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[54] Title: SIGNAL RECORDING AND/OR REPRODUCING APPARATUS

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U.S. PAT. Nos. 5,672,473 Sugiyama 6/1987
4,725,897 Konishi 2/1988

[57]

ABSTRACT

Audio signals the correspond with still images are recorded in an electronic still camera on the same magnetic disc as the v isual images. By time-base compressing the audio signal and dividing each record track into a number of segments, ten seconds of audio can be recorded for each image without requiring a large processor memory. Indentification codes are added to the time-based compressed audio to permit multiple audio tracks to be associated with a recorded image and to record audio signals of time length less than the alloted duration, so that a number of images can be recorded in rapid succession without waiting for each of the successive allotted audio time periods to expire.

SIGNAL RECORDING AND/OR REPRODUCING APPARATUS

ABSTRACT OF THE DISCLOSURE

Audio signals that correspond with still images are recorded in an electronic still camera on the same magnetic disc as the visual images. By time-base compressing the audio signal and dividing each record track into a number of segments, ten seconds of audio can be recorded for each image without requiring a large processor memory. Identification codes are added to the time-base compressed audio to permit multiple audio tracks to be associated with a recorded image and to record audio signals of time length less than the allotted duration, so that a number of images can be recorded in rapid succession without waiting for each of the successive allotted audio time periods to expire.

This invention relates to recording and/or reproduction of video signals by using a recording and/or reproducing device for still images such as so-called electronic still camera devices.

In the Japanese Laid-Open Utility Model Publication No. 197,021/1982 are known electronic still camera devices provided with image pickup devices such as CCDs and adapted to record one-field or one-frame signals on a magnetic disk.

In these devices, video signals from the image pickup devices are taken under gating one field or one frame at the time point of a given shutter operation, these signals being recorded on the magnetic disk so that one field will complete one circular track. It is noted that one-frame signals are recorded by using two tracks. It is therefore possible with these devices to form video signals of the still image by repeatedly reproducing one track or by alternately repeatedly reproducing two tracks.

With these devices, it has also been proposed to make it possible to record speech signals. To this end, it would be feasible to compress the audio signals along time axis by employing, for example, digital signal processing to elevate the frequency of the audio signals to that of the video signals

for recording by using the same recording system as that of the video signals.

It will be noted in this connection that the audio signals up to, for example, 5 kHz may be compressed along time axis to 600 times to provide the signals of the 3 MHz video frequency. In this case, audio signals of ca. 10 seconds, which is 600 times one field period (1/60 second) can be recorded during the one field period.

However, an extremely large memory unit would be required for digitally processing the audio signals of, for example, 10 seconds. While it would be feasible to quadrisect the 10 second period and to process the 2.5 second interval each 2.5 second interval, it would be difficult, in case of dividing into plural portions or segments for recording, to maintain the continuity of the respective segments during reproduction.

When it is desired to record the audio signals of the longer duration than said 10 seconds, recording would be made across plural tracks. It is similarly extremely difficult to maintain the track continuity during reproduction.

The above is the construction of the prior-art devices. In these devices, when the recording

is segmented or effected over plural tracks, it has been extremely difficult to maintain signal continuity during signal reproduction.

The present invention provides a magnetic recording/reproducing device wherein one-field video signals are sequentially recorded as one track, and wherein audio signals are compressed along time axis (22), (25) so as to be recorded (6) on the track in place of said video signals, characterized in that the continuous audio signals are divided into plural segments and recorded on memory means (14) of shorter duration than the time during which said audio signals are continuously recorded after said time axis compression, and in that start identification signals SID are provided at the leading edge of the segment signals, said signals SID being used during reproduction for expansion and continuation (52), (55) of the time-axis-compressed signals.

