- **“Challenge:” Make easy, fun interface**

applications for home use. One of the biggest challenges for an interactive television service is the design of an interface that is easy and fun to use by average consumers.

'560 patent at 1:65-67

Purpose of Florin patents: Improved GUI

- **Solution: Improved, “user-friendly”
A/V user interface using remote control**

vision and other audio-visual programming. As will be described, the present invention provides methods and apparatus for presenting an improved audio-visual user interface,

other audio-visual devices. As will be disclosed, the present invention's user interface provides a user-friendly mechanism for consumers to view, record, and play back TV and A/V programs, as well as control other A/V home entertainment devices using a remote control device. Furthermore,

'560 patent at 2:18-22, 24-27

Purpose of Florin patents: Improved GUI

- Any A/V user interface is generated by both hardware and software

lators and a switch, and an optional CD ROM module. The A/V transceiver hardware is complemented with an operating system and software program which supports the functions provided in the A/V user interface. Additionally, a

'560 patent at Abstract;
'560 patent at 2:49-52

audio-visual display system. In addition, it will be noted that the present invention may be realized using a variety of computer hardware and computer software, and is not limited to any particular hardware or software systems.

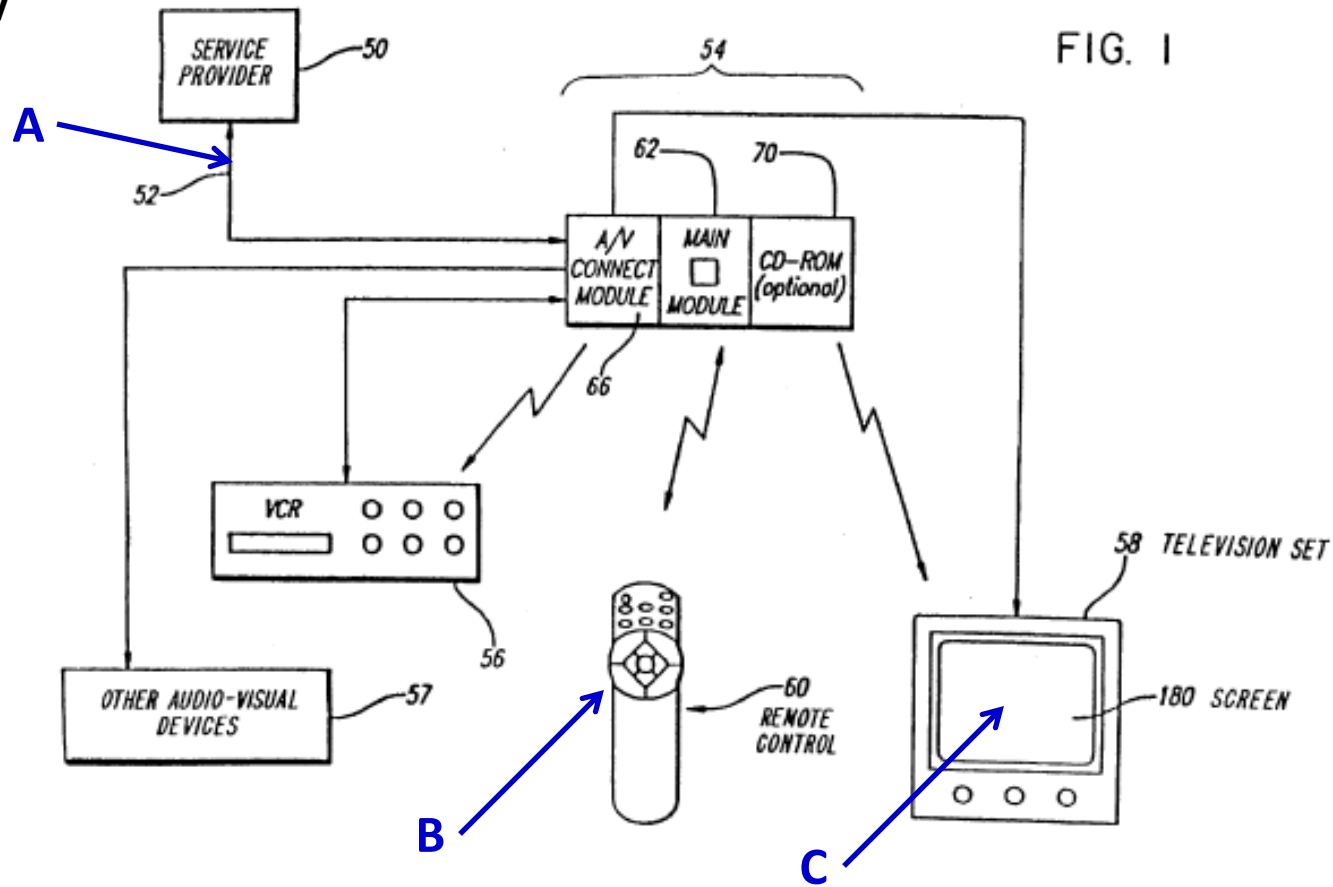
'560 patent at 24:64-67

Purpose of Florin patents: Improved GUI

- Lists 12 types of interfaces/functions:
 1. Full-Screen Viewing Function
 2. Information Function
 3. List Function
 4. Record Function
 5. Mark Function
 6. Jump Function
 7. Categories Function
 8. Pix Function
 9. Menu Function
 10. Pay-Per-View Interface
 11. Home Shopping Interface
 12. Other (e.g. financial transactions)
- Source: '560 patent 13:20-24:57*

Florin set-top box technology components

- A. Set-top box receives TV signals and program schedules from service provider (cable, satellite)
- B. Viewer uses remote to request program schedules and other data
- C. Set-top box hardware and software displays requested information on TV screen using improved GUI



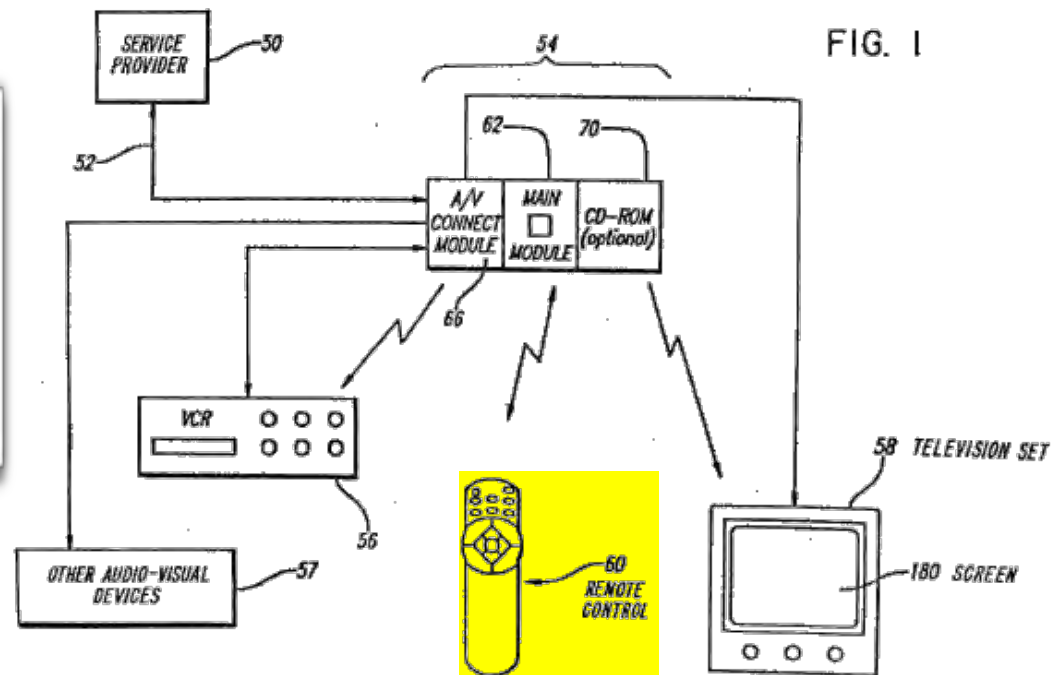
'560 patent at Fig. 1

Florin set-top box technology components

Viewer accesses interface with remote control

lators and a switch, and an optional CD ROM module. The A/V transceiver hardware is complemented with an operating system and software program which supports the functions provided in the A/V user interface. Additionally, a remote control device is provided to communicate with the A/V transceiver to interactively manage selection of program and service sources, selection program and service offerings from any selected source, viewing of selected program offerings, and interaction with selected service offerings. The remote control device is advantageously

'560 Patent at Abstract (cover page)

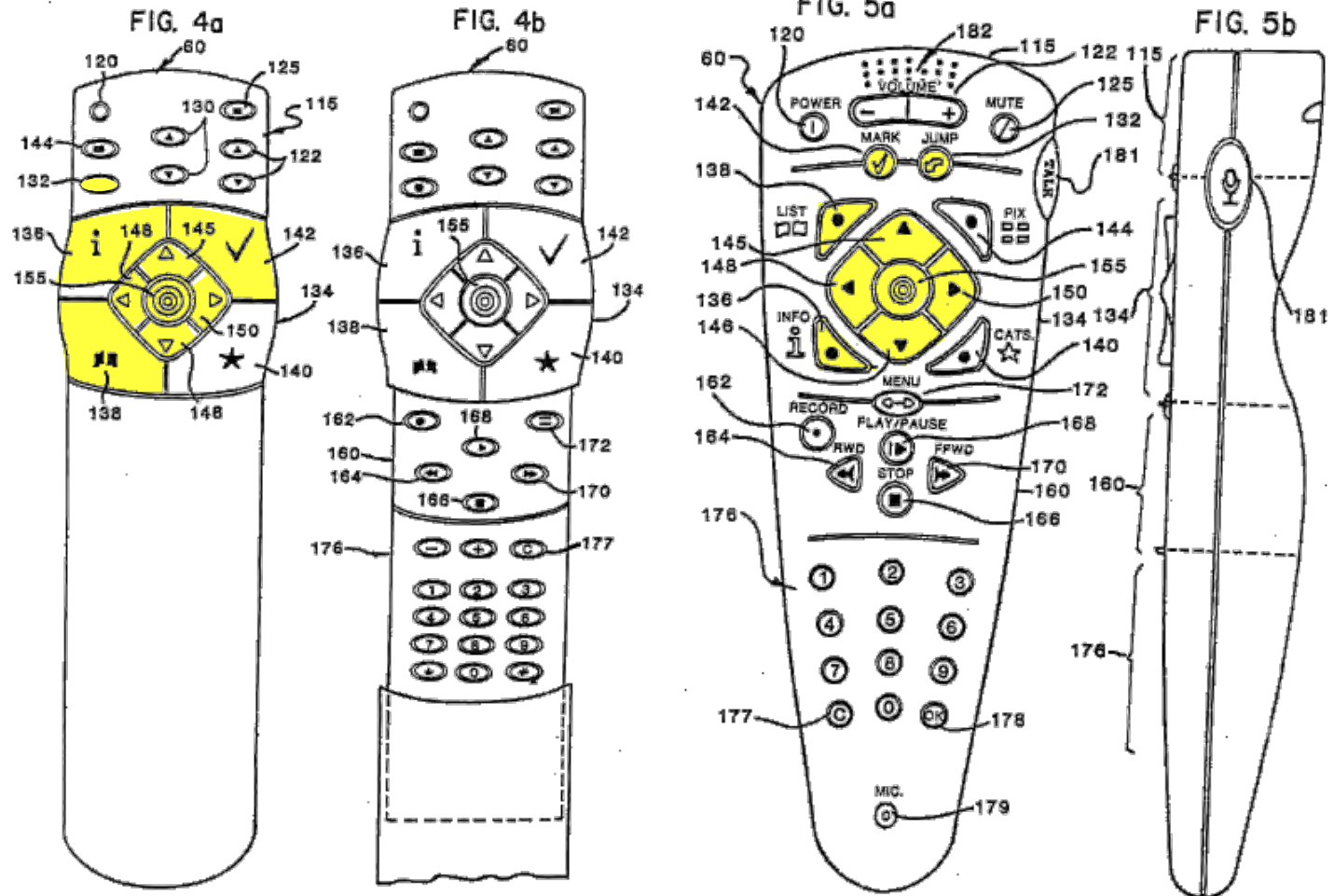


'560 patent at Fig. 1

Florin set-top box technology components

The remote control

- A) List
- B) Mark
- C) Info
- D) Jump
- E) Arrows
- F) Select



'560 patent at Figs. 4, 5

Florin set-top box technology components

In Florin patent, remote control is “in communication with” set-top box...

