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(19) **United States**(12) **Patent Application Publication****Kamise et al.**(10) **Pub. No.: US 2005/0219423 A1**(43) **Pub. Date:****Oct. 6, 2005**(54) **TELEVISION RECEIVER AND METHOD OF CONTROLLING DISPLAY THEREOF****Publication Classification**(75) Inventors: **Shigero Kamise**, Saitama (JP); **Akihiko Ishibashi**, Saitama (JP)(51) **Int. Cl.⁷** **H04N 5/63**(52) **U.S. Cl.** **348/730**

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(57)

ABSTRACT

A television receiver including a liquid crystal display (LCD) panel. When a signal generated by operating a power supply key on a remote controller is received, video and audio are muted, a backlight of the LCD panel is turned off, and a power supply to the LCD panel is turned off. The voltage of the power supply to the LCD panel is monitored. When the voltage is equal to or lower than a predetermined value, the power supply of the whole receiver is turned off. When the power supply key on the remote controller is operated before the voltage supplied to the LCD panel is equal to or lower than the predetermined value, the video and audio mute mode is canceled, the backlight of the LCD panel is turned on, and the power supply to the LCD panel is turned on.

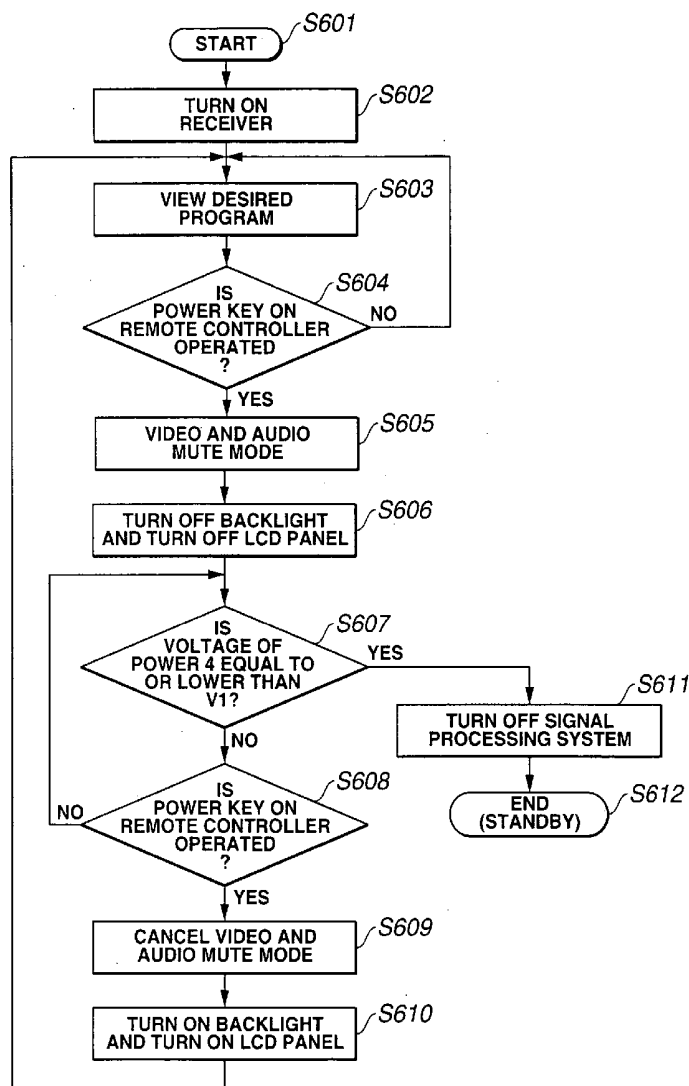


FIG. 1

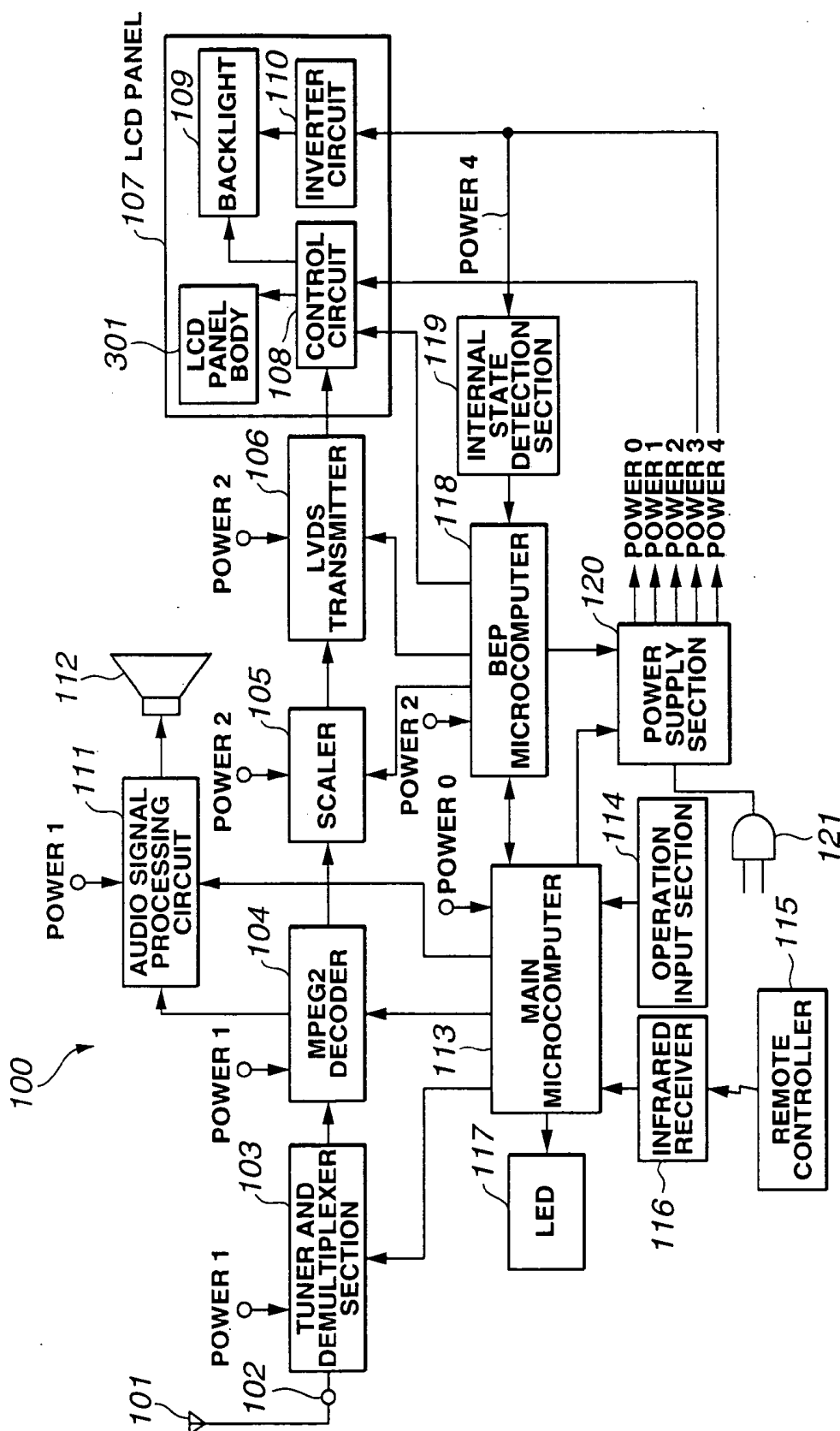


FIG.2

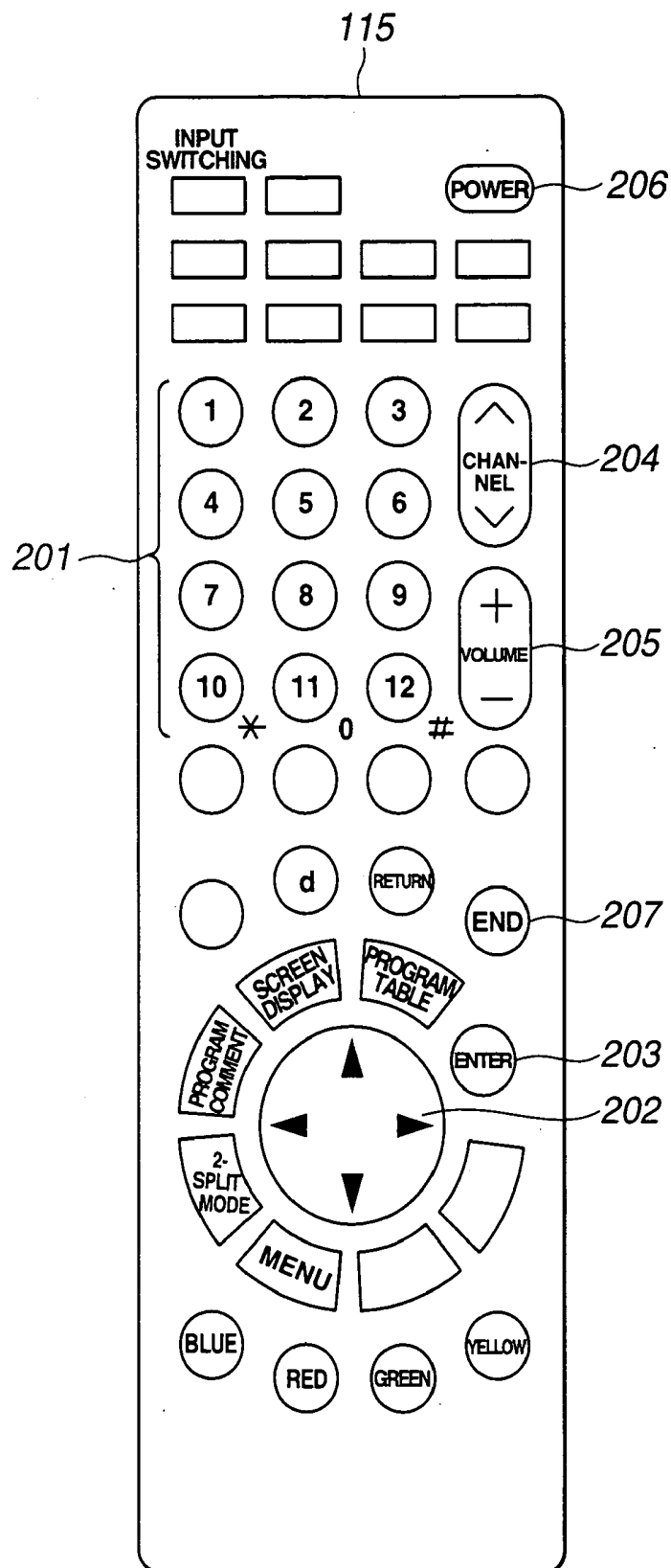
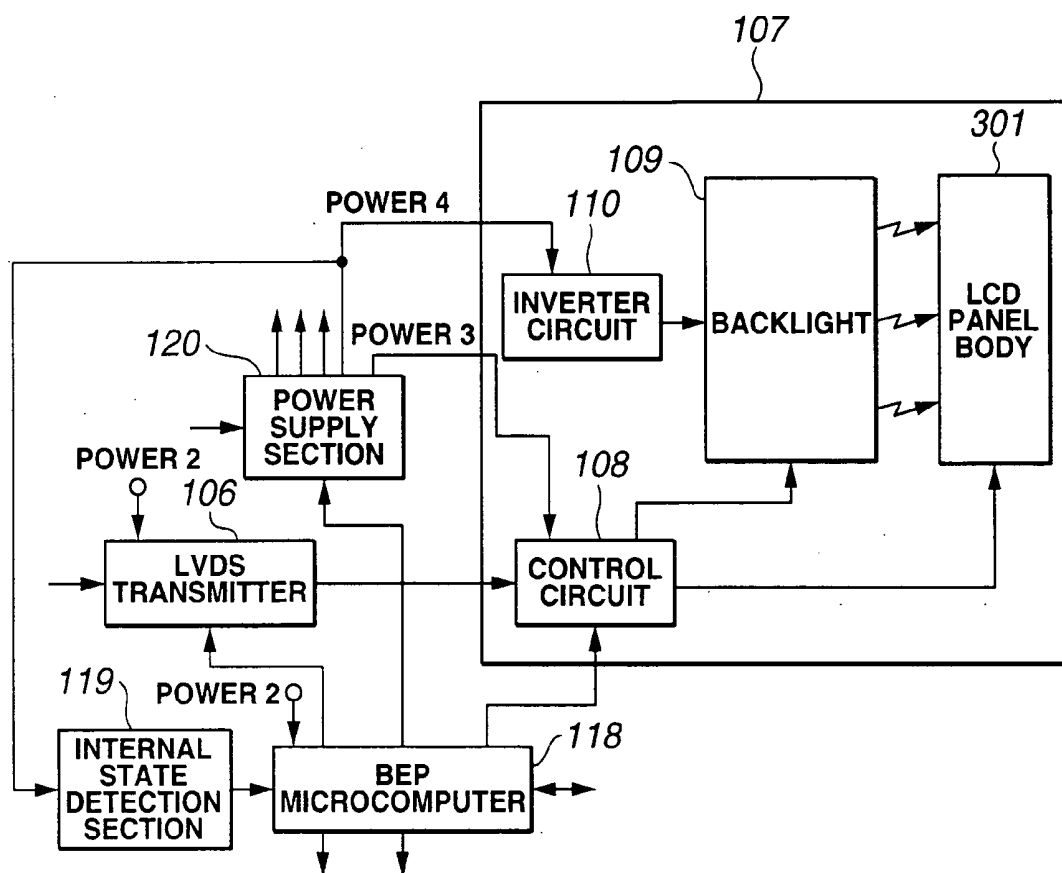