/Operation/

In the above device, the start identification signals at the leading edge of each segment can be used for optimal facilitated continuation of the reproduced signals. It is noted that continuation between the adjoining tracks can be effected similarly to the continuation between the adjoining segments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block view of the recording system according to the present invention;

FIG. 2 is a block view of the reproducing system according to the present invention;

FIG. 3 A and B are timing charts showing the time-ball compression of audio signals according to the present invention;

FIG. 4 A and B represents signal wave forms showing the timing of the audio signals written into a memory according to the present invention;

FIG. 5 is a diagrammatic representation of waveforms showing signal formats for sound or voice signals recorded.

FIG. 6 is a schematic showing the signal identification sensor;

FIG. 7, A through H, represent signal waveforms showing the timing of the operation of the sensor of Fig. 6.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In Fig. 1, video signals are supplied at input terminal (1), converted at the recording circuit (2) into predetermined recording signals, supplied by way of a preemphasis circuit (3) of non-

linear characteristics to an FM circuit (5) so as to be recorded as FM signals on the disk D by the magnetic head (6).

The audio signals are supplied to the input terminal (11) and to the AD converter (13) through an encoder circuit (12) of the noise reduction system. These digitized signals are supplied to the memory circuit (14). The sampling signals of the audio signals of the 5 kHz bandwidth are generated in an oscillator (21), these signals being supplied to an address counter (22) driving the AD converter (13) and the memory (14). There is also provided an oscillator (23) having an oscillation frequency 600 times that of the aforementioned oscillator (21), with the signals from the oscillator (23) supplied to the address counter (22). The pulses related with the rotational phase of the disk D from a magnetic piece provided to a predetermined portion of the disk are sensed by a pickup (24), this signal being supplied to a memory controller (25). Then, for example, at each 2.5 seconds which is a quadrisection of 10 seconds, the signals written into the memory (14) are read at the 600 times rate, with the timing read with a phase delay of 1/4 of a period at each 2.5 seconds with respect to the rotational phase from

the head (24), as shown in Fig. 4.

These signals are supplied to the DA converter (15). To this converter (15) are supplied signals from the oscillator (23). These converted analog signals are supplied by way of a mixer (16) to the preemphasis circuit (17) having the linear characteristics and the signals from the preemphasis circuit (17) are supplied by way of changeover switch (4) to the FM circuit (5) to be converted into FM signals and recorded on the disk D by the magnetic head (6).

In this circuit start identification signals SID and end identification signals EID as shown in Fig. 5 are inserted in the mixer (16) connected between the DA converter (15) and the preemphasis circuit (17) at preset time before and after the time axis compressed audio signals. It is noted that these identification signals are supplied by, for example, the signals from the memory controller (25) supplied to the identification signal generator (26). It will be noted that the identification signals are distinct in profile from audio signals. That is, the low frequency of the audio signals in the above circuit are limited to a preset value, so that any pulse having a width longer than the pulse

corresponding to the frequency of the preset value can be distinguished upon time axis compression. For example, start identification signals are of positive polarity with the reference being its falling edge and the end identification signals are of negative polarity with the reference being its rising edge.

Referring to Fig. 2, signals reproduced from the disk D at the magnetic head (31) are supplied to the FM modulation circuit (32). When the demodulated signals are video signals, these signals are taken at the output terminal (35) through the deemphasis circuit (33) of the non-linear characteristics and the reproducing circuit (34).

When the demodulated signals are audio signals, these signals are supplied by way of the deemphasis circuit (41) of the non-linear characteristics to the AD converter (42). These converted digital signals are supplied to the memory (43). There is provided on oscillator (51) having the same frequency as that of the oscillator (23) with the signals from the oscillator (51) being supplied to the address counter (52) driving the memory (43) and the AD converter (42). There is also provided another oscillator (53) having the frequency same as that of

the above described oscillator (21), with the signals from the oscillator (53) being supplied to the address counter (52). The signals from the pickup head (54) equivalent to the head (24) are supplied to the memory controller (55). The signals written into the memory unit (43) are read out at 1/600 speed by the reverse of the operation used during recording shown in Fig. 4.

