CAMCORDER WITH STILL-PHOTOGRAPHY FUNCTION

The present invention relates to camcorders with an electronic still-photography function.

Camcorders comprise both a video camera and video recorder in a single body. Advances in electronics have allowed camcorders to be manufactured at a sufficiently low cost to enable their widespread purchase and use by private consumers. Recently, electronic still cameras have also been developed. These store a particular still scene in an integrated circuit removeable/ replaceable memory, and display it again on a television monitor if desired.

However, until recently there has been no single apparatus which provides the functions both of the conventional camcorder and the electronic still camera. Camcorders have only been able to record moving images and play them back again. If one wanted to record a still scene it was necessary to purchase an additional electronic still camera. Thus, if a user wanted to record the same scene in both moving and still formats there was no way to achieve it using a single apparatus.

In part solution of this problem, an electronic camera which functions as a movie camera and as a still camera was proposed, as described in Japanese Patent 58-3384. This utilizes a single photograph memory so that one can record either moving scene or still scene. Thus, a moving scene and still scene cannot be recorded at the same time and particularly, a desired still scene out of the successive moving scenes cannot be recorded separately and simultaneously. Therefore, the practical use of this combined camera are extremely restricted.

The present invention overcomes these problems and

provides a camcorder with an electronic still-photography function, which performs the photography of successive "frames" of a moving scene and allows simultaneous electronic still-photography of a single image from the same scene. This is achieved by inclusion of an additional electronic still-photography circuit and a switching circuit.

Thus, according to the present invention, there is provided a camcorder for recording both still and moving images, the camcorder comprising, a camera circuit for providing an image signal, a video circuit for recording the image signal onto a moving image recording medium, an electronic still-photography circuit for recording the image signal onto a still image recording medium distinct from the moving image recording medium, and switching means connected to the camera circuit, the video circuit and the electronic still-photography circuit for enabling simultaneous recording of a moving image and a still image from the same scene.

Preferably, the camera circuit includes a first colour signal processor and the video circuit includes a second colour signal processor.

Preferably, the still image storing means is an integrated circuit memory card. The still-photography

circuit is preferably arranged to supply a received still scene in electronic form to a first monitor. Advantageously, the switching means comprises a first switching part located between the camera and video circuits.

According to a preferred embodiment of the present invention, the camera circuit is connected to either said video circuit or said first monitor, according to a first control signal. A decoder is connected to said second colour signal processor in said video circuit, for separating a luminance signal and a colour signal from said second colour signal processor into a new luminance signal and colour signal processor of said camera circuit, said decoder and said electronic still photography circuit, for connecting either said first colour signal processor or said decoder to said electronic still photography circuit according to second control signal.

These and other objects, features, and advantages of the present invention will become more apparent from the following description of a preferred embodiment taken in conjunction with the accompanying drawings, in which:

Fig. 1 shows a camcorder circuit with electronic still photography function and in accordance with the present invention; and
Fig. 2 shows a switching circuit for use in the camcorder circuit shown in Fig. 1.

Fig. 1 shows the circuit diagram of a camcorder having an electronic still-photography function. The circuit comprises a camera circuit 100, a video circuit 200, a still-photography circuit 300, and a switching circuit 400. The camera, video, and still photography circuits 100, 200, and 300 are of conventional design.

The camera circuit 100 includes an lens part 11 and an optical-to-electrical converter 12 for converting an optical image signal to an electrical signal. The camera circuit further comprises a matrix 13 for converting the electrical signal to colour signals R(Red), G(Green), and B(Blue). The camera circuit also comprises a first colour signal processor 14 for providing a luminance signal Y and colour-difference signals R-Y and B-Y by processing the colour signals R, G and B. An encoder 15 is also provided for producing an electrical image signal by combining the luminance signal Y and the colour-difference signals R-Y and B-Y.

The video circuit 200 includes a switching part 22, which is connected both to an electronic viewfinder 21 (hereinafter termed EVF) and to a second external monitor M2 via an output terminal (a first monitor will be described hereinbelow). The second monitor controls first and second signal paths under user direction. Y/C separators 23 and 27 are also provided for separating a luminance signal and a colour signal Y from an externally input image signal. Y/C mixers 24 and 26 provide an image signal by mixing the luminance signal Y and the colour signal C. A second colour signal processor 25 is provided for amplifying the input signal and for removing noise. The video circuit also includes a recorder 28 for recording and storing the input image signal and a player 29 for playing back the image signal recorded by the recorder.

In the video circuit 200, under the control of the switching part 22, the input image signal from the camera circuit 100 is applied to the EVF 21, the second monitor M2, and to the recorder 28 through a first signal path. Alternatively, the recorded image signal from the player 29 is applied to the EVF 21 and the second monitor M2 through a second signal path.

The recorder and player respectively record onto and play back from any suitable medium for recording and playback of a moving image, for example conventional video-tape.

The first signal path comprises in sequence, the Y/C separator 23, the second colour signal processor 25, the Y/C mixer 26, and the recorder 28. In sequence, the second path comprises the player 29, the Y/C separator 27, the second colour signal processor 25, and the Y/C mixer 24.