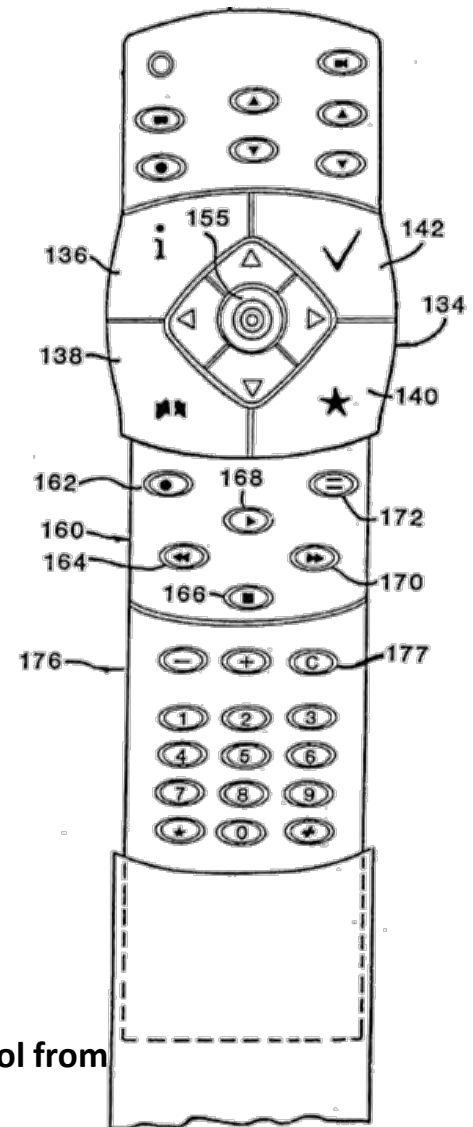
a controller **in communication with** said transceiver for permitting a user viewing said A/V display to selectively display said listing information on said A/V display;

'560 patent at Claim 1

...not “coupled to” it like other hardware components

memory (CD ROM) module 70. The main module 62 includes a central processing unit (CPU) 63 **coupled** over a system bus 64 to a system memory 65 and an infra-red (IR) control unit 82, which sends and receives wireless control signals to and from the remote control device 60. The CPU 63 is further **coupled** through the system bus 64 to a memory and bus controller 80, which is itself **coupled** through an A/V decoder 74 and an A/V encoder 78 to the A/V connect module 66, as well as to an optional CD ROM module 70. The CPU 63 is also **coupled** through the system bus 64, the memory and bus controller 80 and an A/V bus 73 to an A/V processor 77 and an optional A/V memory 75.