The signals thus read out are supplied to the AD converter (44). To this converter (44) are supplied signals from the oscillator (53). These converted analog signals are taken at the output terminal (46) by way of the decoder (46).

In this circuit, output signals from the deemphasis circuit (41) are supplied to the detection circuit (56) for the identification signals. The detection circuit (56) is constructed as shown for example in Fig. 6. In this circuit, signals from the deemphasis circuit (41) are supplied to the input terminal (61) which is supplied to a falling edge detective differentiating circuit (62), a falling edge detective differentiating circuit (63), and a lopass filter (64), so that signals as shown in Fig. 7A, B and C are recovered. Of these signals, those from the lowpass filter (64), Fig. 7D, are

supplied to comparators (65), (66) having the detection levels shown at broken lines a and b, resulting in signals shown at E and F in Fig. 7. These signals are supplied to NAND circuits (67), (68) and the signals from the associated differentiating circuits (62), (63) are supplied to the NAND circuits (67), (68). Thus, from the NAND circuit (67) are detected the falling edges of the start identification signals SID as shown in Figl 7F to be taken at the output terminals (69). From the NAND circuit (68) are detected the rising edges of the end identification signals EID and taken at the output terminal (70), as shown at G in Fig. 7.

These signals are supplied to the memory controller (55) so that, when the falling of the signals SID is sensed, signal sampling and writing is started since time T_2 shown in Fig. 5. Signal writing is continued by the signals from the oscillator (51) and terminated when the rising of the signals EID is sensed. The address counting of the memory unit (43) is reset by an amount T_3 shown in Fig. 5. This This operation is repeated for each segment such that signals consisting of annexed audio signal portions are written into the memory unit (43).

In the above circuit, when an overlap is pro-

vided to the audio signals between the respective segments, the address is counted down by $T_3 + \alpha$ (corresponding to the overlap) when counting down the address of the memory unit (43). This is effective to prevent signal discontinuities due to for example, jitter components.

Signal continuation for the case in which signals are recorded on plural tracks can be achieved in the similar manner.

The above is the manner of audio signal recording and reproduction. According to the above described device, reproduced signals can be annexed into continuous signals very easily and satisfactorily by the provision of the start identification signals.

According to the present invention, since the start identification signals are provided at the leading edge of each segment, these signals can be advantageously employed for continuation of the reproduced signals very easily and satisfactorily by making use of these signals.

WHAT IS CLAIMED IS:

1. Apparatus for use with an analog signal recording and reproducing system of the kind wherein a field of a video signal representing a still image is recorded on a selected one of a plurality of concentrically arranged tracks on a rotary record medium and an audio signal associated with the still image is recorded on another concentrically arranged selected track of the record medium, the apparatus comprising:

means for recording a field of the video signal representing a still image;

means for dividing an audio signal having a known length and associated with the recorded still image into a plurality of audio signal segments;

means for time-base compressing each of said plurality of audio signal segments and including a memory having a predetermined memory duration capacity at a selected clock frequency that is less than said known length of said audio signal associated with the recorded still image;

means for generating segment start and end identification signals for each of said time-base compressed audio signal segments;

means for generating control code data indicating at least a reproduction sequence of said tracks;

means for recording each of said time-base compressed audio signal segments and said segment start and end identification signals and said control code data in a predetermined relationship in corresponding segments of a track other than the track in which the still image is recorded, with respective ones of said segment start and end identification signals at respective leading and trailing edges of each said time-base compressed audio signal segments;

means for detecting the location of the end identification signal in each track segment for determining the length of each time-base compressed audio segment; and

means for shifting the location of said end identification signal and said control code data in accordance with a determined length within a respective track segment, so that upon reproduction said segment start and end identification signals are available following reproduction for time-

32991

base expansion and annexation of the audio signal segments into a continuous audio signal.