FIG.3



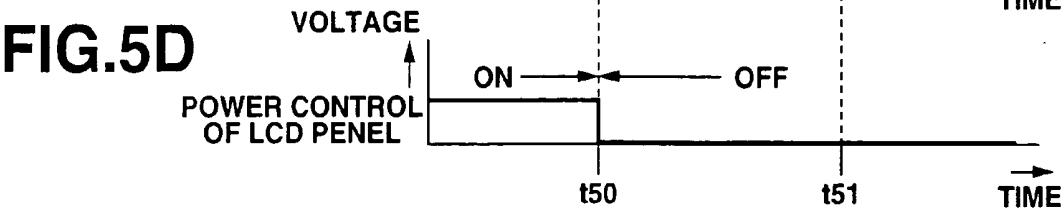
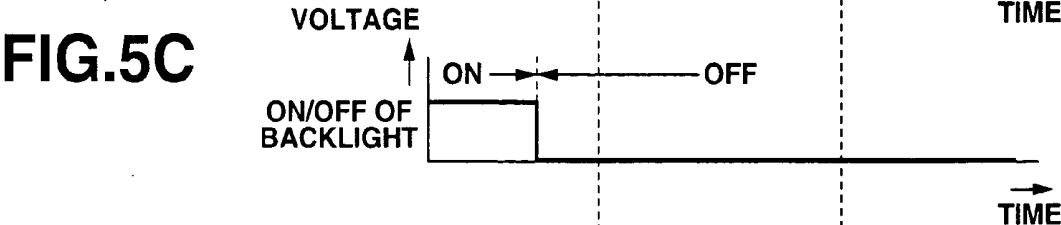
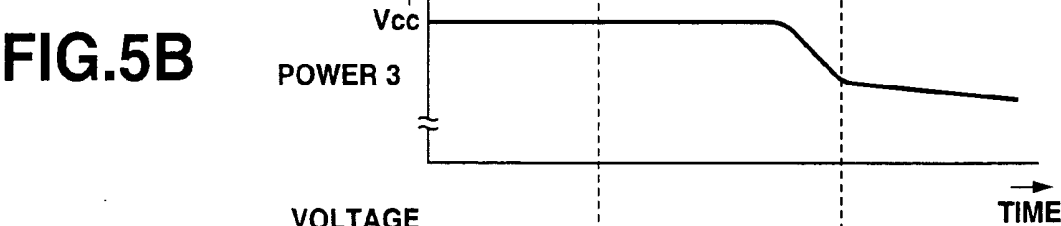
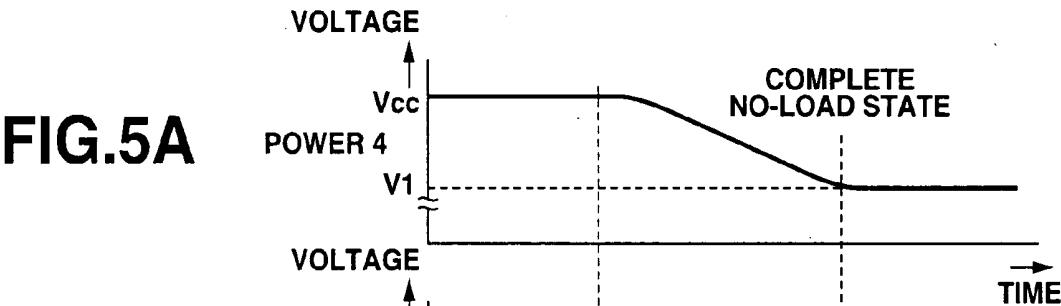
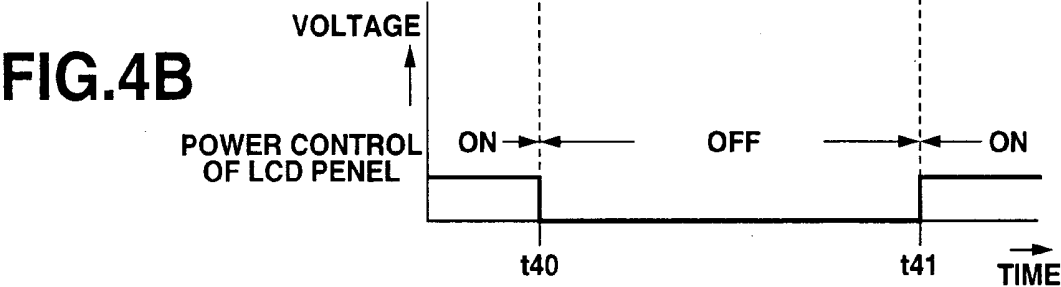
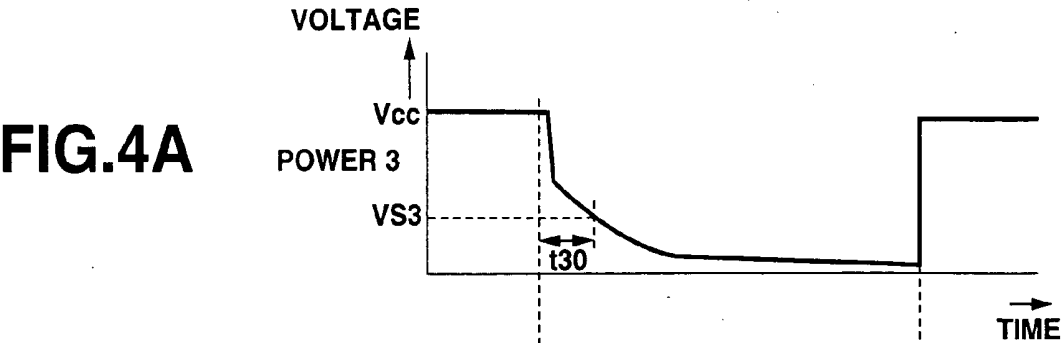
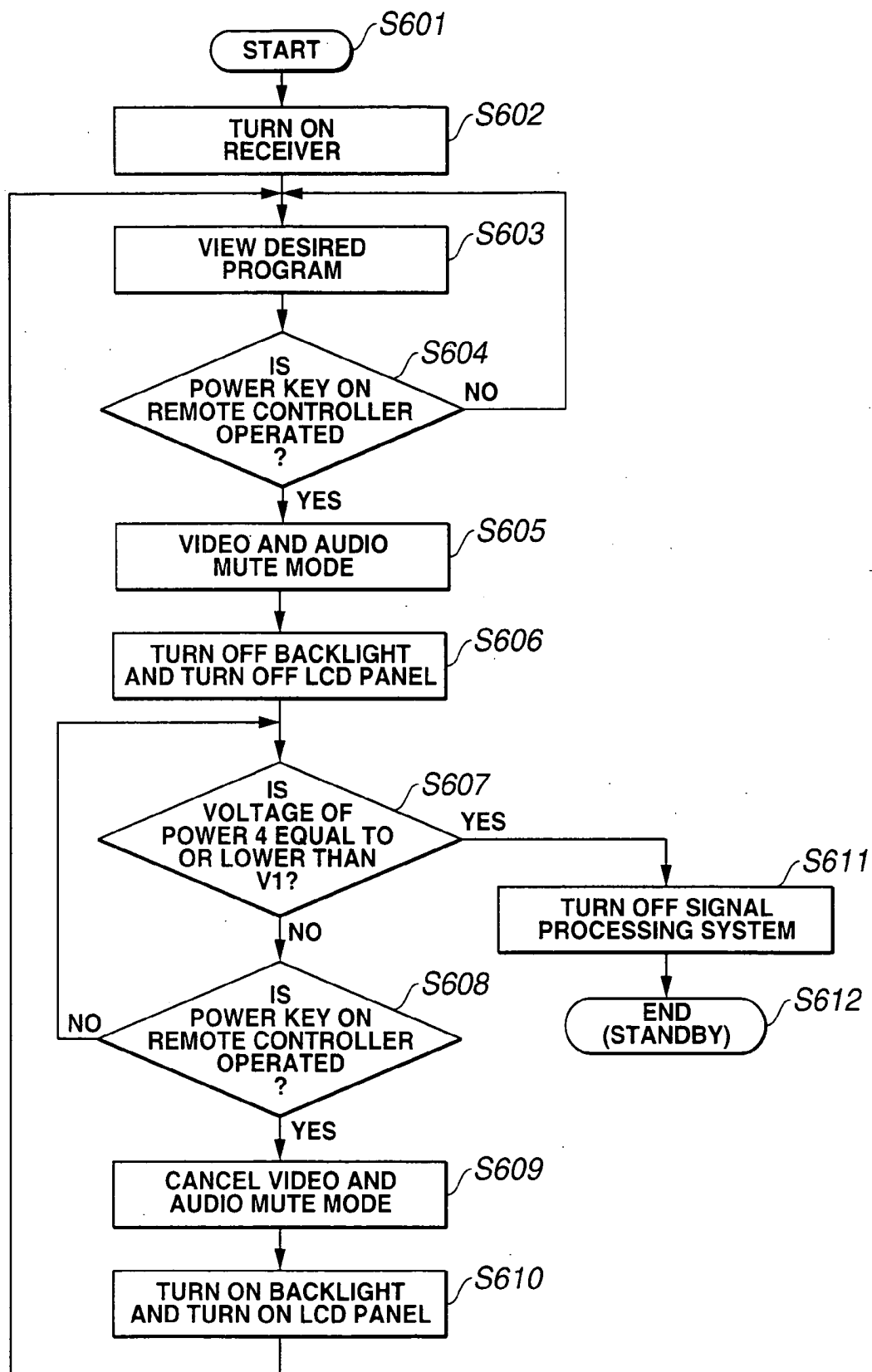


FIG.6



TELEVISION RECEIVER AND METHOD OF CONTROLLING DISPLAY THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2004-108086 filed on Mar. 31, 2004; the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to television receivers each having a liquid crystal display and a method of controlling the display thereof, more particularly, to a television receiver including a liquid crystal display, the television receiver capable of functionally turning on or off an operating power supply to the liquid crystal display, and a method of controlling the display thereof.