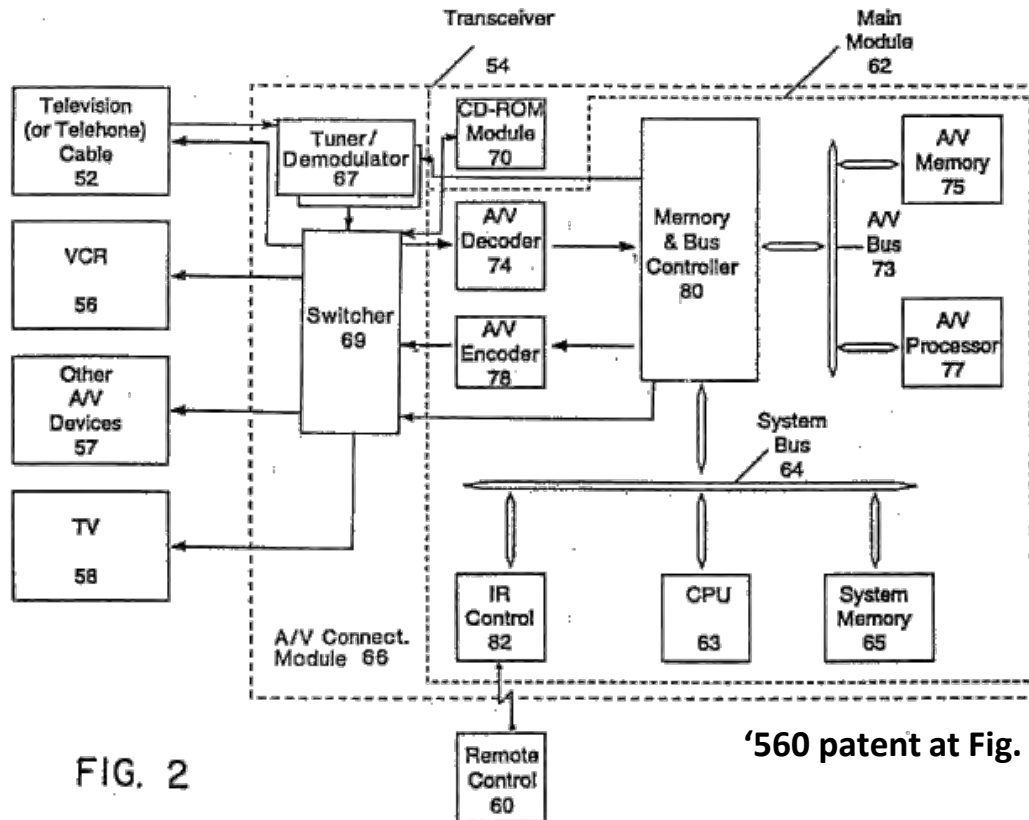
'560 patent at 8:40-51



Remote control from Florin patents

Steps of Florin set-top technology

Displaying A/V signals and graphics on TV



Steps of Florin set-top technology

A) Signal in from provider

Signal from source

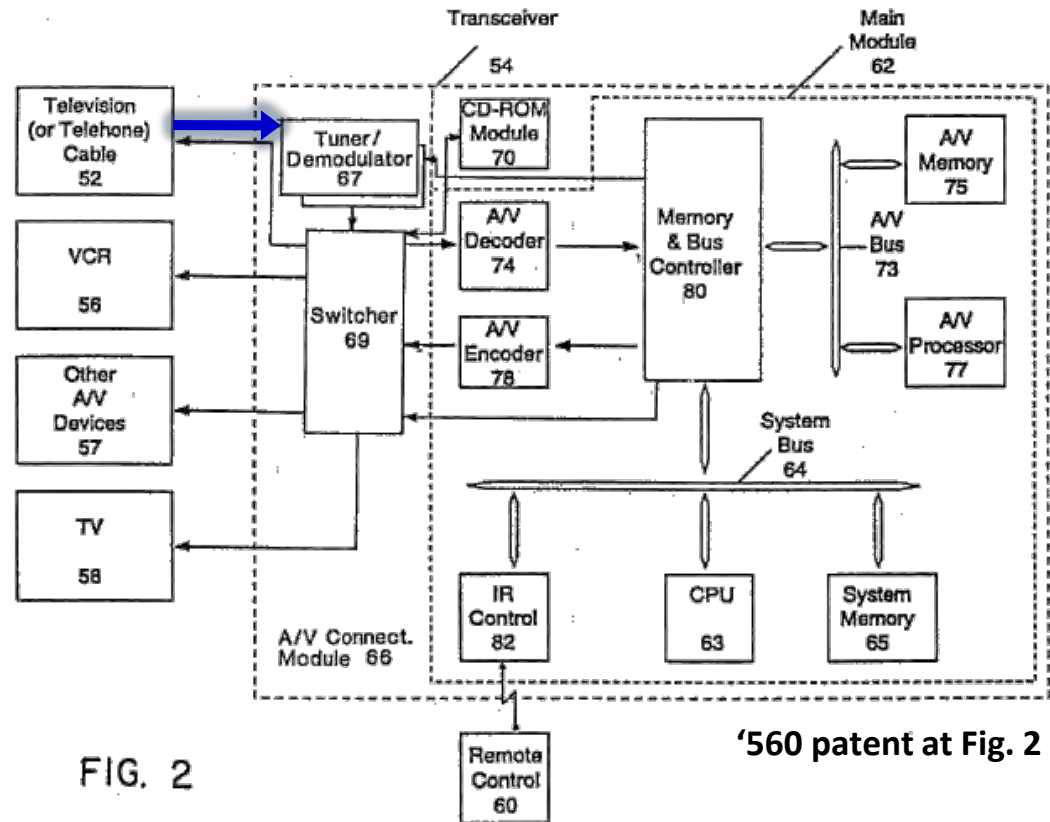


FIG. 2

'560 patent at Fig. 2

Steps of Florin set-top technology

- A) Signal in from provider
- B) Decoded program signal goes to TV

Signal from source

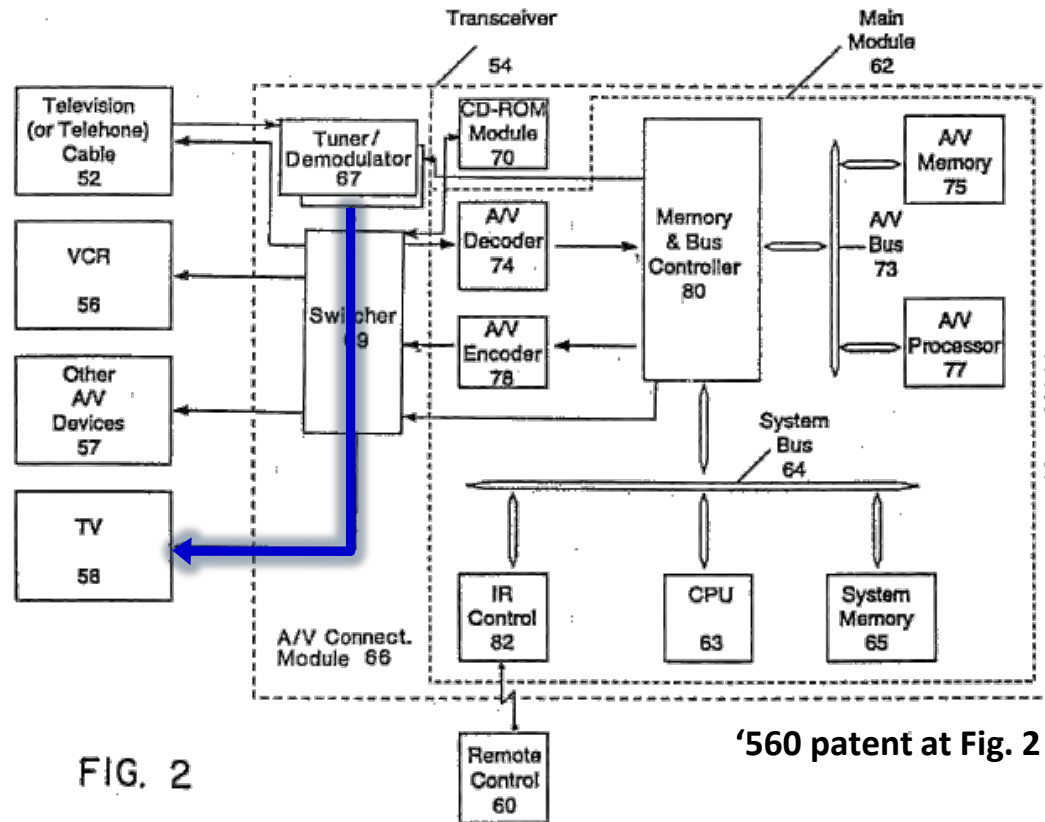


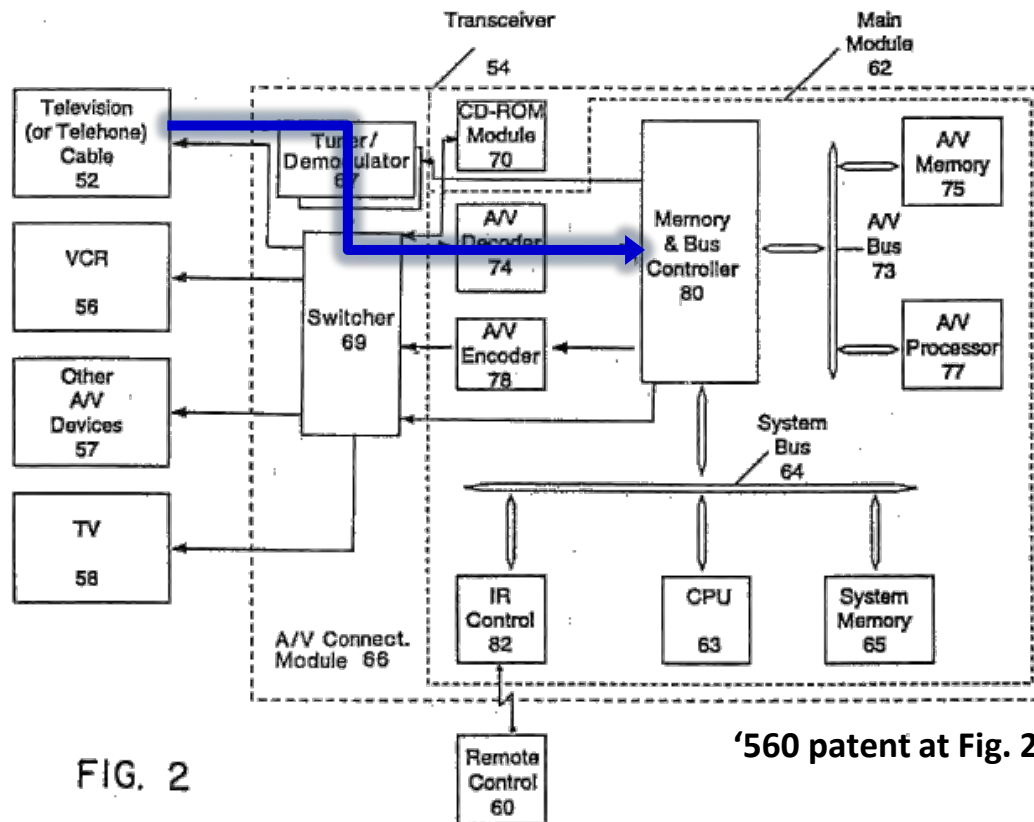
FIG. 2

'560 patent at Fig. 2

Steps of Florin set-top technology

- A) Signal in from provider
- B) Decoded program signal goes to TV
- C) Digital program guide information goes to computer memory

Signal from source



Steps of Florin set-top technology

Receiving user commands

D) Viewer issues command (e.g. "list") through remote

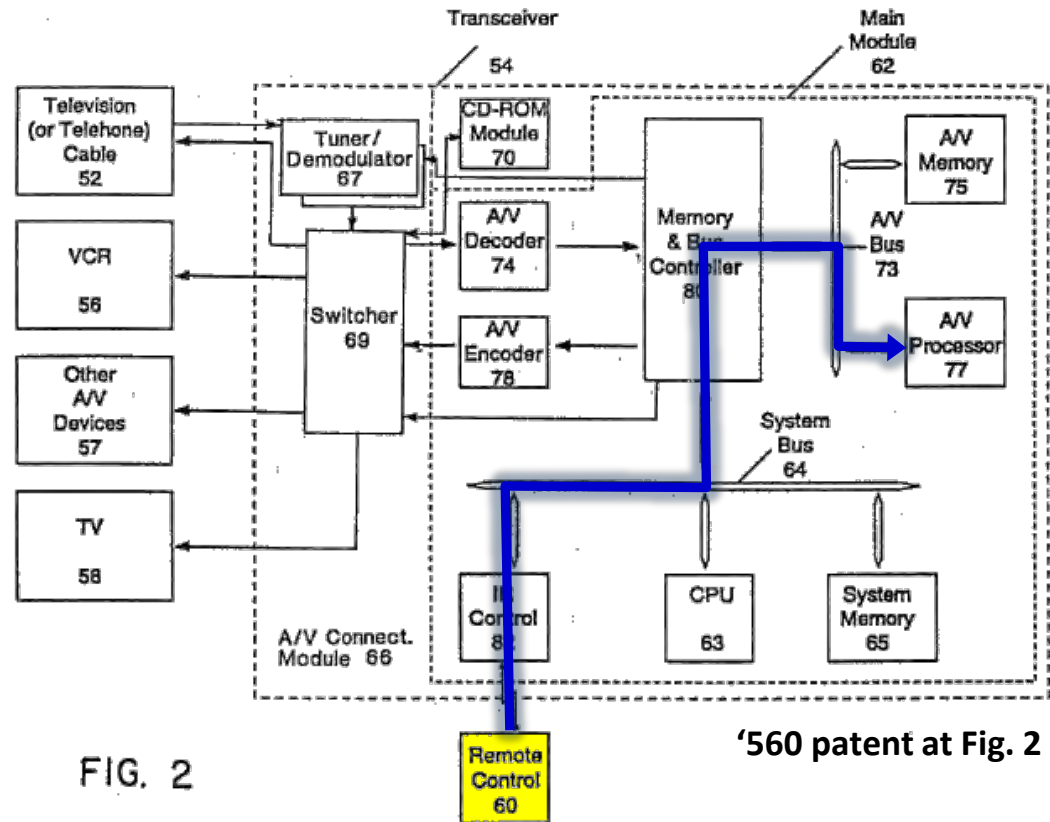


FIG. 2

'560 patent at Fig. 2

Steps of Florin set-top technology

Processing user commands

- D) Viewer issues command (e.g. "list") through remote
- E) CPU, graphics chips process command using GUI software

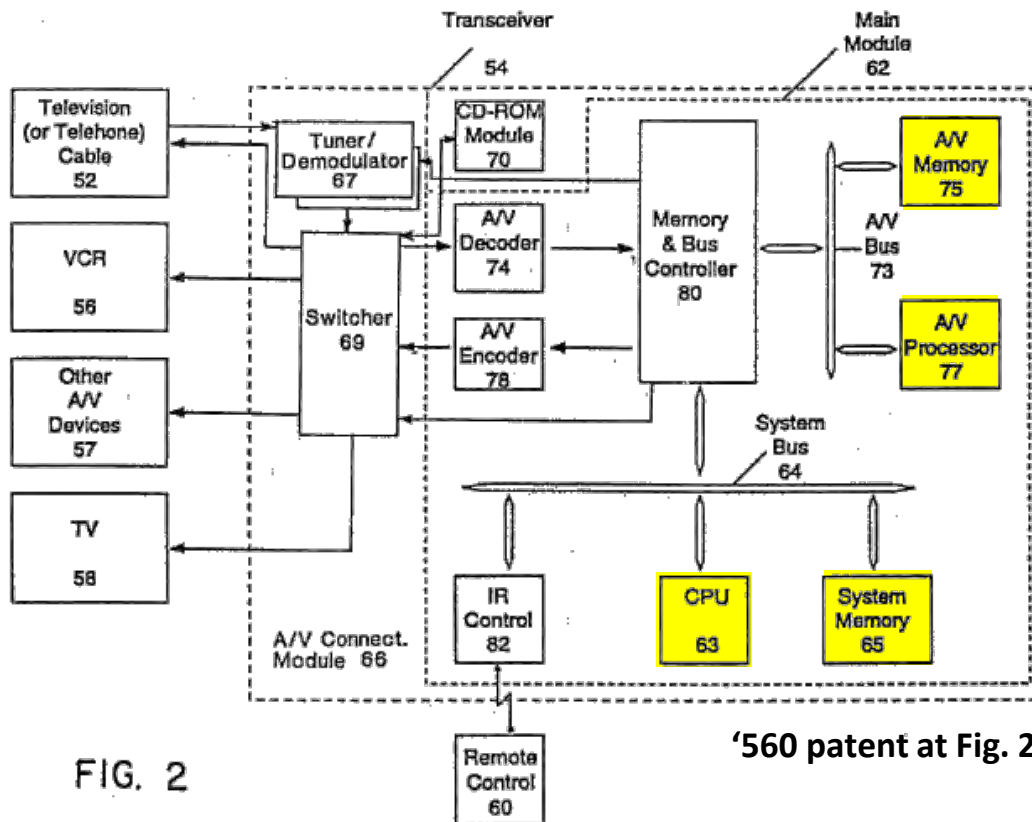


FIG. 2

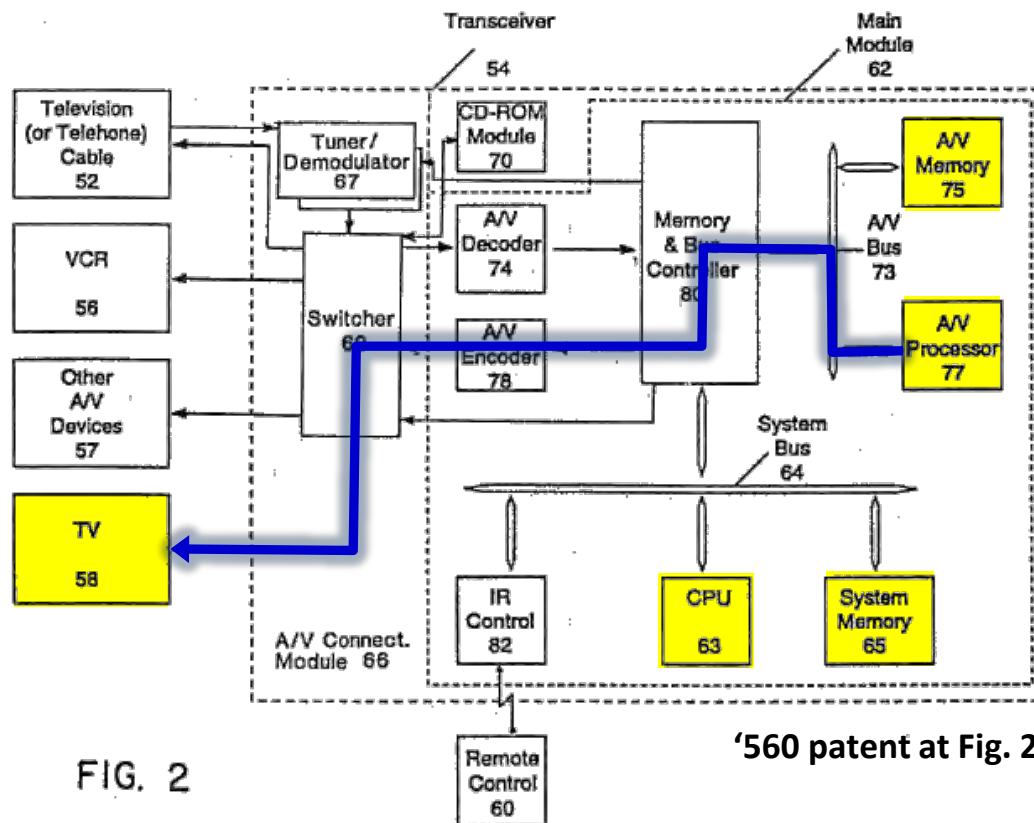
'560 patent at Fig. 2



Steps of Florin set-top technology

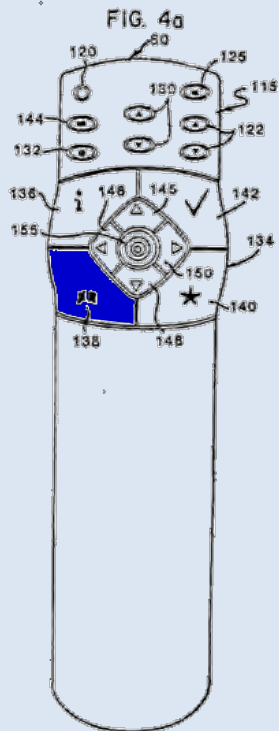
- D) Viewer issues command (e.g. "list") through remote
- E) CPU, graphics chips process command using GUI software
- F) A/V graphics are transmitted to TV