2. Apparatus according to Claim 1, in which said means for time-base compressing each of said plurality of audio signal segments includes a write/read address counter for controlling said memory; first and second clock signal generators for generating respective first and second clock signals fed to said write/read address counter, said first clock signal corresponding to said selected clock frequency and having a frequency substantially less than said second clock frequency, whereby said write/read address counter generates write addresses at a first frequency and read addresses at a second, higher frequency.

3. Apparatus according to Claim 2 in which said second clock signal generator produces at second clock signal having a frequency 640 times the frequency of said first clock signal.

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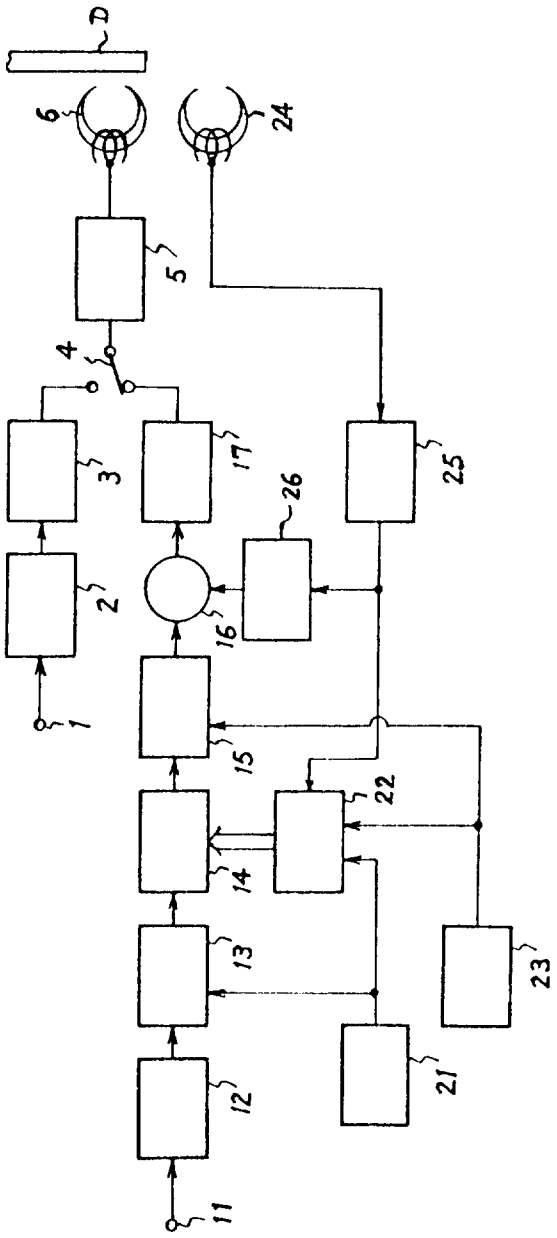