[0004] 2. Description of the Related Art

[0005] General displays using liquid crystal as optical switching elements are liquid crystal display (LCD) panels. The LCD panel includes: a panel-shaped display section including liquid crystal elements and a three primary color optical filter; a control circuit for supplying video data to the liquid crystal elements of the display section; a backlight emitting light to the rear of a set of the liquid crystal elements; and an inverter circuit for supplying a power supply voltage to the backlight. These components are incorporated in a flat frame, thus forming the LCD panel.

[0006] The LCD panel is used as a display of a personal computer and is also used as a display of a television receiver.

[0007] Regarding applications for television receivers, large LCD panels of 40 inches or more appear. Advantageously, the LCD panels are light in weight and save space. In the future, therefore, in addition to plasma displays, the LCD panels will be used as displays of television receivers in many cases.

[0008] In the case of using the LCD panel as a display of a television receiver, to display video without uncomfortable feelings, it is necessary to manage operation timings of respective circuit components with care.

[0009] Particularly, the operation timing of the control circuit needs to be managed with great care. The reason is as follows: When the power supply of the LCD panel is once turned off, the power has to be again turned on after a predetermined time under restriction by liquid crystal characteristics. Unless the control circuit is operatively associated with the backlight at power-on, unfortunately, the backlight is lit up before the liquid crystal elements are driven by video signals, resulting in an unnatural display screen with no video.

[0010] Therefore, the television receiver including the LCD panel is constructed so that after the power is turned on, the backlight is lit up at the conclusion of a predetermined elapsed time to display video.

[0011] General television receivers each have a remote controller as standard equipment. A user switches between

channels of the receiver and adjusts various settings such as volume control mainly using the remote controller. The user can also turn on or off the receiver using the remote controller.

[0012] In a case where the user accidentally operates a power supply key on the remote controller to turn off the receiver while the user is viewing a program, even if the user again turns on the power immediately, it takes some time before video is again displayed on the LCD panel. This irritates the user. Disadvantageously, usability is not very good.

[0013] Television receivers each including a cathode ray tube as a display also have a challenge concerned with the activation characteristics of the cathode ray tube. Attempts to improve the activation characteristics are performed.

[0014] For example, Japanese Unexamined Patent Application Publication No. 5-161093 discloses the following technique: When a power supply key on a remote controller is operated in a program viewing mode to turn off a television receiver, the receiver enters an apparent power-off state, in which the receiver is operated but a cathode ray tube is turned off and audio is muted, for a predetermined time period after the power-off. When the power supply key is operated within the predetermined time period, the OFF state of the cathode ray tube is canceled and the audio mute mode is canceled to immediately restart the program viewing mode. If the power supply key is not operated for the predetermined time period or longer, a normal power-off process is performed.

[0015] The technique disclosed in Japanese Unexamined Patent Application Publication No. 5-161093 can be applied to television receivers each including an LCD panel. However, a state set by operating the power supply key, i.e., the state in which the power is not turned off but video and audio are muted is managed on the basis of time. Therefore, it is not necessarily appropriate to apply the technique to LCD panels because the operations of circuit components require careful management.

[0016] As mentioned above, in the conventional television receivers each including the LCD panel, if the user accidentally turns off the receiver, it takes considerable time to start video display after the user again turns on the receiver. The conventional television receivers each including the LCD panel need to be improved in usability.

BRIEF SUMMARY OF THE INVENTION

[0017] Accordingly, it is an object of the present invention to provide a television receiver including an LCD panel with high usability in which a voltage supplied as an operating power supply to the LCD panel is monitored so that when the receiver is turned on before the voltage is reduced to a predetermined value or lower after turn-off, video and audio outputs can be immediately started, and a method of controlling the display thereof.

[0018] The television receiver according to the present invention comprises a receiving section which receives a broadcast program to obtain video signals; a display section, including a liquid crystal display panel, which displays the video signals; an operating power supply which selectively supplies power supply voltages to the receiving section and the display section, respectively; a command generating

section which generates a command to the operating power supply to turn off power supply and also turn on power supply; a monitoring section which monitors the internal state of the display section to generate a monitoring result; and a control section which interrupts the supply of the power supply voltages from the operating power supply to the display section when the command generating section generates the command to turn off power supply, again starts the supply of the power supply voltages to the display section when the command generating section generates the command to turn on power supply of the operating power supply while the monitoring section monitors the internal state of the display section after interrupting the operating power supply and the internal state satisfies a predetermined condition, and controls the operating power supply to turn off also the power supply voltages to the receiving section if the internal state of the display section does not satisfy the predetermined condition.

[0019] It is preferred that the control section interrupts the supply of the power supply voltages to the display section from the operating power supply after muting the video signals received by the receiving section when the command generating section generates the command to turn off power supply, and again starts the supply of the power supply voltages to the display section after canceling the video mute when the command generating section generates the command to turn off power supply of the operating power supply.

[0020] The television receiver according to the present invention is also the one which comprises a receiving section which receives a broadcast program to obtain video signals; a liquid crystal display panel including a liquid crystal display panel body, an inverter circuit, a backlight which emits light for displaying on the liquid crystal display panel body using an output of the inverter circuit as a power supply, and a control circuit which drives the liquid crystal display panel body on the basis of the video signals from the receiving section and controls the operation of the backlight; an operation power supply which selectively supplies power supply voltages to the receiving section and the liquid crystal display panel, respectively; a command generating section which generates a command to the operating power supply to turn off power supply and also turn on power supply; and a control section which controls the operating power supply to interrupt the supply of the power supply voltages to the liquid crystal display panel when the command generating section generates the command to turn off power supply, again starts the supply of the power supply voltages to the liquid crystal display panel when a value of the voltage supplied to the inverter circuit as a power supply voltage is monitored and the command generating section generates the command to turn on power supply before the value becomes equal to or lower than a predetermined value, and turns off also the supply of the power supply voltage to the receiving section if the value of the power supply voltage to the inverter circuit becomes lower than the predetermined value.

[0021] It is preferred that the control section mutes the video signals received by the receiving section when the command generating section generates the command to turn off power supply, turns off the backlight, and interrupts the supply of the power supply voltages to the liquid crystal display panel, and cancels the video mute when the com-

mand generating section generates the command to turn on power supply of the operating power supply, turns on the backlight, and again starts the supply of the power supply voltages to the liquid crystal display panel.

[0022] Furthermore, the method of controlling the display of a television receiver according to the present invention comprises step of turning on power supply of a receiver; step of receiving a broadcast program by a receiving section to display it on a display section; first determining step to determine whether a power supply key is operated; step of interrupting the supply of a power supply voltage from an operating power supply to the display section when the command to turn off power supply is generated by the operation of the power supply key at the first determining step; second determining step to monitor the internal state of the display section and determine whether the internal state satisfies a predetermined condition; third determining step to determine whether the power supply key is operated while the predetermined condition is satisfied; step to again start the supply of the power supply voltage to the display section when the command to turn on power supply is generated by the operation of the power supply key at the third step; and step to control the operating power supply to turn off also the supply of the power supply voltage to the receiving section if the predetermined condition is not satisfied at the second step.