Displaying A/V graphics



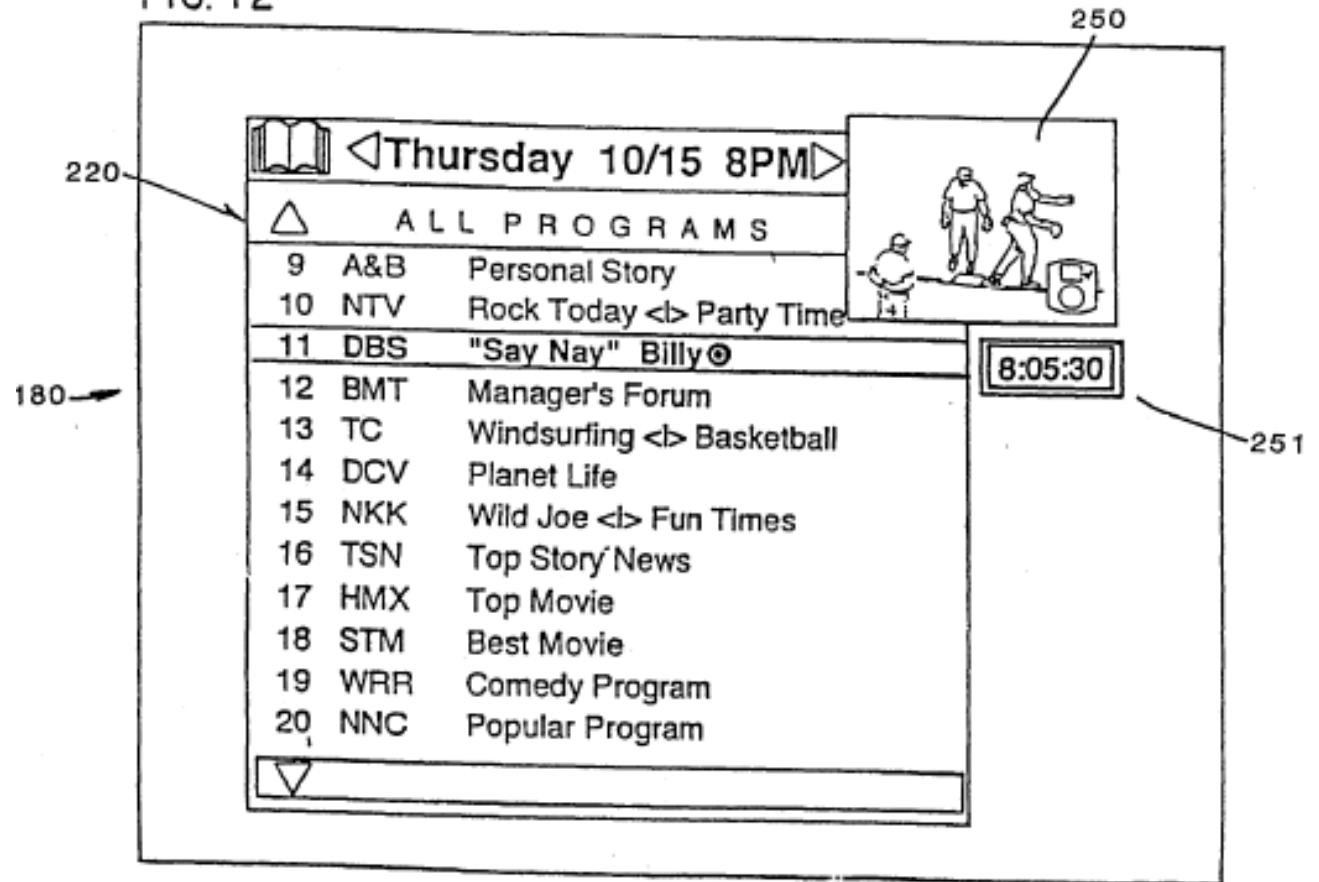
The Florin set-top box interface

Pressing "list"
displays program
listing



The GUI for listing information

FIG. 12

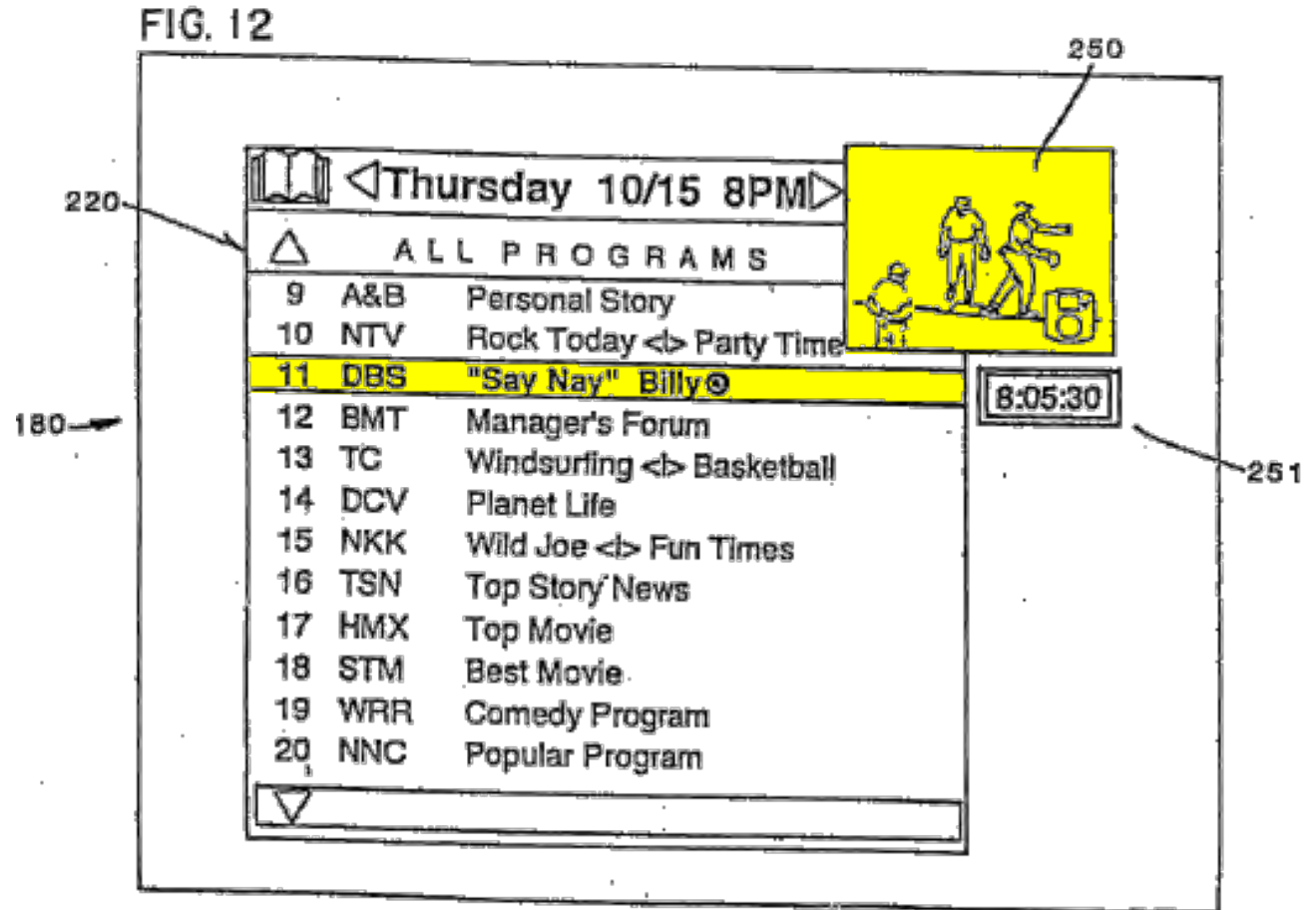
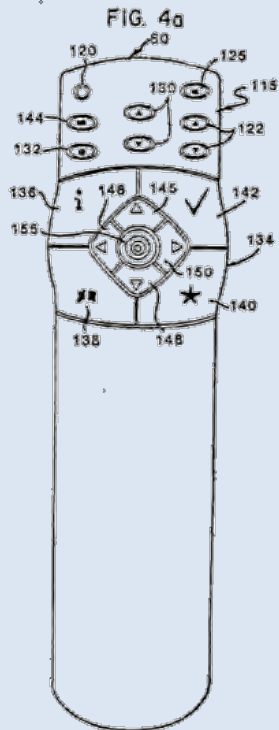


