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COLOR TELEVISION IMAGE DISPLAY APPARATUS

The present invention relates to a color television image display apparatus equipped with an automatic image quality control means.

2. Description of the Prior Art

For the purpose of continuously achieving an optimal image state in television, technical development is recently in rapid progress with regard to a television monitor having a function of automatically controlling the luminance, color saturation and so forth to optimal conditions in every field of a video signal. When the image being displayed in a television monitor changes momentarily among light, dark, colorful and nearly monochromatic states, it is impossible to achieve a desired optimal image condition continuously if the controls for the luminance, color saturation and so on are set at fixed positions. Therefore, a predetermined unitary amount of the video signal is analyzed and then the luminance control and others are adjusted in a manner to

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attain the best condition.

For example, as shown in Fig. 2, a video signal fed via a TV tuner 1 and an IF (intermediate frequency) amplifier 2 is supplied to an image quality control signal generator which comprises an A-D (analog-to-digital) converter 3 and an arithmetic processor 4 consisting of a microcomputer.

The arithmetic processor 4 sets, in each field of the video signal, sampling points denoted by S_{P1} - S_{Pn} in Fig. 3 and supplies sample timing signals to the A-D converter 3. In accordance with such sample timing signals, the A-D converter 3 executes analog-to-digital conversion of the luminance signal for example and then outputs n digital data (voltage value data of the luminance signal) in every field to the arithmetic processor 4. Then the arithmetic processor 4 calculates one field of the luminance data and generates an image control signal S_{Al} of the luminance amplification level in accordance with the result of such calculation (discrimination data determined by the lightness, darkness and so forth of the image). The image control signal S_{Al} thus generated is supplied to a video signal processor 5 where the luminance amplification level is controlled, and the processed signal is outputted to a CRT display unit 6.

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Since such process is executed with regard to every field, it follows that an optimal image quality is ensured continuously.

According to the image quality control signal generator, it is possible to perform simultaneous adjustment of the color saturation, sharpness and so forth in addition to the luminance control by the same constitution, hence achieving enhancement in the overall quality of the image being monitored.

However, in the conventional television image display apparatus mentioned above, there occurs a loss time which is required in the A-D converter 3 and the arithmetic processor 4 for generating an image quality control signal S_{Al} to execute automatic image quality adjustment. Suppose now that, in an exemplary case where the arithmetic processor 4 consists of a 4-bit single chip microcomputer, a time of 0.1 second or so is required until an image quality control signal $S_{Al(n)}$ is outputted after sampling the data of one field F_n. Then, at the instant the image quality control signal $S_{Al(n)}$ is inputted to the video signal processor 5, the video signal of a field $F_{(n+5)}$, which is posterior by 6 fields to the relevant field F_n sampled for generating the image quality control signal $S_{Al(n)}$, is inputted to the video signal

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processor 5. Although it is a slight time delay, such delay causes a failure in adjusting the image quality of the field F_n to be adjusted by the image quality control signal $S_{Al(n)}$.

Consequently, there arises a problem that when the image is suddenly changed, the image quality is deteriorated for a moment.

It is therefore an object of the present invention to provide an improved color television image display apparatus where both an image quality control signal and a video signal to be controlled by such image quality control signal are inputted to a video signal processor substantially without a timing difference therebetween.

According to one aspect of the present invention, there is provided a color television image display apparatus comprising an image quality control signal generator for sampling predetermined data from an input video signal, then producing an image quality control signal in accordance with the data thus sampled, and supplying the image quality control signal to a video signal processor; and a delay means for delaying the input video signal for a time substantially equal to the time required for

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generation of the image quality control signal in the image quality control signal generator, and supplying the delayed signal to the video signal processor. Due to the function of the delay means, both the video signal and the image quality control signal obtained in the image quality control signal generator in accordance with the video signal are inputted to the video signal processor substantially with a timing coincidence.

The above and other features and advantages of the present invention will become apparent from the following description which will be given with reference to the illustrative accompanying drawings.

Fig. 1 is a block diagram of an exemplary color television signal display apparatus embodying the present invention;

Fig. 2 is a block diagram of a conventional example; and

Fig. 3 schematically illustrates a sampling operation for automatic image quality control.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinafter a preferred embodiment of the present

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invention will be described in detail with reference to the accompanying drawings.

Fig. 1 is a block diagram of an exemplary color television image display apparatus embodying the present invention where a delay means is composed of an image memory. In this diagram, the same reference numerals and symbols as those used in Fig. 2 denote the same or corresponding components, and both a power supply circuit and an audio circuit are omitted.