The electronic still-photography circuit 300 includes an analog-to-digital (A/D) converter 31 for converting the luminance signal Y and the colour-difference signals R-Y and B-Y to digital data and a first memory part 32 for storing the digital data provided from the A/D converter 31. A removeable image-storing integrated circuit (IC) card 33 is connected between the A/D converter and a second memory part 34. A digital-to-analogue (D/A) converter 35 is provided for converting the digital data to analogue signals and an encoder 36 changes these analogue signals into an image signal to be delivered to a first external monitor M1 via an output terminal.

Finally, the switching circuit 400 includes a first switching part 41, a second switching part 42, and a decoder 43. In the switching circuit 400, the first switching part 41 interconnects the camera circuit 100, the video circuit 200, and the electronic still-photography circuit 300. The output of the camera circuit is controlled by a switching control signal C1.

Fig. 2 shows the detailed configuration of the switching circuit 400 of Fig. 1. The second switching part 42 is connected to the decoder 43. The latter combines the luminance signal Y and the colour signal C, provided from the second colour signal processor 25, to output

both the luminance signal Y and the colour-difference signals R-Y and B-Y.

As shown in Fig. 2, the luminance signal Y provided from the first colour signal processor 14 is applied to a terminal 1 of a switch SW1 in the second switching part 42, while the other luminance signal ouput from the decoder 43 is applied to a terminal 2 of the switch SW1. Thus, either of these luminance signals can be applied to the electronic still-photography circuit 300 under the control of a signal C2.

Furthermore, a colour-difference signal R-Y provided from the first colour signal processor 14 is applied to a terminal 1 of a switch SW2 in the second switching part 42. Another colour difference signal R-Y provided from the decoder 43 is applied to a terminal 2 of the switch SW2. Thus, either of these colour difference signals can be applied to the electronic still-photography circuit 300 under the control of the signal C2.

Similarly, a colour difference signal B-Y provided from the first colour signal processor 14 and another colour difference signal B-Y provided from the decoder 43 are applied to the terminals 1 and 2 of a switch SW3 in the second switching part 42. One or other of these difference signals is applied to the electronic still-photography circuit 300, again under the control of the signal C2.

The camcorder has four modes of operation. In the first, the camcorder scans an object by using the camera circuit 100 and the video circuit 200. This mode is called the Electronic-to-Electronic (E-E) mode and even in this mode, electronic still-photography is possible. In other words, a desired scene is still photographed

during scanning of the object through the EVF 21 or the second monitor M2 by using the camera circuit 100.

The optical image "seen" through the lens 11 is converted to the corresponding electrical signal by the optical-to-electrical converter 12. The electrical signal is changed to the colour signals R, G, and B, by the matrix 13. Subsequently, these colour signals R, G, and B are converted to the luminance signal Y and the colour-difference signal R-Y and B-Y by the first colour signal processor 14. The converted signals are applied to the encoder 15 to provide the electrical image signal.

In order to operate the E-E mode, the user switches the first switching part 41 to the position 1 by means of the control signal C1. The electrical image signal of the camera circuit 100 is thereby provided to the video circuit 200. The user also controls the switching part 22 in the video circuit 200 so that the electrical image signal is applied to the EVF 21 or the second monitor M2 as desired, to display an image of the object in front of the lens 11 on one or the other.

At this stage, if the user wants electronic still photography, the signal C2 is used to actuate the switches SW1 - SW3 in the second switching part 42 so that the output signals of the first colour signal processor 14 are applied to the electronic still-photography circuit 300 via the terminals 1.

Therefore, the luminance signal Y and the colour difference signals R-Y and B-Y provided from the first colour signal process 14 are converted to the digital data by the A/D converter 31 stored in the first memory part 32. Then, under user control, the stored image data are transferred to and stored in the image-storing IC card 33. This is done by means of a separate switch

(not shown).

The image-storing IC card 33 is removeable/replaceable so that recorded still images can be kept for future viewing. Therefore, a user is likely to own a collection of such IC cards. When an IC card on which a previously recorded image is stored, is inserted again, the stored image data are transferred to the second memory part 34. The stored image data are then converted into the luminance signal Y and the colour difference signals R-Y and B-Y by the D/A converter 35. The converted signals are converted back into an image signal by the encoder 36 and provided to the first monitor M1. Subsequently, the image stored in the image storing IC card 33 is displayed on the first monitor M1.

The second mode of operation is recording of a moving image with optional electronic still-photography. During recording of the moving image, the first switching part 41 and the switches SW1 - SW3 are all in the position with terminal 1 connected. If desired, the still scene can be stored in the image-storing IC card 33 as in the first mode.

Under user control, the switching circuit 22 is operated so that the image signal from the camera circuit 100, via the first switching part 41, is applied to the first signal path of the video circuit 200 referred to above, as well as to the EVF 21 and/or to the second monitor M2 if the latter is connected. Then, the image signal provided through the switching part 22 is separated into the luminance signal Y and the colour signal C by the Y/C separator 23. These luminance and colour signals Y and C are amplified by the second colour signal processor 25, which simultaneously removes any noise components.