[0023] In the method of controlling the display as mentioned above, it is preferred that the supply of the power supply voltage to the display section from the operating power supply is interrupted after muting the video signals received by the receiving section when the first command to turn off power supply is generated by the operation of the power supply key at the first determining step; and the supply of the power supply voltage to the display section is again started after canceling the video mute when the command to turn on power supply is generated by the operation of the power supply key at the third determining step.

[0024] According to the present invention, a television receiver including a liquid crystal display is constructed such that after a command to turn off power is generated, the television receiver can be switched between an apparent power-off state in which video and audio outputs can be immediately output and a true power-off state depending on the operating state of the liquid crystal display. Thus, the more useful television receiver can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. 1 is a circuit block diagram of a television receiver according to an embodiment of the present invention;

[0026] FIG. 2 is a plan view of the arrangement of keys on a remote controller used in the television receiver of FIG. 1;

[0027] FIG. 3 is a circuit block diagram of essential components of the television receiver of FIG. 1;

[0028] FIGS. 4A and 4B are timing charts explaining the operation of the television receiver of FIG. 1, FIG. 4B showing a control signal to turn on or off a liquid crystal display panel, the signal being transmitted from a back end processing (BEP) microcomputer to a power supply section,

FIG. 4A showing a change in voltage of power **3** output from the power supply section based on the control signal;

[0029] **FIGS. 5A to 5D** are timing charts explaining the operation of the television receiver of **FIG. 1**, **FIG. 5D** showing a control signal transmitted from the BEP microcomputer to the power supply section, **FIG. 5A** showing a change in voltage of power **4** output from the power supply section based on the control signal shown in **FIG. 5D**, **FIG. 5B** showing a change of the power **3** output from the power supply section based on the control signal in **FIG. 5D**, **FIG. 5C** showing timing at which a backlight is turned on and off; and

[0030] **FIG. 6** is a flowchart of the operation of the television receiver of **FIG. 1**.

DETAILED DESCRIPTION OF THE INVENTION

[0031] A television receiver according to an embodiment of the present invention will now be described in detail with reference to the drawings.

[0032] **FIG. 1** is a block diagram of the circuit configuration of the television receiver according to the embodiment of the present invention.

[0033] Referring to **FIG. 1**, a television receiver **100** is compatible with digital broadcasting. The television receiver **100** has an antenna input terminal **102** connected through a cable to an antenna **101** for receiving digital satellite broadcasting signals and digital terrestrial broadcasting signals.

[0034] The antenna input terminal **102** is connected to a tuner and demultiplexer section **103** serving as a receiving section. Airwaves as broadcasting signals received by the antenna **101** are supplied to the tuner and demultiplexer section **103**. In the tuner and demultiplexer section **103**, the broadcasting signals are subjected to channel selection, demodulation, and error correction and are then converted into a transport stream (TS) of MPEG2 (Moving Picture Experts Group 2). Further, packetized elementary streams (PES) constituting a program are extracted from the TS and are supplied to an MPEG2 decoder **104**.

[0035] The MPEG2 decoder **104** decodes an MPEG2 video PES into uncompressed digital video signals, which are supplied to a scaler **105**. The scaler **105** corrects the gray scale of the digital video signal supplied from the MPEG2 decoder **104** in accordance with the display characteristics of an LCD panel **107** and then supplies the resultant signal to a low voltage differential signaling (LVDS) transmitter **106**.

[0036] The LVDS transmitter **106** receives the video signal, a sync signal, and a clock to produce a low voltage differential signal and supplies the signal to the LCD panel **107** serving as a display section. The LCD panel **107** includes a control circuit **108** and an inverter circuit **110** for applying a power supply voltage to a backlight **109**. On the basis of the low voltage differential signal, the control circuit **108** drives an LCD irradiated with light emitted from the backlight **109**, thus displaying video based on the video signal.

[0037] The MPEG2 decoder **104** performs a decoding process on an audio PES constituting the program to produce uncompressed digital audio signals and supplies the signals to an audio signal processing circuit **111**. The audio

signal processing circuit **111** processes each digital audio signal, e.g., performs volume control and conversion into an analog signal and then supplies the resultant signal to a speaker **112** to output audio.

[0038] The television receiver **100** further includes a main microcomputer **113** constituting a control section for channel switching and volume control including audio mute. The main microcomputer **113** is connected to an operation input section **114** and an infrared receiver **116** which receives a signal from a remote controller **115**. Each of the operation input section **114** and the remote controller **115** functions as a command generating section for generating various commands including power-on/off commands.

[0039] The operation input section **114** includes a plurality of switches arranged on, for example, a front panel of the television receiver **100**. A user operates the operation input section **114** or the remote controller **115** to send a command, which is received by the main microcomputer **113**, thereby to control the tuner and demultiplexer section **103**, the MPEG2 decoder **104**, and the audio signal processing circuit **111** to perform channel selection, audio mute, or volume control.

[0040] The main microcomputer **113** is further connected to a light emitting diode (LED) **117** for indicating the ON or OFF state of the television receiver **100**. When the television receiver **100** is turned on, the LED **117** emits green light. When the television receiver **100** is turned off, the LED **117** emits red light.

[0041] The television receiver **100** further includes a back end processing (BEP) microcomputer **118** for controlling the scaler **105**, the LVDS transmitter **106**, and the LCD panel **107**. The BEP microcomputer **118** and the main microcomputer **113** constitute the control section. The BEP microcomputer **118** is connected to an internal state detection section **119** serving as a monitoring section which is an essential component according to the present invention. The internal state detection section **119** monitors a change in power supply voltage to the LCD panel **107**. When the power supply voltage is equal to or lower than a predetermined voltage, the internal state detection section **119** transmits information indicating the fact to the BEP microcomputer **118**, the BEP microcomputer **118** transmits the information to the main microcomputer **113**, and the main microcomputer **113** turns off powers **1-4** of a power supply section **120**, whereby to control so that the television receiver **100** is turned off. The above operation will be described in detail below.

[0042] The television receiver **100** further includes the power supply section **120** serving as an operating power supply which supplies a power supply voltage to each circuit component. The power supply section **120** is connected to a commercial AC power supply through a power plug **121**. The power supply section **120** generates five kinds of DC power supply voltages (of powers **0** to **4**).

[0043] In other words, the power supply section **120** outputs the powers **0** to **4**. The power supply voltage of the power **0** is always applied as long as the power plug **121** is connected to the commercial AC power supply. The power **0** is used as a power supply voltage for the main microcomputer **113**.

[0044] The power 1 is used for front-end circuit components, i.e., the tuner and demultiplexer section 103, the MPEG2 decoder 104, and the audio signal processing circuit 111.

[0045] The power 2 is used for back-end circuit components, i.e., the scaler 105, the LVDS transmitter 106 and the BEP microcomputer 118. The powers 3 and 4 are supplied to the LCD panel 107. The power 3 is supplied to the control circuit 108 in the LCD panel 107. The power 4 is supplied to the inverter circuit 110 in the LCD panel 107.

[0046] The main microcomputer 113 controls the ON and OFF states of the power 1. The BEP microcomputer 118 controls the ON and OFF states of each of the powers 2, 3 and 4 under the management by the main microcomputer 113.

[0047] FIG. 2 shows an example of the arrangement of keys on the remote controller 115. Referring to FIG. 2, the remote controller 115 has a numeric keypad 201 including "1" to "12" keys used to switch between channels or input numeric data.