A rectangular section 10 enclosed with a one-dot chained line denotes a delay means employed in this embodiment. The delay means 10 comprises an A-D (analog-to-digital) converter 11 for converting the supplied video signal into a digital signal, an image memory 12 where the digital video data is stored and read out at a predetermined timing, a D-A (digital-to-analog) converter 13, and an image memory controller 14 for supplying a timing clock signal to both the A-D converter 11 and the D-A converter 13 while supplying a read/write control signal, an operation clock signal and an address data to the image memory 12 so as to control the operation thereof. The storage capacity of the image memory 12 is set in conformity with the time required for the arithmetic processor 4 to generate an image quality control signal

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S_{A1}. For example, when a time of 0.1 second is required for generation of an image quality control signal S_{A1}, it is desired that the capacity of the image memory be sufficient to store at least six fields of the image data.

A video signal fed via a TV tuner 1 and an IF (intermediate frequency) amplifier 2 is supplied to an A-D converter 3 and an arithmetic processor 4 similarly to the aforementioned example of Fig. 2, so that a predetermined arithmetic process is executed with regard to every field of the video signal to thereby generate an image quality control signal S_{A1}. Meanwhile the video signal is supplied also to the A-D converter 11 to become digital data, which is then stored in the image memory 12.

The video data stored in the image memory 12 is read out therefrom in synchronism with the output timing of the image quality control signal S_{A1} under control of the image memory controller 14 and is converted into analog video data, which is then inputted to the video signal processor 5. Consequently, in case a time of 0.1 second is required for generation of the image quality control signal S_{A1}, input of the video signal is delayed for 0.1 second.

In the video signal processor 5, a predetermined

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process (such as luminance amplification to a level preset by the image quality control signal S_{A1} for example) is executed for the input video signal in accordance with the image quality control signal S_{A1}, and also the R (red), G (green) and B (blue) signals are demodulated. Thereafter the color signals thus demodulated are outputted to a CRT (cathode-ray tube) display unit 6. The operation mentioned above is performed with regard to every field of the video signal, so that the image of the automatically adjusted quality can be displayed on the CRT display unit 6.

In this embodiment where the video signal is delayed by the delay means 10 for a time required for generation of the image quality control signal S_{A1}, the process based practically on the image quality control signal S_{A1} can be executed for the video signal of the field to be controlled by the image quality control signal S_{A1}, thereby averting the disadvantage that the image being controlled is rendered noncoincident by the delay derived from generation of the image quality control signal S_{A1}.

When a time of 0.1 second is required for generation of an image quality control signal in such automatic image quality control operation performed with regard to

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every field as in this embodiment, it is necessary for the image memory 12 to have a sufficient storage capacity of at least 6 fields of the video signal as mentioned to attain a timing coincidence between the video signal and the image quality control signal S_{A1} inputted to the video signal processor 5. However, the desired effect can be achieved to a certain extent even if a complete input timing coincidence is not exactly attained. For example, when the image memory 12 has a storage capacity of merely 3 fields, there occurs an input timing difference of 0.05 second even by setting a maximum delay value. It follows that an image quality adjustment based on the image quality control signal S_{A1} is executed for the field posterior by three fields to the data-sampled field relative to generation of the image quality control signal S_{A1}. However, if the timing difference corresponds merely to three fields or so, any sudden change of the displayed image gives no incongruous visual impression to a television viewer. Therefore it is not exactly necessary for the delay means 10 to have a delay value corresponding to the time required for generation of the image quality control signal S_{A1}.

It is a matter of course that the required storage capacity of the image memory 12 can be reduced if

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the time for generation of the image quality control signal S_{A1} is shortened by the use of a high-speed microcomputer or the like.

Although a description has been given with respect to an exemplary case of executing an automatic image quality adjustment for every field of the video signal, a similar adjustment may be executed for every frame or every several fields. Furthermore, it is not exactly necessary to provide an exclusive delay means as the image memory 12, and in any appliance having an image memory to perform other process, such image memory may be utilized for the delay mentioned. It is also to be understood that the delay means is not limited to a type utilizing an image memory.

According to the color television image display apparatus of the present invention, as described hereinabove, a video signal is delayed by a delay means in conformity with the time required for generation of an image quality control signal, whereby it is rendered possible to eliminate the known disadvantage that an automatic image quality adjustment is delayed from the video output to be adjusted, thereby averting an incongruous visual impression that may otherwise be given to a television viewer due to some sudden change in the image being displayed.

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1. A color television image display apparatus comprising:

a means for supplying a video control signal to a video signal processing circuit, including a sampling means for dividing every field of an input video signal into a plurality of areas and sampling the video signal level in each of said areas, and an arithmetic processing means supplied with the sampled data from said sampling means for generating the video control signal to adjust the condition and quality of the displayed video image; and

a signal delay means for delaying the video signal for a time substantially equal to the time required for generation of the video control signal, so as to render the phase of the video signal coincident with that of said video control signal supplied to said video signal processing circuit.

2. A color television image display apparatus according to claim 1, wherein said signal delay means consists of an analog-to-digital converter, a field memory, a digital-to-analog converter and a memory controller.

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