

RECORDING MEDIUM SEARCH METHOD AND CIRCUIT

The present invention relates to methods and circuits for searching a recording medium.

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A known search method applied to conventional image process systems is that the duty ratio of a control pulse recorded on a control track of a tape is recorded differently from the normal case, so that a place recorded with a different duty ratio of control pulse can be identified during a search. A
10 known search method applied to sound instruments is to detect a gap of silence between recorded tunes or other programs.

However, the method of identifying or indexing a desired place on a tape by recording a different duty ratio of control pulse has a drawback of
15 involving a practically complicated circuit construction, because the circuit needs to be constructed for finding out a place having a different duty ratio by detecting the control pulse, and a circuit is required to cause a changes in the duty ratio of the control pulse. In the case of sound instruments, the method of finding out a desired part by utilizing a non-recorded gap between
20 tunes (or other programs) has a drawback that only the first part or end part of a tune can be searched and the middle of a tune can not be searched, and besides, if there is a long rest period in the middle of a tune, that place can be mis-read as a recordless place, for possible wrong operation.

25 Accordingly, preferred embodiments of the present invention aim to provide a search method and circuit which search for a specific audio signal after recording the specific audio signal, having frequencies above normal audio frequencies in the audio track, resulting in simple circuit construction,

enabling search for any part when applied to a sound instrument, and finally resulting in preventing wrong operation caused by recordless areas between tunes.

5 According to one aspect of the present invention, there is provided a method of indexing programs which are recorded on a recording medium to include audio signals recorded on an audio track, the method comprising the steps of:

10 generating an index signal having a frequency higher than normal audio frequencies;

 recording the index signal on the audio track together with audio signals at normal audio frequencies, at a desired index position of the
15 recording medium;

 reproducing the signals recorded on the audio track; and

 discriminating the reproduced index signal from the audio signals
20 reproduced from the audio track.

 Preferably, said index signal is generated in response to actuation of a search key by a user during recording of an input audio or video and audio signal.
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 Preferably, said reproducing and discriminating steps are carried out at a high transport speed of the recording medium, in response to actuation of a search key by a user.

Preferably, said index signal is generated by an oscillator, in response to an enable signal from a control means.

5 Preferably, a transport mechanism is controlled to transport the record medium at a normal transport speed in a normal reproduction mode after said index signal has been discriminated, and otherwise to continue transport of the recording medium at said high transport speed until an end position of the recording medium is reached.

10 According to another aspect of the present invention, there is provided a circuit for indexing programs which are recorded on a recording medium to include audio signals recorded on an audio track, the circuit comprising:

15 generating means for generating an index signal having a frequency higher than normal audio frequencies;

recording means for recording the index signal on an audio track together with audio signals at normal audio frequencies, at a desired index position of a respective recording medium;

20 reproducing means for reproducing the signals recorded on the audio track; and

25 discriminating means for discriminating the reproduced index signal from the audio signals reproduced from the audio track.

A circuit as above may further include a control means for generating a search mode enable signal and controlling recording and reproducing operations.

A circuit as above may further include a search key for operation by a user and a microprocessor responsive to said search key to generate said enable signal.

5 Preferably, said generating means comprises an oscillator, said recording and reproducing means comprise a head for recording signals on and reproducing signals from a respective record medium, and said reproducing means comprises an amplifier for amplifying an audio signal reproduced by said head.

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Preferably, said discriminating means includes:

a bandpass filter for passing frequencies higher than said normal audio frequencies;

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an amplifier for amplifying the output of said bandpass filter;

smoothing means for converting the output of said amplifier to direct current;

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a comparator for comparing the direct current of said smoothing means with a reference voltage; and

25 an output transistor for generating a detection signal in response to the output of said comparator.

Said recording medium may comprise a magnetic tape.

The invention extends to audio or video and audio recording and/or reproducing means provided with a circuit, or adapted to operate in accordance with a method, according to any of the preceding aspects of the invention.

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Such a recording and/or reproducing means may comprise a VCR or Camcorder.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a block diagram showing the general construction of one example of a search circuit utilizing an audio signal in accordance with the present invention;

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Figure 2 is a block diagram illustrating in more detail the construction of an example of a search circuit utilizing an audio signal in accordance with the present invention; and

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Figure 3 is a flow chart of one example of a search method utilizing an audio signal in accordance with the present invention.

In Figure 1 there are provided control means 100 for controlling the generation of a search mode enable signal and set operation, and audio signal generating means 200 for recording and reproducing a search signal on an audio track of recording means by generating the search signal by way of the search mode enable signal output from said control means 100 and for recording and reproducing the audio signal as well.

In Figure 1, there is also provided search signal detecting means 300 for outputting the search signal to control means 100 by detecting the search signal from an audio signal output from said audio signal generating means 200.