[0048] The remote controller 115 further includes a cursor key 202 to select an item on a screen, an enter key 203 to determine the item selected using the cursor key 202, a channel up/down key 204 to select a channel, a volume control key 205 to turn up or down volume, and a power supply key 206 to turn on or off the television receiver 100.

[0049] The typical operation of the television receiver 100 will now be described with reference to FIG. 1.

[0050] In the OFF state of the television receiver 100, the power supply section 120 generates only the supply voltage of the power 0. The LCD panel 107 does not display any video. The user operates the power supply key 206 on the remote controller 115 to view a broadcast program.

[0051] When receiving a remote control signal through the infrared receiver 116, the main microcomputer 113 controls the power supply section 120 to output the powers 1 to 4. In addition, on the basis of channel data stored in an internal memory of the main microcomputer 113, the channel data indicating a channel which was selected before the television receiver 100 was turned-off, the main microcomputer 113 controls the tuner and demultiplexer section 103 to select the channel.

[0052] The main microcomputer 113 further controls the MPEG2 decoder 104, the BEP microcomputer 118, the scaler 105, the LVDS transmitter 106, the LCD panel 107, and the audio signal processing circuit 111 to display video of a broadcast program of the selected channel on the LCD panel 107 and generate audio of the program from the speaker 112.

[0053] To view a broadcast program of another channel, the user operates the numeric keypad 201 on the remote controller 115 to directly input a channel number. Alternatively, the user operates the channel up/down key 204 to switch between channels. To adjust the volume, the user operates the volume control key 205. To turn off the television receiver 100, the user operates the power supply key 206.

[0054] The operation of the television receiver 100 according to the present invention will now be described.

When the power supply key 206 is operated while the user is viewing a program, i.e., during a program viewing mode, the main microcomputer 113 transmits a control signal to the BEP microcomputer 118 so that the BEP microcomputer 118 controls the LVDS transmitter 106 to allow the LCD panel 107 to display black, i.e., to mute video. Simultaneously, the main microcomputer 113 controls the audio signal processing circuit 111 to mute audio. In addition, the main microcomputer 113 controls the LED 117 to emit red light.

[0055] Further, the main microcomputer 113 transmits a control signal to the BEP microcomputer 118, thereby to control the control circuit 108 to turn off the backlight 109. Since the LED 117 emits red light, therefore, it appears that the television receiver 100 is turned off, i.e., the television receiver 100 enters an apparent OFF state.

[0056] Subsequently, the BEP microcomputer 118 turns off the powers 3 and 4 of the power supply section 120. The voltages of the powers 3 and 4 gradually decrease depending on the circuit configuration (for example, the capacitances of capacitors connected to respective output terminals for the powers 3 and 4) of the power supply section 120.

[0057] At that time, the power supply section 120 continuously outputs the powers 1 and 2. Each of the tuner and demultiplexer section 103, the MPEG2 decoder 104, the audio signal processing circuit 111, the BEP microcomputer 118, the scaler 105, and the LVDS transmitter 106 is in the operating state.

[0058] The internal state detection section 119, connected to the BEP microcomputer 118, detects the voltage of the power 4 to monitor the internal state of the LCD panel 107, i.e. the state of the inverter circuit 110, and transmits a detection output to the BEP microcomputer 118. The BEP microcomputer 118 does not transmit any signal to the main microcomputer 113 so that the power supply section 120 keeps supplying the powers 1 and 2 until the BEP microcomputer 118 determines on the basis of the detection output from the internal state detection section 119 that the voltage of the power 4 is reduced to, e.g., a threshold V1.

[0059] When the power supply key 206 on the remote controller 115 is operated before the voltage of the power 4 is equal to or lower than the threshold V1, the main microcomputer 113 allows the BEP microcomputer 118 to control the power supply section 120 to turn on the powers 3 and 4.

[0060] Consequently, in the LCD panel 107, the power 3 is supplied to the control circuit 108 and the power 4 is supplied to the inverter circuit 110. Simultaneously, the main microcomputer 113 controls the audio signal processing circuit 111 and allows the BEP microcomputer 118 to control the LVDS transmitter 106 to cancel the video and audio mute mode. Further, the main microcomputer 113 allows the BEP microcomputer 118 to turn on the backlight 109 of the LCD panel 107.

[0061] Thus, video of the program that the user has viewed so far is displayed on the LCD panel 107 and audio is output from the speaker 112. The user can again view the program immediately.

[0062] When the voltage of the power 4 is equal to or lower than the threshold V1, the internal state detection section 119 transmits a signal to the BEP microcomputer

118. In response to the signal, the BEP microcomputer **118** transmits a control signal to the main microcomputer **113**. The main microcomputer **113** controls the power supply section **120** to turn off the powers **1** and **2**. Thus, the television receiver **100** enters a state of having the powers **1-4** turned off, i.e. a power-off state, which is called a standby mode.

[0063] As mentioned above, according to the present invention, when the power supply key **206** on the remote controller **115** is operated in the program viewing mode, the television receiver **100** enters the video and audio mute mode, namely, the apparent power-off state (apparent standby mode). When the power supply key **206** is operated before the voltage supplied to the inverter circuit **110** of the LCD panel **107** is equal to or lower than the threshold **V1**, video and audio are immediately output. When the voltage supplied to the inverter circuit **110** of the LCD panel **107** is equal to or lower than the threshold **V1**, the television receiver **100** enters the true power-off state. Even when the user operates the power supply key **206** accidentally, therefore, the user can immediately bring the television receiver **100** into the original program viewing mode by again operating the power supply key **206**. The usability of the television receiver **100** is not reduced.

[0064] According to the present invention, particularly, the state of the inverter circuit **110** of the LCD panel **107** is monitored. On the basis of a monitoring result, the setting of the state in which the video and the audio are muted and the backlight is turned off (the apparent turn-off state) and the true power-off state is managed. Consequently, the display operation of the television receiver **100** with the liquid crystal display can be properly controlled.

[0065] Voltage supply timing to the LCD panel **107** and the operations of the components in the LCD panel **107** will now be described in detail with reference to FIGS. **3** to **5D**.

[0066] **FIG. 3** is a circuit block diagram of the essential components of an embodiment of the present invention. In **FIG. 3**, the same components as those in **FIG. 1** are designated by the same reference numerals.

[0067] The LCD panel **107** has an LCD panel body **301** including liquid crystal elements and a three primary color filter, the backlight **109** emitting light to the LCD panel body **301**, the inverter circuit **110** for supplying power supply voltage to the backlight **109**, and the control circuit **108** for driving the LCD panel **107** and controlling the operation thereof.

[0068] In response to a signal from the LVDS transmitter **106**, the control circuit **108** drives the LCD panel body **301** and also turns on or off the backlight **109** under the management of the BEP microcomputer **118**.

[0069] The powers **3** and **4** are supplied from the power supply section **120** to the control circuit **108** and the inverter circuit **110**, respectively, under the management of the BEP microcomputer **118**. In response to a control signal from the main microcomputer **113** in **FIG. 1**, the BEP microcomputer **118** controls the power supply section **120** to turn on or off the powers **3** and **4** and also controls the LVDS transmitter **106** to mute video. In addition, the BEP microcomputer **118** controls the control circuit **108** to turn on or off the backlight **109**.

[0070] The BEP microcomputer **118** is connected to the internal state detection section **119**. The BEP microcomputer **118** receives a detection output of the internal state detection section **119**. The internal state detection section **119** has a function of monitoring the voltage of the power **4**. The internal state detection section **119** has a predetermined voltage, e.g., the threshold **V1** therein. When the voltage of the power **4** is equal to or lower than the threshold **V1**, the internal state detection section **119** transmits information indicating the fact to the BEP microcomputer **118**.