'560 patent at Fig. 12

The Florin set-top box interface

The GUI for listing information

Listing includes
PIP and
highlighting of
current program



'560 patent at Fig. 12

The Florin set-top box interface

The GUI for listing information

Pressing "up" arrow highlights next program up screen

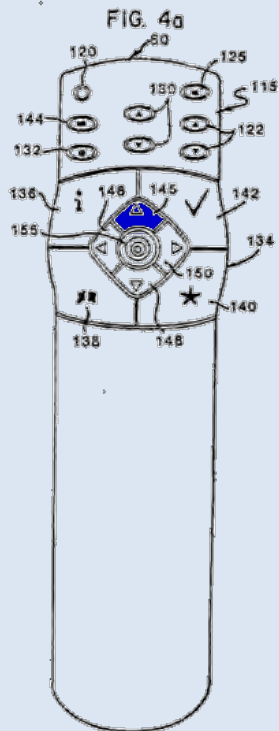
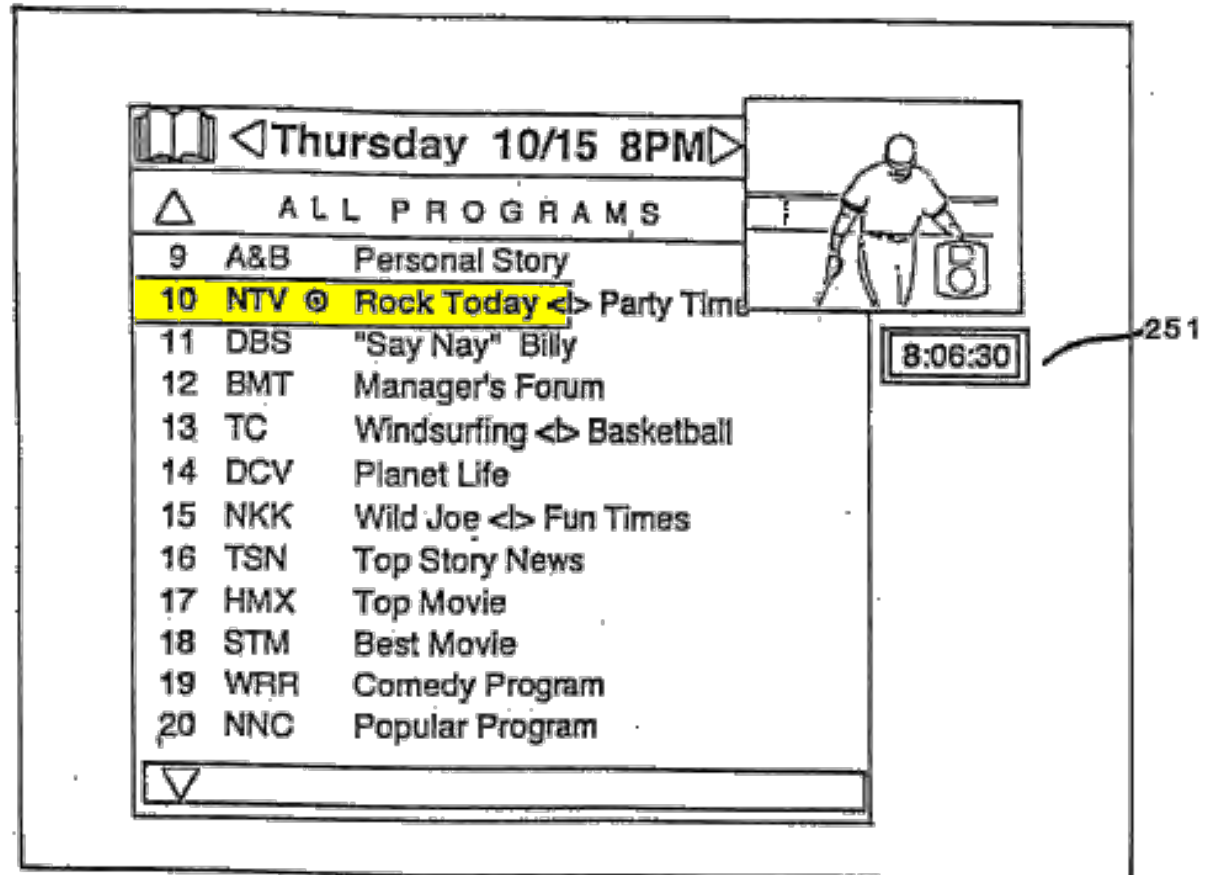


FIG. 13

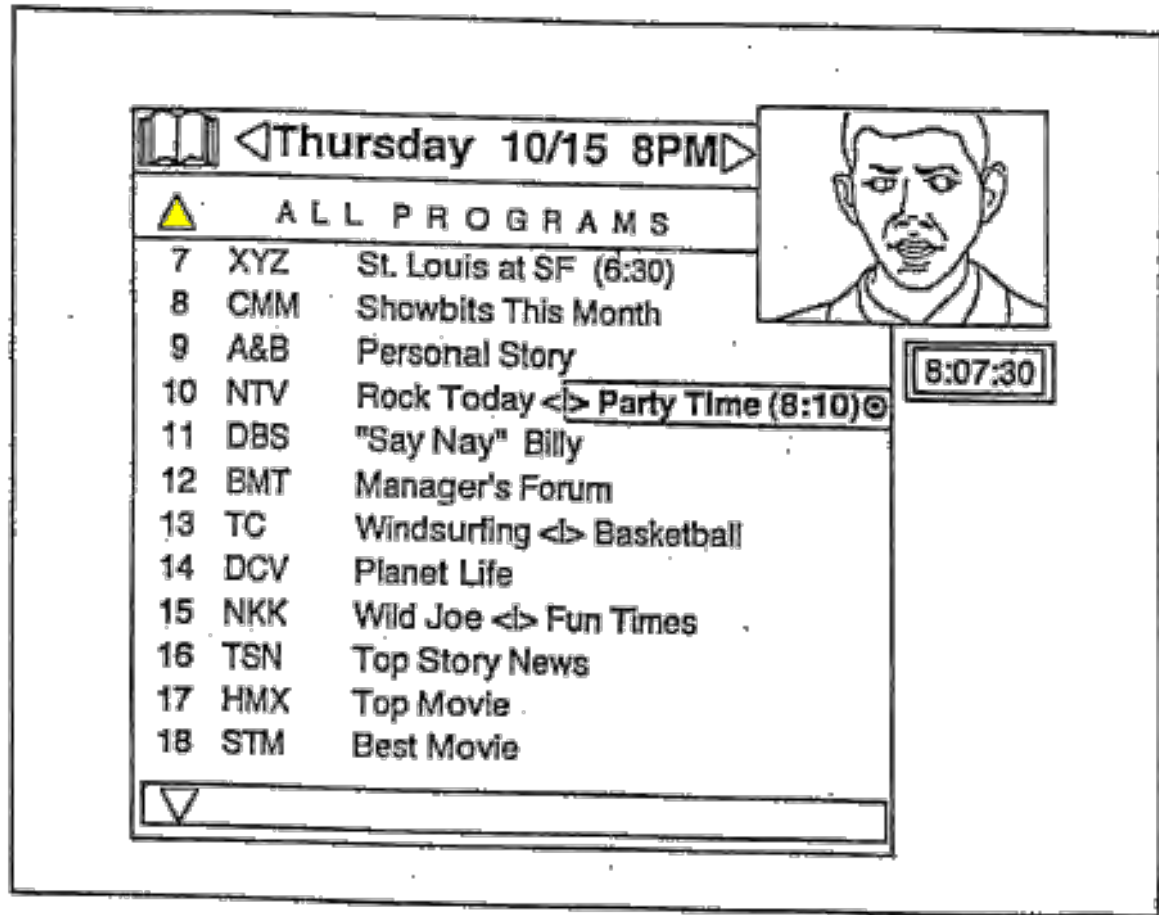


'560 patent at Fig. 13

The Florin set-top box interface

The GUI for listing information

FIG. 14



Continuously
pressing "up"
arrow
scrolls guide upwards

The Florin set-top box interface

The GUI for listing information

Pressing right or left arrows scrolls guide right or left

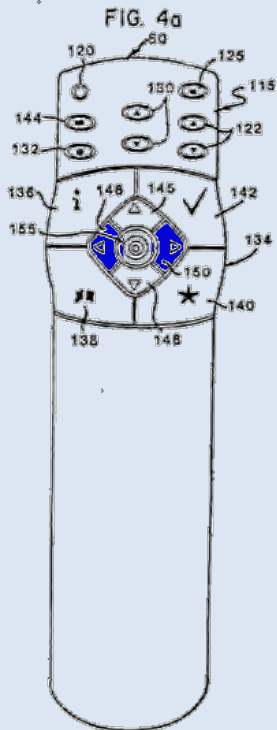
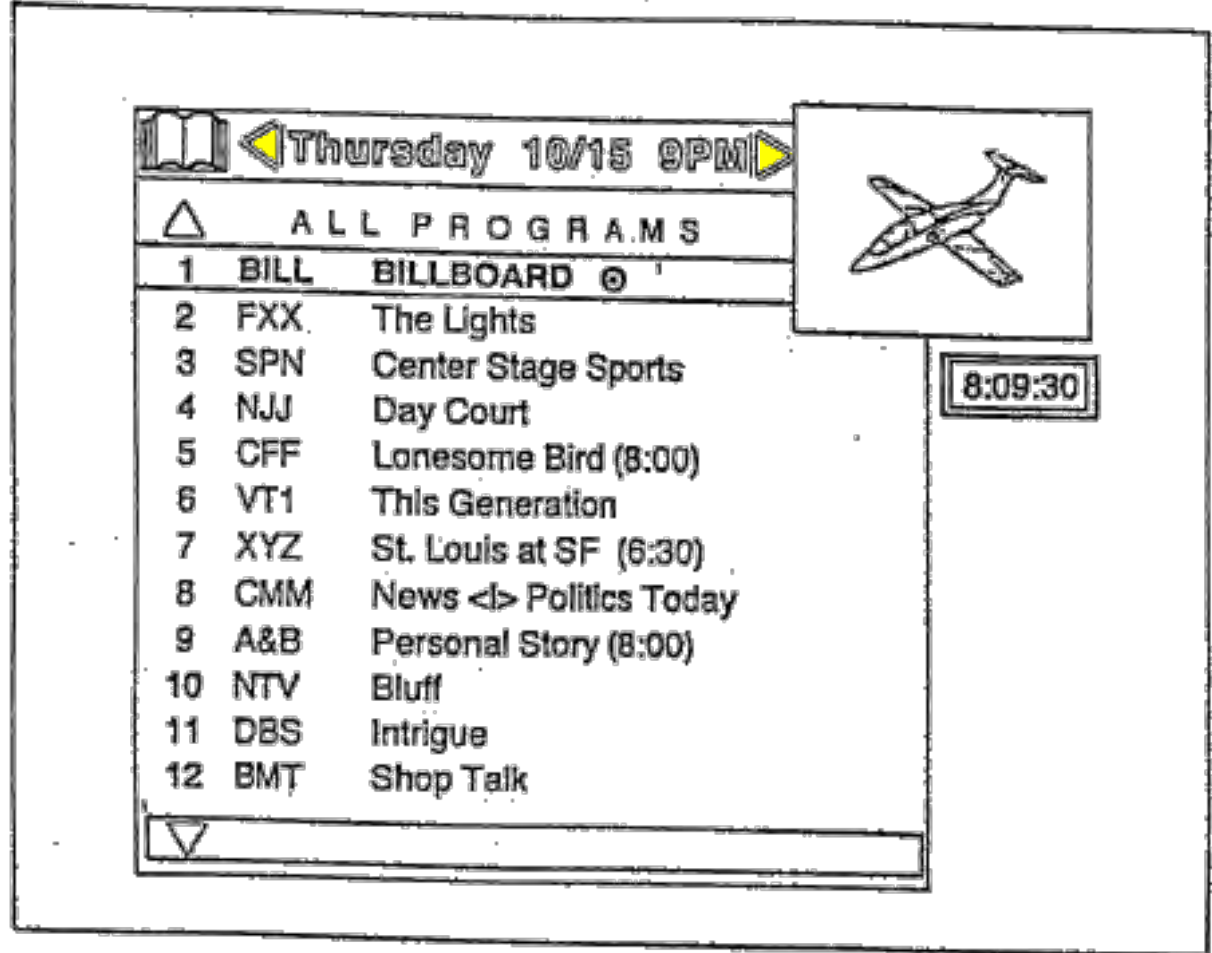