The amplified luminance and colour signals Y and C are mixed by the Y/C mixer 26 and finally, the mixed signal is recorded by the recorder 28.

The third mode of operation is playback of a recorded moving image, again with optional electronic still-photography. The image signal stored in the recorder 28 is played back by the player 29 at the will of the user. This image signal is separated into the luminance signal Y and the colour signal C by the Y/C separator 27 and these separated signals Y and C are amplified by the second colour signal processor 25, noise components being removed.

Subsequently, the signals Y and C are mixed by the Y/C mixer 24 and the mixed signal is applied to the switching part 22. The user causes the switching part 22 to be disconnected by means of the first switching part 41. The image signal provided from the Y/C mixer 24 is applied to the EVF 21 or the second monitor M2. During playback, if the user wants to make an electronic still-photograph of a desired scene, he or she operates the switches SW1 - SW3 to make connection via the terminals 2.

The luminance and colour signals Y and C from the second colour signal processor 25 are supplied to the decoder 43 to output luminance signal Y and the difference signals R-Y and B-Y. These signals output from the decoder are routed by the switches SW1 - SW3 to the still-photography circuit 300.

In the fourth operational mode, a still image stored in the IC card 33 can be recorded by the moving image recorder. The user operates the apparatus such that the image signal stored in the image-storing IC card 33 is applied to the first switching circuit 41, and thence

the recorder 28. This user operation initiates the signal C1 to enable the first switching part to make connection to terminal 2. The switching part 22 is also made to provide the image signal from the electronic still photography circuit 300 to the first signal path of the video circuit 200. The image signal is displayed on EVF 21 or the second monitor M2. Thus, the image signal from the IC card is transferred to the recorder 28 through the first path of the video circuit 200, to be recorded.

By using the special switching circuitry and the electronic still photography circuit, together with the conventional camera and video recording and playback circuits, the camcorder according to the present invention can record a still image in the image-storing IC card when a moving image of the same scene is being recorded. The camera can also transfer the still image from IC card to the moving image recorder. Thus, the present invention is extremely versatile and very convenient use.

The invention is in no way limited to the particular preferred embodiment described hereinbefore. Various modifications of the disclosed embodiment as well as other embodiments, all within the scope of the invention as defined by the appended claims, will now apparent to persons skilled in the art upon reference to this description.

CLAIMS

1. A camcorder for recording both still and moving images, the camcorder comprising:

a camera circuit for providing an image signal;

a video circuit for recording the image signal onto a moving image recording medium;

an electronic still-photography circuit for recording the image signal onto a still image recording medium distinct from the moving image recording medium; and

switching means connected to the camera circuit, the video circuit and the electronic still-photography circuit for enabling simultaneous recording of a moving image and a still image from the same scene.

2. A camcorder according to claim 1, wherein the video circuit includes means for playing back a moving image signal recorded onto the moving image recording medium and the electronic still-photography circuit includes means for playing back a still image signal recorded onto the still image recording medium.

3. A camcorder according to any preceding claim, wherein the switching means is also arranged so that if desired, a still image derived from the image signal provided by the camera circuit can be recorded whilst a moving image derived

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from the image is being viewed without being recorded.

4. A camcorder according to claim 2, or claim 3 when dependent on claim 2, wherein the switching means is also arranged so that if desired, a still image can be recorded during viewing of a moving image being played-back via the video circuit.

5. A camcorder according to claim 2, or claim 3 or claim 4 when dependent on claim 2, wherein the switching means is also arranged so that if desired, a still image signal can be recorded onto the moving image recording medium from the still image recording medium.

6. A camcorder according to any preceding claim, wherein the camera circuit includes a first colour signal processor and the video circuit includes a second colour signal processor.

7. A camcorder according to claim 6, wherein said switching means includes a first switching part for alternatively providing an output of said camera circuit or said electronic still-photography circuit to said video circuit according to a control signal (C1), a decoder connected to said second colour signal processor in said video circuit for separating a luminance signal (Y) and a

colour signal (C) from said second colour signal processor into a new luminance signal (Y) and colour-difference signals (R-Y, B-Y), and a second switching part for alternatively providing an output of said first colour signal processor or said decoder according to said control signal (C2).

8. A camcorder according to claim 7, wherein said second switching part includes a first switch for alternatively providing a luminance signal from said first colour signal processor or said decoder to said electronic still-photography circuit according to said control signal (C2), a second switch for alternatively providing said colour-difference signal (R-Y) from said first colour signal processor or the decoder to said electronic still-photography circuit according to said control signal (C2), and a third switch for alternatively providing said colour difference signal (B-Y) from said first colour signal processor or said decoder to said electronic still-photography circuit.

9. A camcorder for recording and playback of both still and moving images, the camcorder being substantially as hereinbefore described with reference to the accompanying drawings.