[0071] The BEP microcomputer **118** transmits the information to the main microcomputer **113**. The main microcomputer **113** turns off the operating powers (excluding the power **0**) of the television receiver **100** to switch the television receiver **100** into the standby mode.

[0072] The operations of the circuit components in **FIG. 3** will now be described with reference to **FIGS. 4A** to **5D**.

[0073] **FIG. 4B** shows a control signal to control the power supply section **120**, the signal being transmitted from the BEP microcomputer **118** to the power supply section **120**. **FIG. 4A** shows a change in the voltage of the power **3** output from the power supply section **120** depending on the control signal of **FIG. 4B**. Referring to **FIG. 4B**, at time **t40**, the power supply (the powers **3** and **4**) of the LCD panel **107** is controlled to be turned off. At time **t41**, the power supply is controlled to be turned on.

[0074] **FIG. 5D** shows the control signal to control the power supply section **120**, the signal being transmitted from the BEP microcomputer **118** to the power supply section **120**. **FIG. 5A** shows a change in the voltage of the power **4** output from the power supply section **120** depending on the control signal of **FIG. 5D**. **FIG. 5B** shows a change in the voltage of the power **3** generated from the power supply section **120** depending on the control signal of **FIG. 5D**. **FIG. 5C** shows timing at which the ON state of the backlight **109** is switched into the OFF state. The time axes in **FIGS. 5A-5D** are the ones having parts of the time axes in **FIG. 4A** and **FIG. 4B** enlarged and shown. **FIG. 5A** shows the state of change in the voltage of the power **4**, and **FIG. 5B** shows the state of change in the voltage of the power **3**. Referring to **FIG. 5D**, at time **t50**, the power supply (the powers **3** and **4**) of the LCD panel **107** is turned off. Time **t51** shows a turn-on boundary timing necessary for restoring the power supply by the re-operation of the power supply key. The backlight **109** is first controlled to be turned off based on the command to turn off the power supply by the operation input section **114** or the remote controller **115** (see **FIG. 5C**), and subsequently, the power supply (the powers **3** and **4**) of the LCD panel **107** is controlled to be turned off.

[0075] When the power supply key **206** on the remote controller **115** is operated in the program viewing mode, the main microcomputer **113** receives a signal indicating the operation and transmits a command to the BEP microcomputer **118** in order to turn off the LVDS transmitter **106** and the backlight **109** of the LCD panel **107**, and further turn off the power supply (the powers **3** and **4**) of the LCD panel **107**.

[0076] In response to the command, the BEP microcomputer **118** controls the LVDS transmitter **106** to mute video and transmits a control signal to the control circuit **108** to turn off the backlight **109**. Thus, the backlight **109** turns off. **FIG. 5C** shows the turn-off timing.

[0077] Further, the BEP microcomputer 118 transmits a control signal to the power supply section 120 to turn off the power supply (the powers 3 and 4) of the LCD panel 107. The timing thereof is as shown in FIG. 5D. In other words, the falling edge of the control signal leads to turning off the powers 3 and 4 through the power supply section 120. Thus, the voltages of the powers 3 and 4 start to fall. As shown in FIG. 4A, if the voltage of the power 3 is equal to or lower than a value VS3 that is 0.3 times a specified value Vcc (e.g., VS3 represents 1.5 V when the specified voltage Vcc is 5 V), it is necessary to provide a time interval of one second at minimum until the voltage of the power 3 is equal to or higher than a value that is 0.9 times the specified value Vcc after the next command to turn on the power supply is generated. In other words, after the power supply (power 3) is turned off once, the power supply cannot be turned on for a minimum of one second.

[0078] Therefore, in order to immediately turn on the power supply (power 3), it is necessary to transmit a command to turn on the power supply before the voltage is equal to or lower than the value VS3 (0.3Vcc).

[0079] Regarding a period elapsed after the command to turn off the power supply (power 3) until the voltage of the power 3 is equal to or lower than 0.3Vcc, an observed value is about 0.3 seconds as shown by reference symbol t30 in FIG. 4A. When the resistance of a specific circuit component is changed, a period elapsed until the voltage is equal to or lower than 0.3Vcc can be extended. Therefore, power control can be set so that the user can again operate the power supply key 206 on the remote controller 115 with sufficient time to return the television receiver 100 into the original program viewing mode.

[0080] Referring to FIG. 5A, the voltage of the power 4, i.e. the input voltage of the inverter circuit 110 relatively rapidly drops due to a connected load until an output voltage (not shown) of the inverter circuit 110 is reduced to 0 V after the backlight 109 is turned off (refer to FIG. 5C) and a power control signal is turned off (refer to FIG. 5D). After the output voltage of the inverter circuit 110 reaches 0 V, the power 4 enters a complete no-load state. The voltage of the power 4 remarkably gradually drops. It takes ten or more seconds until the voltage of the power 4 reaches 0 V. Accordingly, the voltage of the power 4 is held at about 4.7 V for one second after the output voltage of the inverter circuit 110 reaches 0 V.

[0081] The ratio between the powers 3 and 4 is substantially 1:1. Accordingly, observing the voltage of the power 4 is equivalent to observing the power 3.

[0082] On the assumption that the threshold V1 of the power 4 is 4.7 V, when the voltage of the power 4 is equal to or lower than the threshold V1, the internal state detection section 119 transmits information indicating the fact to the BEP microcomputer 118. The BEP microcomputer 118 transmits a signal indicating the information to the main microcomputer 113.

[0083] In the case where the signal indicating that the voltage of the power 4 is equal to or lower than the threshold V1 is transmitted from the BEP microcomputer 118 to the main microcomputer 113, if the power supply key 206 on the remote controller 115 is not operated again, the main microcomputer 113 determines that the preceding command to

turn off the power is normal and again transmits the power-off command to the power supply section 120, thus turning off the powers 1 and 2.

[0084] Consequently, the power supply (power 2) of the BEP microcomputer 118 is turned off. Since the LCD panel 107 is just being turned off, the television receiver 100 substantially enters the standby mode after a while.

[0085] On the other hand, if the power supply key 206 on the remote controller 115 is operated again before the signal indicating that the voltage of the power 4 is equal to or lower than 4.7 V is transmitted from the BEP microcomputer 118 to the main microcomputer 113, the main microcomputer 113 determines that the preceding power-off command is cancelled depending on the user's convenience and transmits a command to the BEP microcomputer 118 in order to cancel the video mute of the LVDS transmitter 106, control the audio signal processing circuit 111 to cancel the audio mute, turn on the backlight 109 of the LCD panel 107, and return the power supply (powers 3 and 4) of the LCD panel 107. In addition, the LED 117 is rendered in a state of emitting green light.

[0086] Thus, video is again displayed on the LCD panel 107 and audio is output from the speaker 112.

[0087] As mentioned above, the television receiver 100 in the apparent power-off state, i.e., in the video and audio mute mode can be rapidly returned to the power-on state by successively operating the power supply key 206. It seems to the user that the television receiver 100 is instantaneously switched from the power-off state to the power-on state. Thus, the user is not impatient with the switching.

[0088] FIG. 6 is a flowchart to once more explain the operation of controlling the display of a television receiver according to the present invention as mentioned above. In FIG. 6, the operation starts in step S601. In step S602, the receiver is turned on. In step S603, a desired program is viewed.

[0089] In step S604, whether the power supply key 206 on the remote controller 115 is operated is determined. If it is determined that the power supply key 206 is not operated, the operation returns to step 603. When it is determined in step S604 that the power supply key 206 is operated, in step S605, the LVDS transmitter 106 and the audio signal processing circuit 111 are controlled so that the receiver enters the audio and video mute mode. In step S606, the backlight 109 is turned off and the LCD panel 107 is turned off.