FIG. 1

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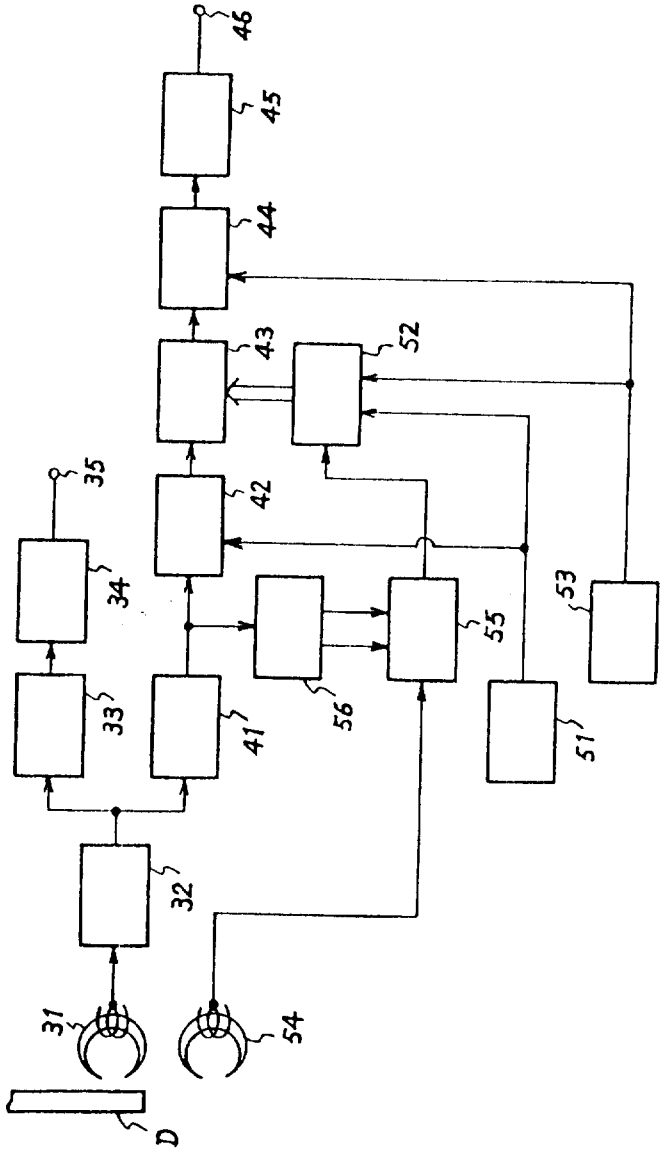

FIG. 2

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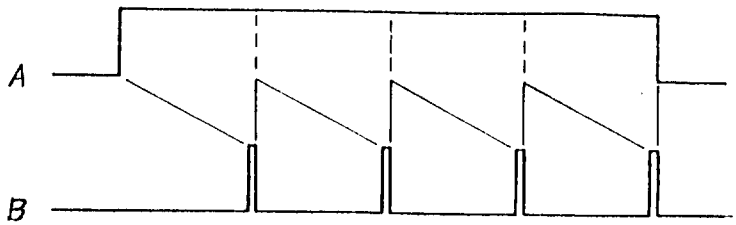

FIG. 3

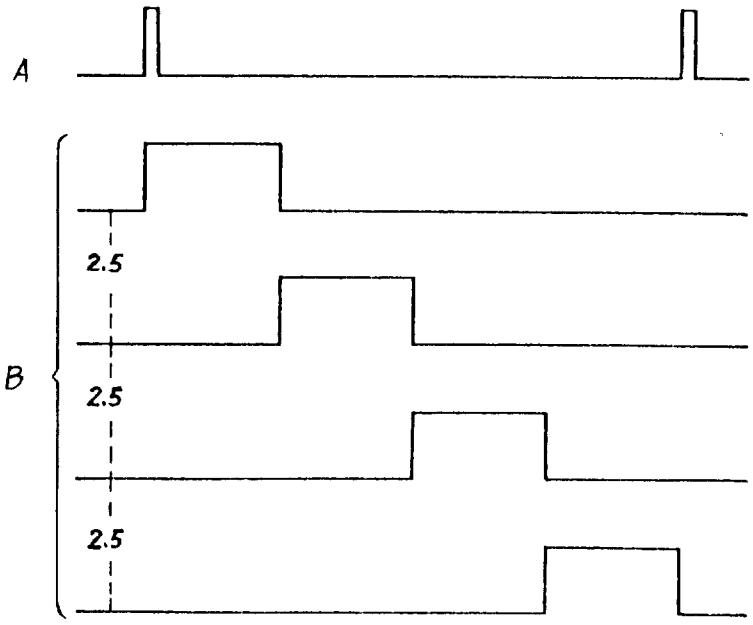

FIG. 4

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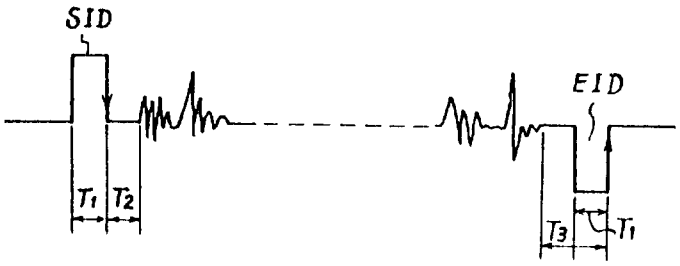