FIG. 16



The Florin set-top box interface

The GUI for listing information

“Mark” button
marks highlighted
program with check
mark for later
retrieval

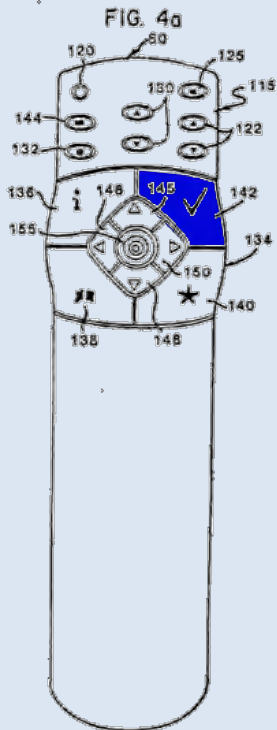
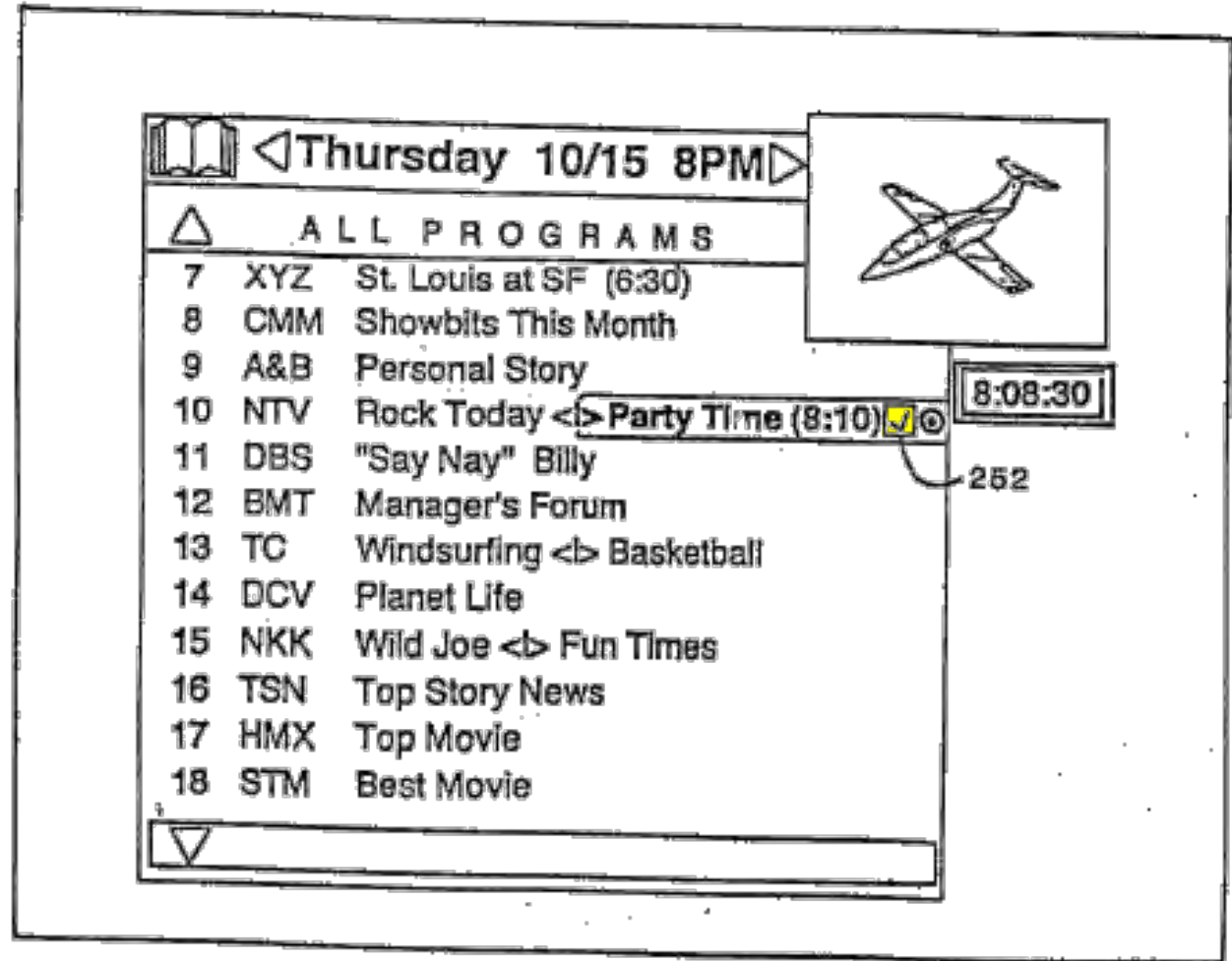


FIG. 15

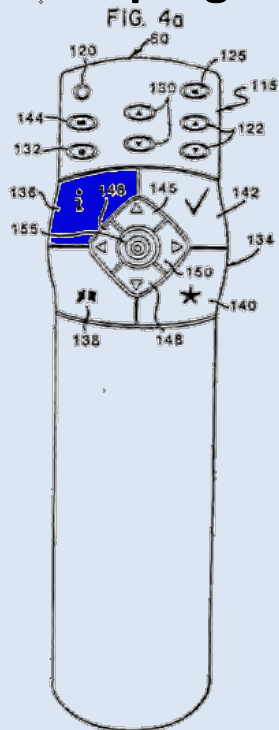


'560 patent at Fig. 15

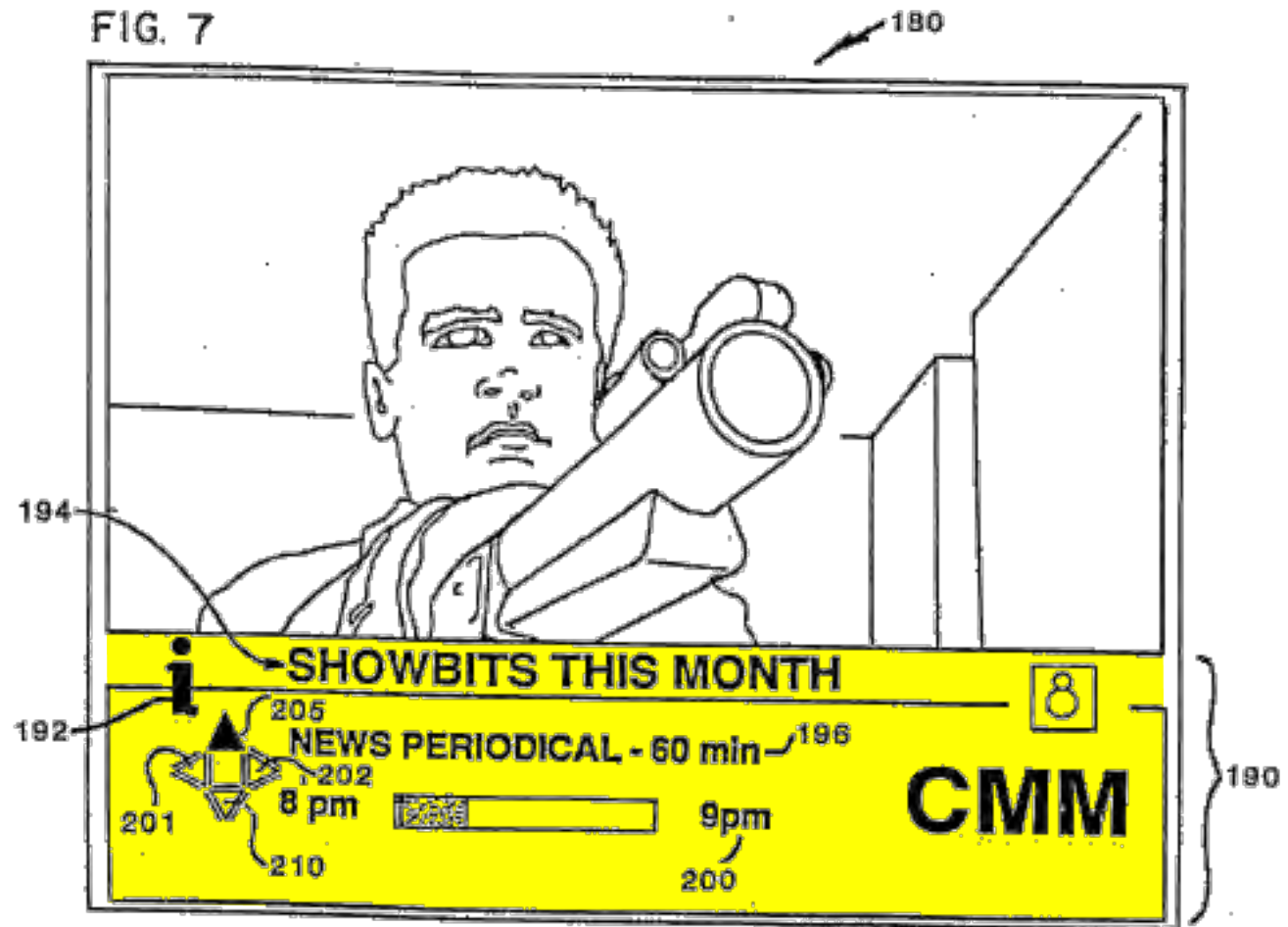
The Florin set-top box interface

The GUI also lets viewers interact with the current TV show

“Info” button retrieves information on current program



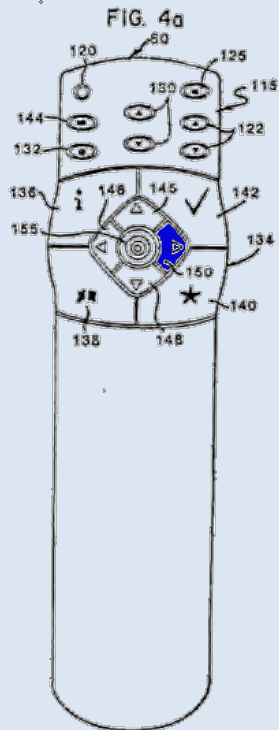
Individual program GUI



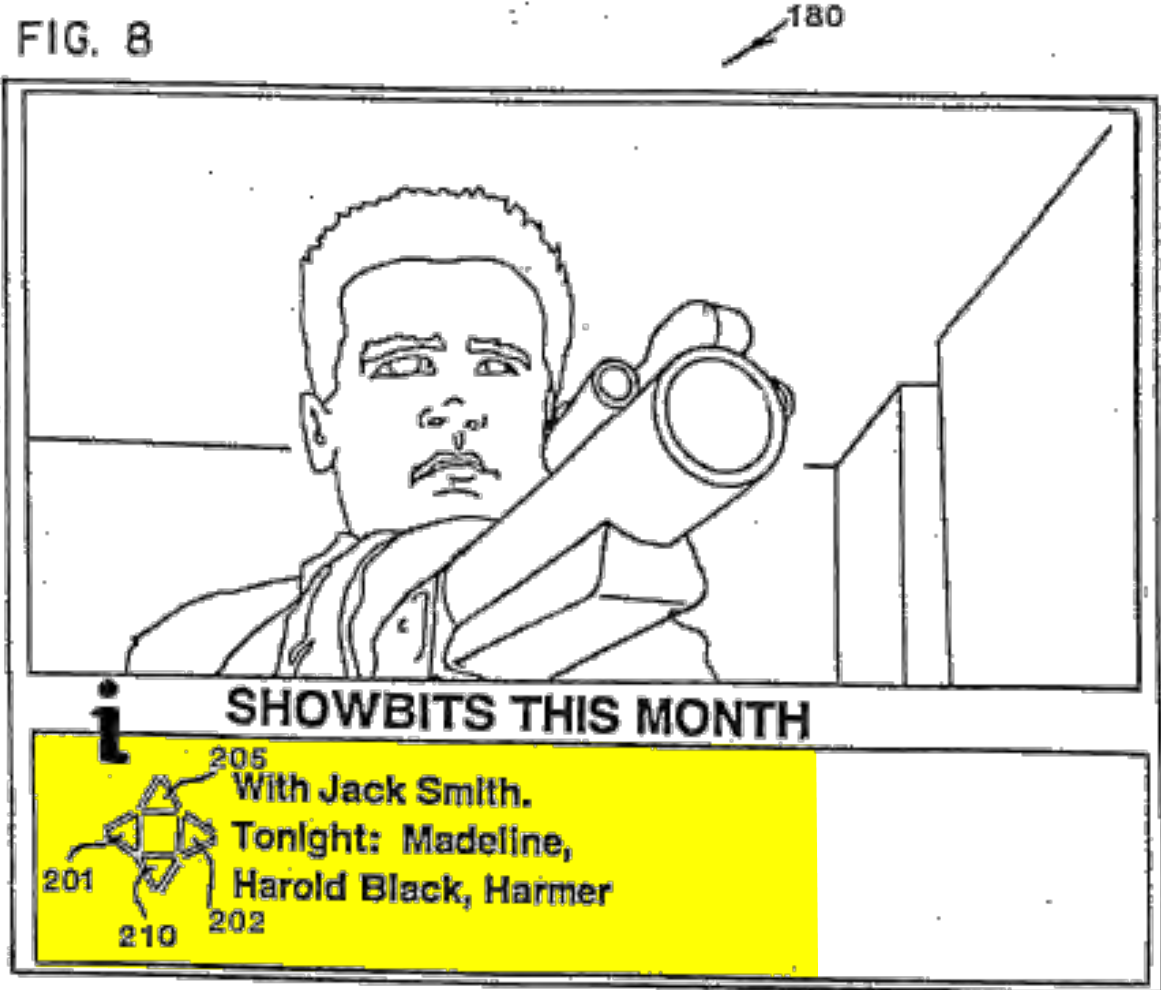
'560 patent at Fig. 7

The Florin set-top box interface

From there, pressing right/left buttons retrieves additional levels of program information ('560 patent at 11:49-51)