[0090] In step S607, whether the voltage of the power 4 is equal to or lower than the threshold V1 is determined. When the voltage is not equal to or lower than the threshold V1, it is determined in step S608 whether the power supply key 206 on the remote controller 115 is operated again. When it is determined that the power supply key 206 is not operated, the operation returns to step S607.

[0091] When it is determined in step S608 that the power supply key 206 is operated again, in step S609, the LVDS transmitter 106 and the audio signal control circuit 111 are controlled to cancel the video and audio mute.

[0092] Then, in step S610, the backlight 109 is turned on and the power supply of the LCD panel 107 is turned on, thereby to have the operation return to step S603.

[0093] When it is determined in step S607 that the voltage of the power 4 is equal to or lower than the threshold V1, in step S611, the powers 1 and 2 for a signal processing system including the signal processing circuits are turned off in the power supply section 120, so that the television receiver 100 substantially enters the standby mode (step S612).

[0094] As mentioned above, according to the present invention, the television receiver 100 operates as follows: When the power supply key 206 on the remote controller 115 is operated in the program viewing mode, the television receiver 100 enters the video and audio mute mode. It appears that the television receiver 100 enters the power-off state (standby mode), i.e., the television receiver 100 enters the apparent power-off state. When the power supply key 206 is operated again before the voltage supplied to the LCD panel 107 is equal to or lower than the threshold V1, video and audio are immediately output. When the voltage supplied to the LCD panel 107 is equal to or lower than the threshold V1, the television receiver 100 enters the true power-off state. If the user operates the power supply key 206 by accident, the user successively operates the power supply key 206 to immediately return the television receiver 100 to the program viewing mode. Accordingly, the usability is not reduced.

[0095] According to the present invention, particularly, the internal state of the LCD panel 107 is monitored to manage the setting of the apparent power-off state, in which the video and audio mute mode is set and the backlight is turned off, and that of the true power-off state. Thus, the display operation of the television receiver 100 with the liquid crystal display can be properly controlled.

[0096] Having described the preferred embodiments of the invention referring to the accompanying drawings, it should be understood that the present invention is not limited to those precise embodiments and various changes and modifications thereof could be made by one skilled in the art without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. A television receiver, comprising:

- a receiving section which receives a broadcast program to obtain video signals;
- a display section, including a liquid crystal display panel, which displays the video signals;
- an operating power supply which selectively supplies power supply voltages to the receiving section and the display section, respectively;
- a command generating section which generates a command to the operating power supply to turn off power supply and also turn on power supply;
- a monitoring section which monitors the internal state of the display section to generate a monitoring result; and
- a control section which interrupts the supply of the power supply voltages from the operating power supply to the display section when the command generating section generates the command to turn off power supply, again starts the supply of the power supply voltages to the display section when the command generating section generates the command to turn on power supply of the

operating power supply while the monitoring section monitors the internal state of the display section after interrupting the operating power supply and the internal state satisfies a predetermined condition, and controls the operating power supply to turn off also the power supply voltages to the receiving section if the internal state of the display section does not satisfy the predetermined condition.

2. The television receiver according to claim 1, wherein the control section interrupts the supply of the power supply voltages to the display section from the operating power supply after muting the video signals received by the receiving section when the command generating section generates the command to turn off power supply, and again starts the supply of the power supply voltages to the display section after canceling the video mute when the command generating section generates the command to turn off power supply of the operating power supply.

3. The television receiver according to claim 1, wherein the display section includes an inverter circuit and a backlight to emit light using an output of the inverter circuit as a power supply, and

the predetermined condition of the internal state of the display section is set based on a power supply voltage supplied to the inverter circuit.

4. The television receiver according to claim 2, wherein the display section includes an inverter circuit and a backlight to emit light using an output of the inverter circuit as a power supply, and

the predetermined condition of the internal state of the display section is set based on a power supply voltage supplied to the inverter circuit.

5. A television receiver comprising:

- a receiving section which receives a broadcast program to obtain video signals;
- a liquid crystal display panel including a liquid crystal display panel body, an inverter circuit, a backlight which emits light for displaying on the liquid crystal display panel body using an output of the inverter circuit as a power supply, and a control circuit which drives the liquid crystal display panel body on the basis of the video signals from the receiving section and controls the operation of the backlight;
- an operation power supply which selectively supplies power supply voltages to the receiving section and the liquid crystal display panel, respectively;
- a command generating section which generates a command to the operating power supply to turn off power supply and also turn on power supply; and
- a control section which controls the operating power supply to interrupt the supply of the power supply voltages to the liquid crystal display panel when the command generating section generates the command to turn off power supply, again starts the supply of the power supply voltages to the liquid crystal display panel when a value of the voltage supplied to the inverter circuit as a power supply voltage is monitored and the command generating section generates the command to turn on power supply of the operating power supply before the value becomes equal to or lower than a predetermined value, and turns off also the

supply of the power supply voltage to the receiving section if the value of the power supply voltage to the inverter circuit becomes lower than the predetermined value.

6. The television receiver according to claim 5, wherein the control section mutes the video signals received by the receiving section when the command generating section generates the command to turn off power supply, turns off the backlight, and interrupts the supply of the power supply voltages to the liquid crystal display panel, and cancels the video mute when the command generating section generates the command to turn on power supply of the operating power supply, turns on the backlight, and again starts the supply of the power supply voltages to the liquid crystal display panel.

7. The television receiver according to claim 6, wherein the receiving section also outputs audio of the received broadcast program, and

the control section controls muting the audio signal and canceling the muting in association with the video signals.

8. A method of controlling the display of a television receiver comprising:

step of turning on power supply of a receiver;

step of receiving a broadcast program by a receiving section to display it on a display section;

first determining step to determine whether a power supply key is operated;

step of interrupting the supply of a power supply voltage from an operating power supply to the display section when the command to turn off power supply is generated by the operation of the power supply key at the first determining step;

second determining step to monitor the internal state of the display section and determine whether the internal state satisfies a predetermined condition;

third determining step to determine whether the power supply key is operated while the predetermined condition is satisfied;

step to again start the supply of the power supply voltage to the display section when the command to turn on power supply is generated by the operation of the power supply key at the third step; and

step to control the operating power supply to turn off also the supply of the power supply voltage to the receiving section if the predetermined condition is not satisfied at the second step.

9. The method of controlling the display of a television receiver according to claim 8, wherein the supply of the power supply voltage to the display section from the operating power supply is interrupted after muting the video signals received by the receiving section when the first command to turn off power supply is generated by the operation of the power supply key at the first determining step; and

the supply of the power supply voltage to the display section is again started after canceling the video mute when the command to turn on power supply is generated by the operation of the power supply key at the third determining step.

10. The method of controlling the display of a television receiver according to claim 8, wherein the predetermined condition in the display section is set based on the power supply voltage supplied to the display section.

11. The method of controlling the display of a television receiver according to claim 9, wherein the predetermined condition in the display section is set based on the power supply voltage supplied to the display section.

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专利名称(译)	电视接收机和控制其显示的方法		
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摘要(译)

一种包括液晶显示 (LCD) 面板的电视接收器。当接收到通过操作遥控器上的电源键产生的信号时, 视频和音频被静音, LCD面板的背光被关闭, 并且LCD面板的电源被关闭。监视LCD面板的电源电压。当电压等于或低于预定值时, 整个接收器的电源关闭。当在提供给LCD面板的电压等于或低于预定值之前操作遥控器上的电源键时, 视频和音频静音模式被取消, LCD面板的背光打开, 并且LCD面板的电源已打开。