When a user presses various keys for set operation, control means 100 in Figure 1 perceives the key signals generated by key operation and controls the respective part of the set accordingly.

If the user presses a search key to implement the search function, control means 100 generates the search mode enable signal.

Audio signal generating means 200 records a normally -input audio signal on a recording medium and also outputs the audio signal by amplification after reading the audio signal recorded on the recording medium.

If the search mode enable signal is input from control means 100, audio signal generating means 200 generates the search signal having frequencies above the normal audio frequencies for recording on the recording medium,

and also outputs the search signal after reading it from the recording medium on which it has been recorded.

5 Search signal detecting means 300 detects the search signal from the audio signal generated from said audio signal generating means 200 for output to the control means 100, which controls the set or perceives the tape status (tape position and the like) after input of the search signal output from said search signal detecting means 300.

10 Figure 2 is a detailed block diagram for illustrating in detail one example of the construction of the search circuit utilizing an audio signal, as shown in Figure 1.

15 In Figure 2, the control means 100 which comprises:

a search switch 110 for selecting search mode; and

20 a microprocessor 120 for generating the search mode enable signal and simultaneously for controlling a mechanism part 130 of the set by perceiving the signals generated by the operation of said search switch 110 and various other keys (not shown).

Audio signal generating means 200 comprises:

25 an oscillator 210 for generating a search signal having frequencies above audio frequency by dint of the search mode enable signal generated from the microprocessor 120 of said control means 100;

a head 230 for recording on recording media an audio signal input through audio input means 220 and the search signal generated from said oscillator 210 and for reproducing signals recorded on recording media;

5 a first amplifier 240 for outputting to external output means (speaker or terminal) after amplification the audio signal reproduced from said head 230; and

10 a switch S_{ϕ} for switching an audio signal output to said first amplifier 240, after being reproduced at the head 230.

Search signal detecting means 300 comprises:

15 a bandpass filter 310 for passing the frequency bands having frequencies above audio frequency from the audio signal reproduced by the head 230 of said audio signal generating means 200;

20 a second amplifier 320 for amplifying the output of said bandpass filter 310;

a smoothing means 330 for converting the output of said second amplifier 320 to direct current;

25 a comparator 340 for comparing the direct current of said smoothing means 330 with reference voltage V_{ref} ; and

a transistor 350 for outputting a detection signal according to the output of said comparator 340 and for supplying the detection signal to the microprocessor 120 of control means 100.

5 Accordingly, in Figure 2, the microprocesor 120 of control means 100, according to the operation of various keys (not shown), drives the set by controlling mechanism part 130.

10 If the user intends to index a specific position of a tape, the user presses the search switch 110 when the tape is at the required position.

15 When search switch 110 is pressed, microprocessor 120 perceives the switching signal generated from the operation of search switch 110 and generates the search mode enable signal.

20 The search mode enable signal generated from the microprocessor 120 of said control means 100 by the operation of search switch 110 is supplied to oscillator 210 of audio signal generating means 200, and once supplied to oscillator 210, the oscillator 210 outputs a search signal having frequencies above audio frequency, which can be converted freely by the user.

25 The search signal generated from oscillator 210 is applied to the head 230, which records on the recording medium the search signal having frequencies above audio frequency, generated from the oscillator 210.

 In this location, head 230 conventionally records on recording media various audio signals input into audio input means 220, and reproduces audio signals recorded on recording media.

Meanwhile, during reproduction operation by key operation of the user, the search signal which was generated at oscillator 210 and recorded on recording media by the head 230, and the audio signal which was input into audio input means 220 and recorded on recording media by the head 230, are reproduced by the head 230.

The reproduced audio signal is converted to an aural signal through first amplifier 240 for outputting and at the same time, is input to the bandpass filter 310 of search signal detecting means 300.

At this time, a search signal reproduced from the head 230 and having frequencies above the normal audio frequencies does not affect the aural signal output from the first amplifier 240.

The bandpass filter 310 of search signal detecting means 300 passes the search signal having the frequencies above normal audio frequency from the audio signal, and the search signal filtered through bandpass filter 310 is amplified at second amplifier 310, and then is converted to direct current at smoothing means 330.

At this point, as the frequency filtered through bandpass filter 310 is set up above audio frequency, only the audio signal of above audio frequency is shown at the output side of bandpass filter 310, and in the case that the normal audio signal is reproduced in the head 230, no signal is shown at the output side of bandpass filter 300.

Accordingly, only in the case of the search signal having frequencies above audio frequency being reproduced by head 230, is the search signal

output to the output side of bandpass filter 310, to be amplified at second amplifier 320 and converted to direct current at smoothing means 330 for comparison at comparator 340 with reference voltage V_{ref} .