FIG. 5

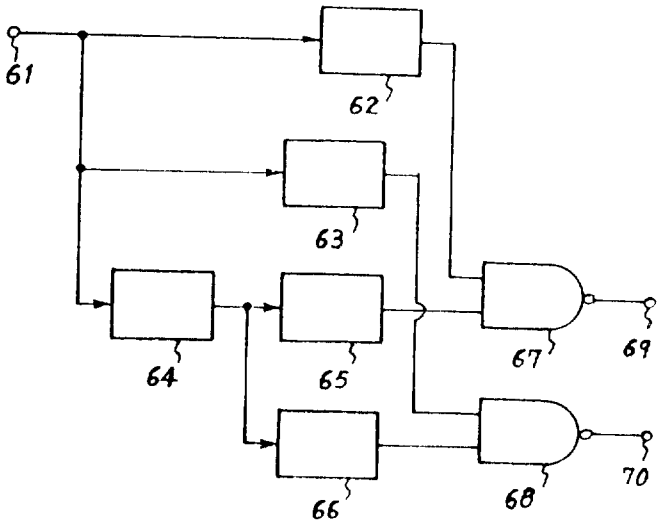

FIG. 6

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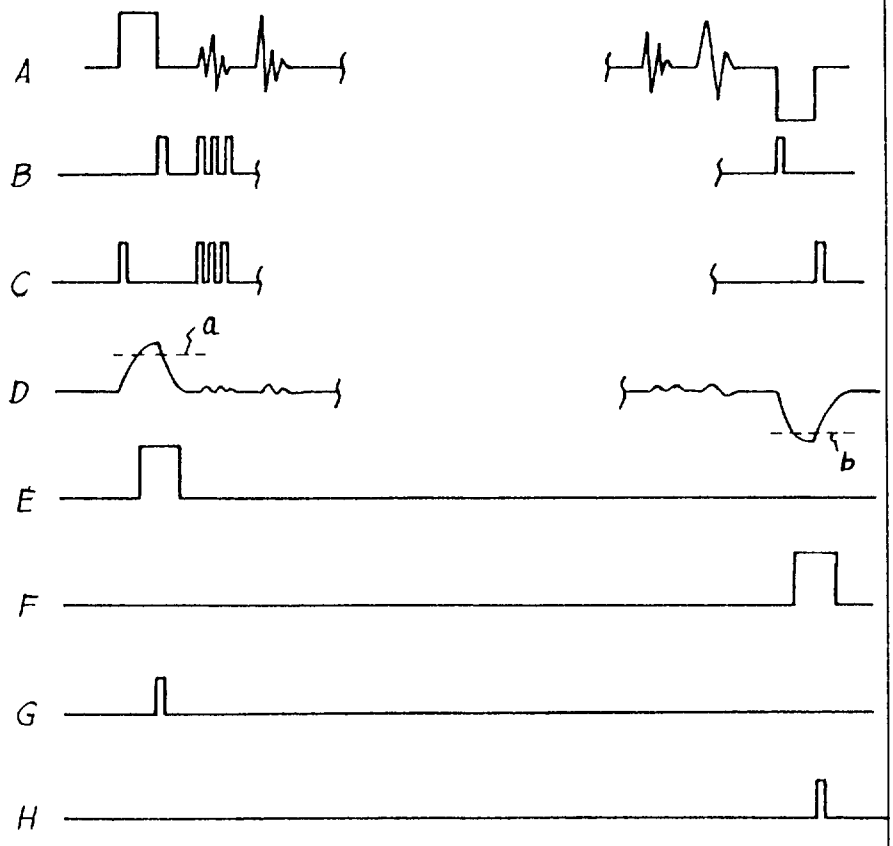

FIG. 7

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