Individual program GUI



'560 patent at Fig. 8

The Florin set-top box interface

Individual program GUI

“Mark” button
marks program

“Jump” button
displays marked
show on TV screen

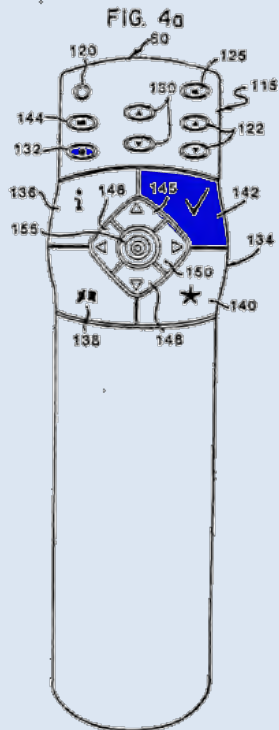
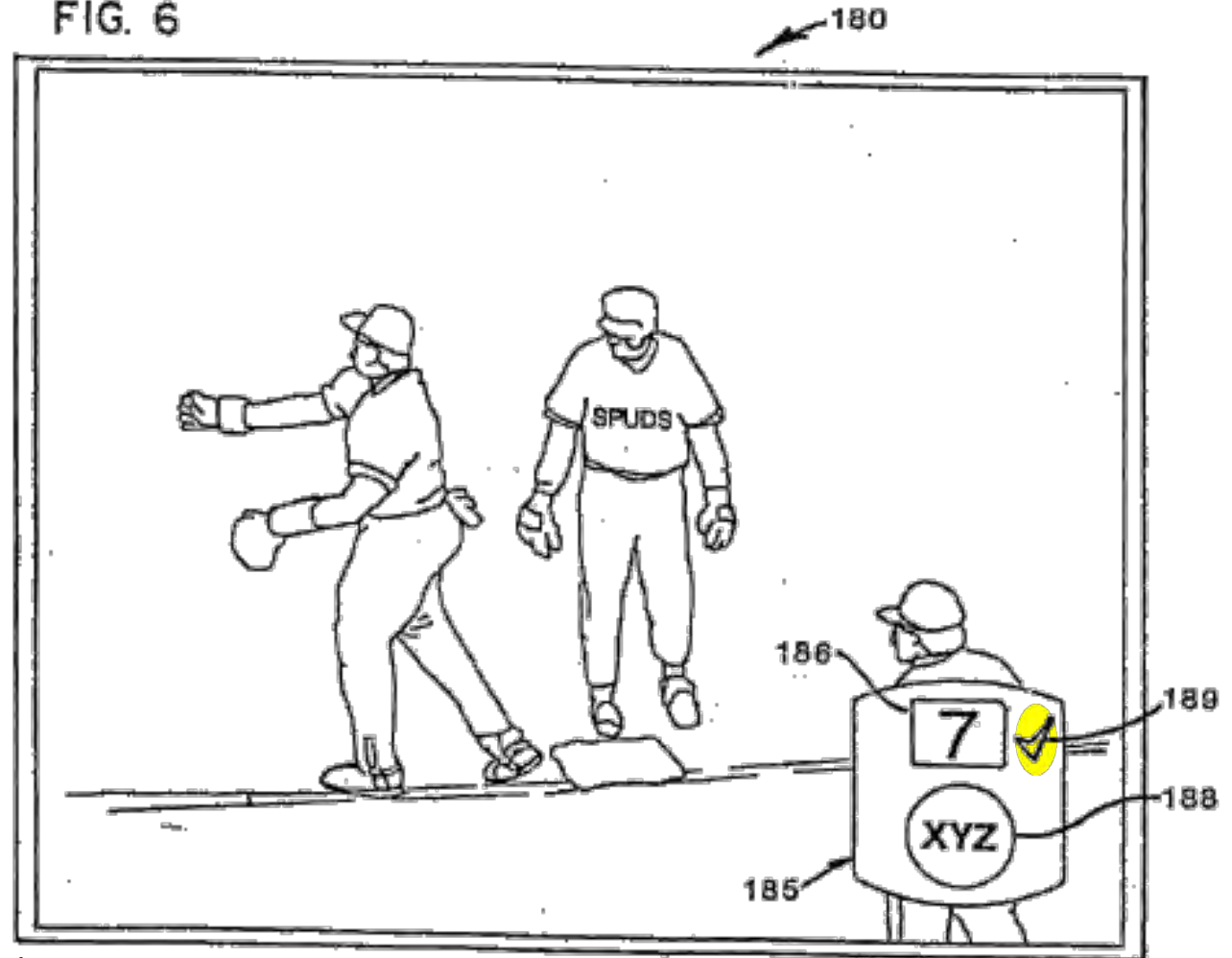


FIG. 6



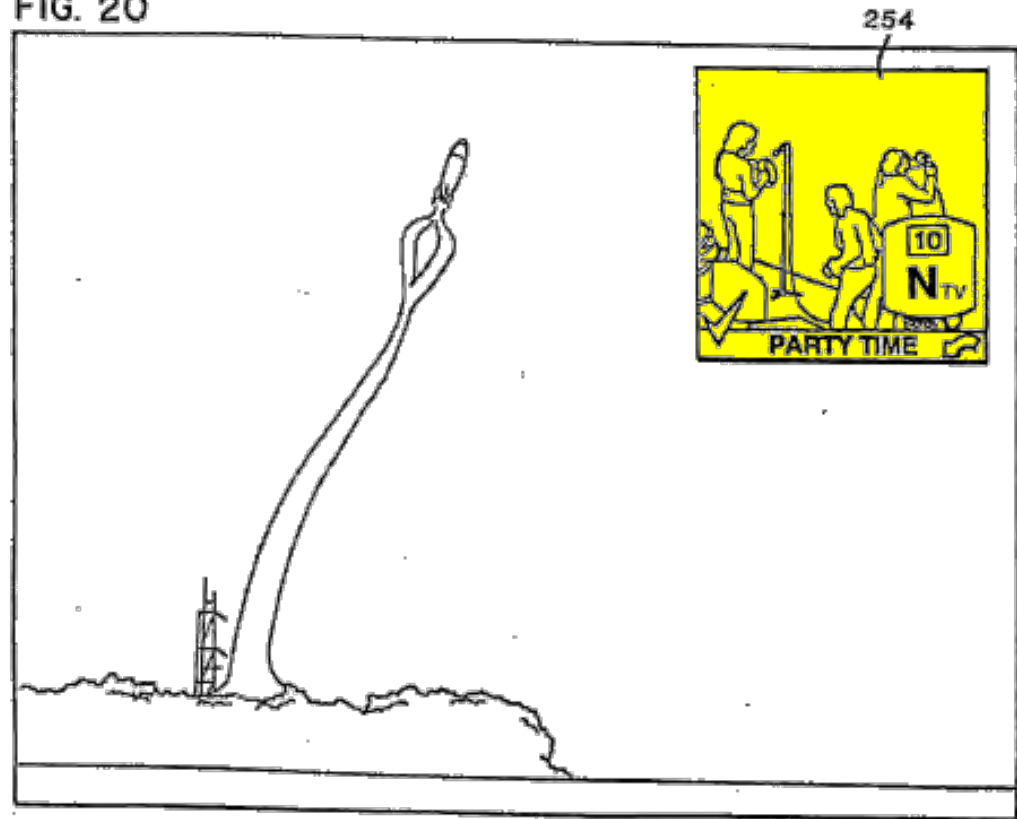
'560 patent at Fig. 6

The Florin set-top box interface

Reminding viewers of marked programs

When marked shows start, they are displayed in a PIP reminder window

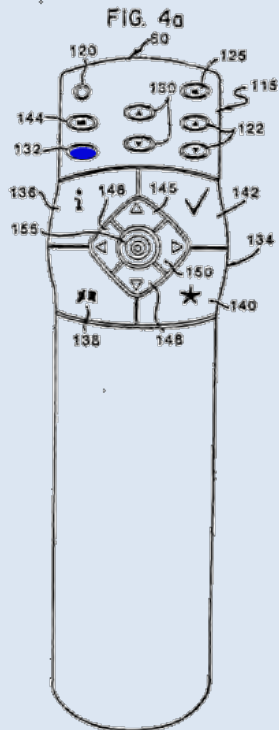
FIG. 20



'560 patent at Fig. 20

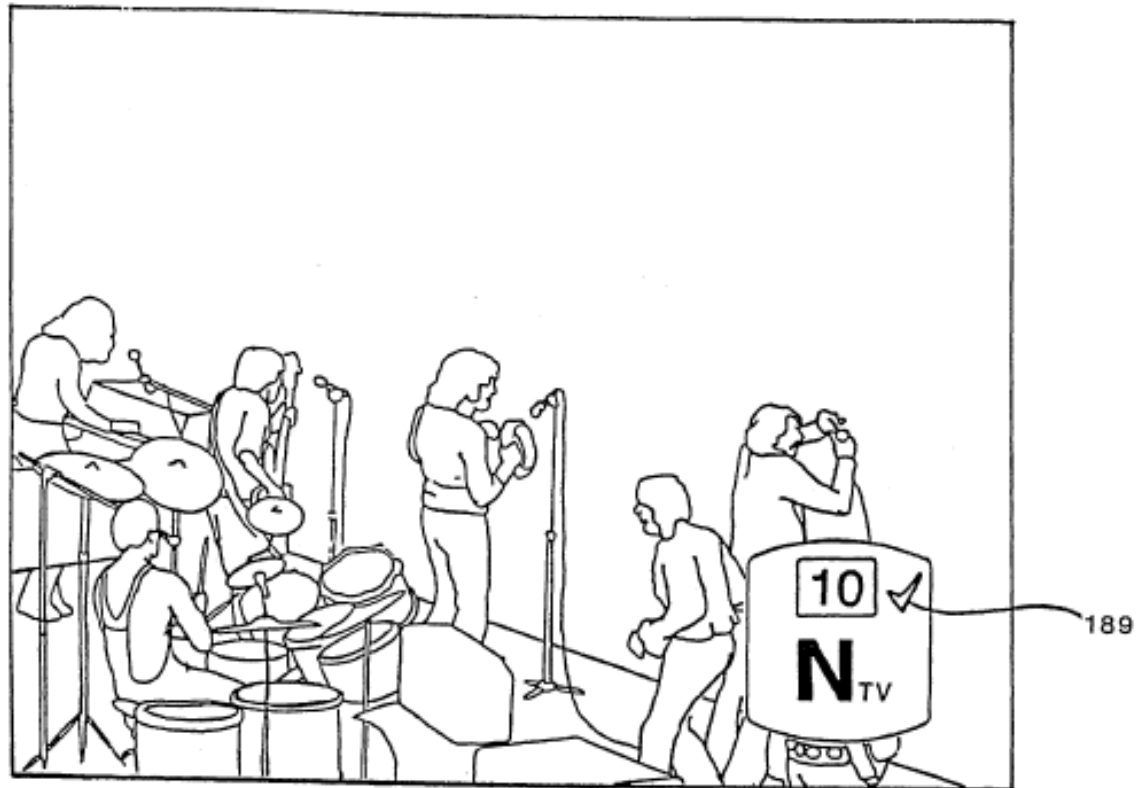
The Florin set-top box interface

Pressing “jump” button will cause the TV display to switch to the marked program



Reminding viewers of marked programs

FIG. 21



'560 patent at Fig. 21

III. EZTV Video Incorporated Into Florin Patents

Apple prototype: EZTV

EZTV

- Promotional video produced by Apple describes the Florin patent invention
- Video is incorporated into Florin patents:

are part of the present invention. Due to the limitations of a written specification, the reader is referred to a videotape entitled "EZTV" submitted by the Applicants concurrent with the filing of the application on which this patent is based.