5 The comparator 340 drives transistor 350 when the search signal is reproduced, and a signal of logic level is generated by the driving of the transistor 350 to supply a detection signal to the microprocessor 120 of control means 100.

10 Microprocessor 120 performs the function of the user's key operation after said detection signal is supplied.

 In other words, when the user presses a high speed search key, the microprocessor 120 outputs switch control signal S_c for opening the switch
15 So and subsequent cut-off of audio output to the first amplifier 240, and at the same time, controls mechanism part 130 for performance of winding or re-winding of the tape at a high speed. When the search signal is detected from search signal detecting means 300, the microprocessor 120 controls mechanism part 130 for stoppage of tape running and performance of
20 reproduction operation.

 Figure 3 is a flow chart of one example of a search method utilizing an audio signal, in accordance with the present invention, and comprises:

25 a recording process for recording a search signal along with an audio signal on recording media by generating the search signal; and

a reproducing process for detecting the search signal by dint of high speed reproduction in accordance with search key input during reproduction.

In Figure 3, when tele-recording or recording key is input at step S1,
5 an external video or audio signal is recorded on a tape, at step S2.

When a video signal or audio signal is recorded on the tape and simultaneously a key signal is input at step S3 by operation of a search key, an oscillator is enabled at step S4 for generation of the search signal having
10 frequencies above the normal audio frequencies, and the generated search signal and audio signal input from externally are recorded on the audio track of the tape at step S5.

The input of a stop key signal is discriminated at step S6 and if there
15 is no input of the stop key signal, continued tele-recording or recording is performed in steps S2 to S5, and if there is an input of stop key signal, the operation of the tape device mechanism is stopped at step S100.

Meanwhile, when a reproduction key signal is input at step S7 by the
20 operation of a reproduction key, the video signal or audio signal recorded on the tape is reproduced at step S8.

During reproduction of the video signal or audio signal, when a search signal is input at step S9 by the operation of the search key, the audio signal
25 is muted and simultaneously, the tape drive mechanism is controlled for high speed reproduction at step S10.

Detection of the search signal having frequencies above audio frequency is discriminated continuously during reproduction at step S11. When the search signal is not detected, the end of tape is discriminated at step S12 and the detection of the search signal is continuously discriminated if the end of tape position is not detected.

If the search signal is detected, the tape drive mechanism is controlled, and reproduction operation is performed at step S13 with the tape at normal speed.

During the performance of reproduction operation, when a key signal is input by the operation of a stop key, the operation of the tape drive mechanism is ended at step S100.

Of course, if key input is neither tele-recording, nor recording key input, nor input of the reproduction key, a corresponding function of key input is performed at step S200.

In this manner, the search method and circuit utilizing an audio signal, by dint of simple circuit construction for detecting a specific audio signal recorded on an audio track, can search for a desired position quickly and can obtain the effect of preventing wrong operation possibly caused by a silent passage located between tunes.

The present invention can be applied to, *inter alia*, image processing systems with sound systems, such as VCRs (Video Cassette Recorders), Camcorders (Movie Cameras), etc., as well as audio systems *per se*.



CLAIMS:

1. A method of indexing programs which are recorded on a recording medium to include audio signals recorded on an audio track, the method
5 comprising the steps of:

generating an index signal having a frequency higher than normal audio frequencies;

- 10 recording the index signal on the audio track together with audio signals at normal audio frequencies, at a desired index position of the recording medium;

reproducing the signals recorded on the audio track; and

- 15 discriminating the reproduced index signal from the audio signals reproduced from the audio track.

2. A method according to claim 1, wherein said index signal is generated
20 in response to actuation of a search key by a user during recording of an input audio or video and audio signal.

3. A method according to claim 1 or 2, wherein said reproducing and discriminating steps are carried out at a high transport speed of the recording
25 medium, in response to actuation of a search key by a user.



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4. A method according to claim 1, 2 or 3, wherein said index signal is generated by an oscillator, in response to an enable signal from a control means.

5 5. A method according to claim 3 or claims 3 and 4, wherein a transport mechanism is controlled to transport the record medium at a normal transport speed in a normal reproduction mode after said index signal has been discriminated, and otherwise to continue transport of the recording medium at said high transport speed until an end position of the recording medium is reached.

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6. A circuit for indexing programs which are recorded on a recording medium to include audio signals recorded on an audio track, the circuit comprising:

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generating means for generating an index signal having a frequency higher than normal audio frequencies;

recording means for recording the index signal on an audio track together with audio signals at normal audio frequencies, at a desired index position of a respective recording medium;

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reproducing means for reproducing the signals recorded on the audio track; and

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discriminating means for discriminating the reproduced index signal from the audio signals reproduced from the audio track.