'560 patent at 25:10-14



Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Discusses technological advances in TV, need for improved interface

“Watching TV used to be simple. If you didn’t like what was on, you just walked over to the set and switched to the other channel.

Now we have dozens of channels to choose from, VCRs, multiple remotes...watching TV will present some real problems. One solution: EZTV.”

--Quote from EZTV video



Excerpt from EZTV promotional video

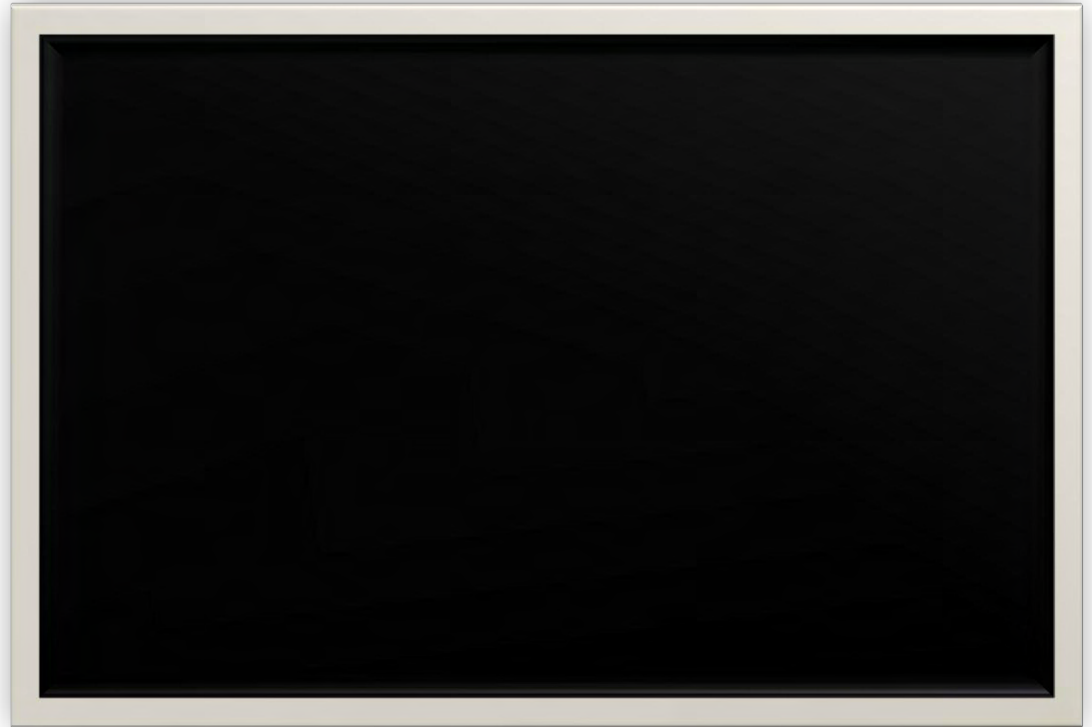
Apple prototype: EZTV

EZTV video

- Depicts using remote control to get individual program information, get listing information, and mark, record, and jump between programs

“This new remote allows us to use all of EZTV’s interactive functions, as well as operate any standard TV and VCR.”

--Quote from EZTV video

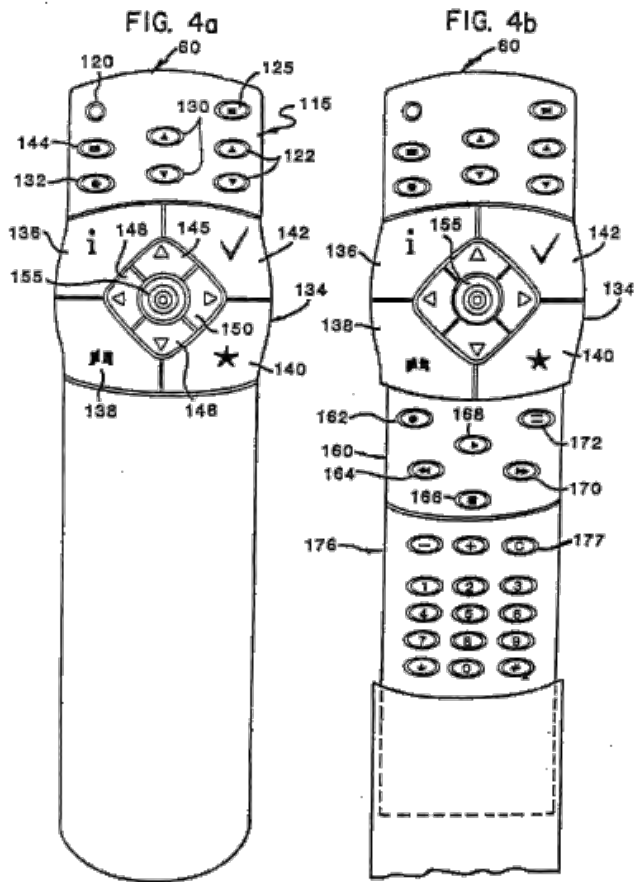


Excerpt from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows the remote control depicted in Figures 4a and 4b



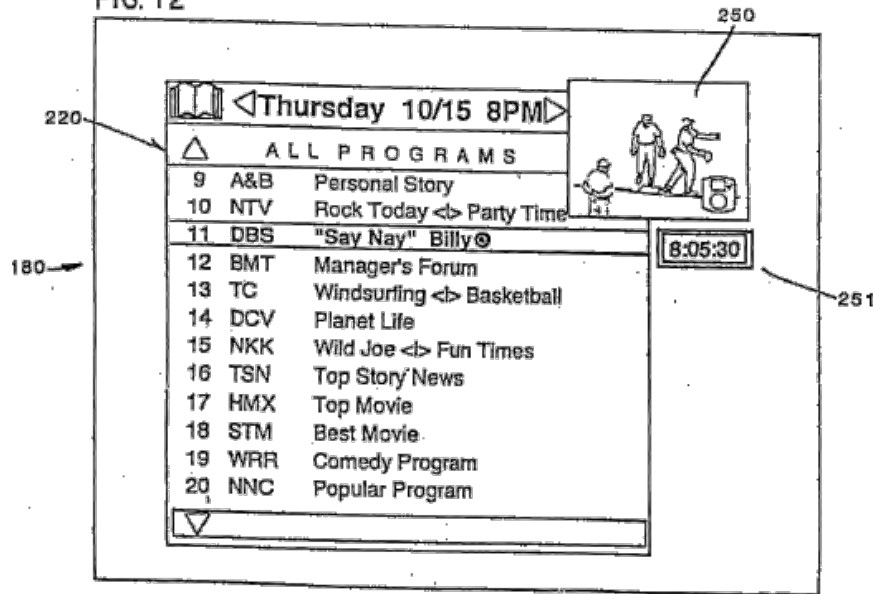
Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows the program listing GUI depicted in Figures 12-17, including PIP

FIG. 12



Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows viewer hitting “list” button on remote to call up listing GUI



Still shot from EZTV promotional video



Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows viewer hitting “mark” button on remote to mark program



Still shot from EZTV promotional video

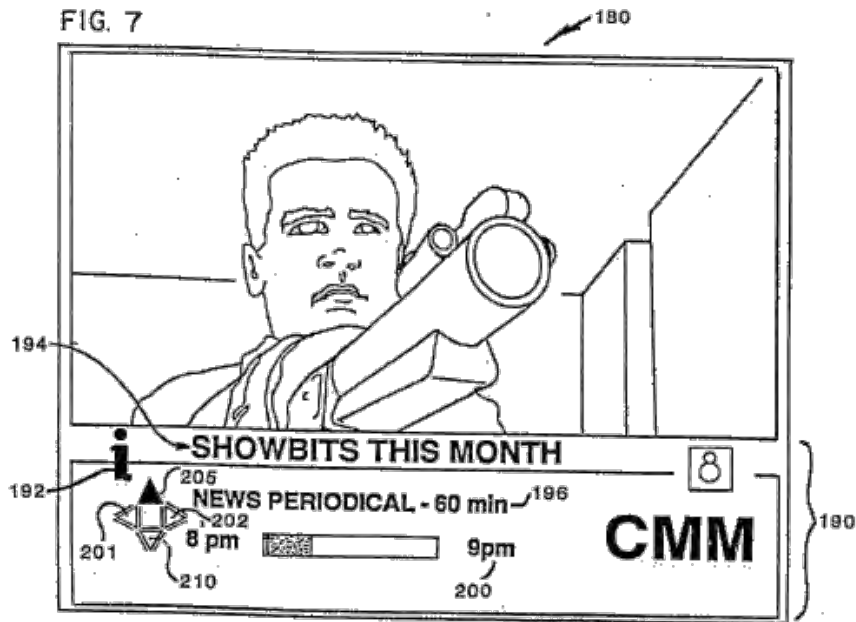


Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows the individual program GUI depicted in Figures 7-11



Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows user hitting “info” button to call up program info GUI



Still shot from EZTV promotional video



Still shot from EZTV promotional video

Apple prototype: EZTV

EZTV video

- Shows user hitting “jump” button to jump to marked program



Still shot from EZTV promotional video



Still shot from EZTV promotional video

IV. Accused Motorola devices

Accused Motorola devices

Motorola set-top boxes

- Apple accuses 27 Motorola devices of infringing Florin patents
- Devices are manufactured by Motorola and/or Motorola contractors
- Motorola sells accused devices to cable providers
- Cable providers then sell and/or provide modified accused devices to customers



Motorola DCX3400 accused device

Accused Motorola devices

Motorola set-top boxes

- Motorola provides no remote control with accused devices
- Devices ship without the graphic user interface described in the Florin patents; most ship without any GUI
- Cable providers develop and add their own GUIs before providing devices to customers
- Cable providers provide remote controls for customers



Motorola DCX3200 accused device

Accused Motorola devices

Motorola products generally lack a remote control or any type of graphic user interface such as program guide



Picture source: Apple's Preliminary Infringement Contentions, Ex. A at 7