

Various recording/reproduction modes in recording/reproducing a digital information signal and at least one digital auxiliary signal.

The invention relates to an apparatus for recording a digital information signal in slant tracks on a longitudinal magnetic record carrier, the apparatus comprising

- an input terminal for receiving the digital information signal,
- channel encoding means for carrying out a channel encoding step on the digital information
- 5 signal so as to obtain a channel encoded digital information signal,
- writing means for writing the channel encoded digital information signal in a first track portion of the tracks. The invention also relates to an apparatus for reproducing a digital information signal from slant tracks on a longitudinal magnetic record carrier, the digital information signal being recorded in channel encoded form in the tracks, the apparatus
- 10 comprising
- reading means for reading the channel encoded digital information signal from a first track portion of the tracks,
- channel decoding means for carrying out a channel decoding step on the channel encoded digital information signal so as to obtain a replica of the digital information signal,
- 15 - an output terminal for supplying the replica of the digital information signal

A recording apparatus as defined above is known from US patent spec. 5,142,421, document D1 in the list of related documents that can be found hereafter.

The known apparatus records a digital information signal in the form of a

20 digital video signal in data compressed form in portions of the tracks. Further a digital audio signal is recorded in other portions of the tracks. The order in which the various portions occur in the track is not relevant for the present invention.

The invention aims at providing a recording apparatus and a reproducing

25 apparatus that is more versatile. To that purpose, the recording apparatus is characterized in that the apparatus is adapted to function in a first recording mode in which said channel encoded digital information signal is recorded in said first track portions of the tracks and a second recording mode in which the apparatus is adapted to record the channel encoded digital information signal in a second track portion of the tracks and a digital auxiliary signal

in a third track portion in the tracks, the second and third track portions lying within said first track portions, the apparatus comprising a second input terminal for receiving the digital auxiliary signal, the writing means being further adapted to write the channel encoded digital information signal and the digital auxiliary signal in said second and third track portions
5 respectively.

The reproducing apparatus is characterized in that the apparatus is adapted to function in a first reproducing mode in which said channel encoded digital information signal is reproduced from said first track portions of the tracks and a second reproducing mode in which the apparatus is adapted to reproduce the channel encoded digital information signal
10 from a second track portion of the tracks and a digital auxiliary signal from a third track portion in the tracks, the second and third track portions lying within said first track portions, the reading means being further adapted to read the channel encoded digital information signal and the digital auxiliary signal from said second and third track portions respectively and the apparatus comprising a second output terminal for supplying the digital
15 auxiliary signal.

The digital information signal may be an MPEG encoded information signal. The MPEG encoded information signal comprises transport packets that may occur irregularly in the serial datastream of the MPEG transport stream received.

The ISO/IEC 13.818 international standard, part 1 'Systems', dated 13
20 November 1994, document D2 in the list of related documents, comprises a description of a transport system for transmitting an MPEG information signal, which may include a data compressed digital video signal and a corresponding data compressed digital audio signal, for broadcasting purposes or for transmission via a cable network. The MPEG information signal is in the form of transport packets comprises 188 bytes of information each.

25 Packets in the MPEG serial data stream comprise, apart from 'system information', one kind of information, that is: either a portion of a video signal, or a portion of an audio signal or a portion of a data signal. A plurality of video signals and/or a plurality of audio signals and/or a plurality of data signals may be transmitted via the transport packets in the MPEG serial data stream. A packet also comprises information of only one of
30 the video signals, or one of the audio signals or one of the data signals transmitted via the MPEG serial data stream.

The digital auxiliary signal may be a digital audio signal or a digital data signal. In the first recording mode, only the digital information signal is recorded in the first track portions of the tracks. In the second recording mode, not only the digital information signal,

but also the digital auxiliary signal are recorded in the first track portions 'at the same time'.

If the apparatus has the first and second recording mode only, it may be further characterized in that the second and third track portion in the track are separated by an edit gap, and that the total length of the second and third track portion and the edit gap is

5 substantially equal to the length of the first track portion.

More specifically, the apparatus is characterized in that the third track portion is located before the second track portion in a track, and that the beginning of the third track portion obtained in the second recording mode is substantially at the same location, viewed in the longitudinal direction of a track, as the beginning of the first track portion obtained in the

10 first recording mode.

The apparatus in accordance with the invention has the advantage that at least two recording modes are possible. In the first recording mode, the apparatus can be used to record an MPEG information stream in the first track portions. The second recording mode can be used to record a digital information signal of a lower bitrate. This also may be an

15 MPEG information signal, but with less information content than the MPEG information recorded in the first recording mode. The digital information signal recorded in the second recording mode in the second track portions may be an MPEG information signal comprising only video packets, whereas the audio packets could have been recorded in the third track portions. This enables the possibility of editing the audio information recorded in the third

20 track portions.

The apparatus in accordance with the invention has the advantage that the signal processor memory, required for carrying out the signal processing of the digital information signal to be recorded in the first track portions, may also be used, and is large enough, to process the information signal and the auxiliary signal for recording in the second and third

25 track portions in the second recording mode. Further, the fact that the beginning of the first track portion in the first recording mode and the third track portion in the second recording mode has the advantage that the first sync word of the data will be found at substantially the same location, viewed in the longitudinal direction of the tracks, for the two recording modes, which simplifies synchronisation during reproduction, and thus the read-out of data in

30 both modes for reproduction. Further, editing of the third track portion is more reliable, when the location of the beginning of the third track portion is well defined.

In a further embodiment, the apparatus is characterized in that the apparatus is adapted to function in a first recording mode in which said channel encoded digital information signal is recorded in said first track portions of the tracks, a second recording

mode in which the apparatus is adapted to record the channel encoded digital information signal in said second track portion, a first digital auxiliary signal in said third track portion of the tracks, the second and third track portions lying within said first track portions, and at least a third recording mode in which the apparatus is adapted to record the channel encoded digital information signal in said second track portions of the tracks, said first digital auxiliary signal in said third track portions of the tracks and at least a second digital auxiliary signal in a fourth track portion of the tracks, the second, third and fourth track portions lying within said first track portions, the apparatus comprising at least a third input terminal for receiving the second digital auxiliary signal, the writing means being further adapted to write the channel encoded digital information signal and the first and second digital auxiliary signal in said second, third and fourth track portions respectively.

This enables the recording of two or more auxiliary signals, together with the digital information signal. The auxiliary signals may be audio signals in two or more languages. The third recording mode may also enable karaoke, where the original audio signal is recorded in the third track portion and the song sung by a karaoke person is recorded in an edit mode in the fourth track portion.

The reproducing apparatus is characterized by the claims defining the reproducing apparatus.

It should be noted that the book 'The art of digital audio' by John Watkinson, document D3 in the list of related documents, disclose in chapter 10 the 8 mm video system. An apparatus of the 8 mm video type has two modes. In a first mode, an analog video signal is recorded in a first track portion and a PCM audio signal is recorded in a second track portion of the tracks. In a second recording mode, the first track portion can also be used for recording a PCM audio signal. In this so-called 'audio-only mode', six recordings are made in alternate directions, resulting in six different time compressed audio segments of 36 degrees each. However only one audio signal is recorded.

These and other aspects of the invention will be apparent from and further elucidated with reference to the embodiments described in the following figure description, in which

figure 1 shows an embodiment of the recording apparatus,

figure 2 shows in (a), (b) and (c) three track formats obtained by the recording apparatus of figure 1, and

figure 3 shows an embodiment of the reproducing apparatus.

Figure 1 shows a schematic circuit diagram of the recording apparatus in accordance with the invention. The recording apparatus comprises a first input terminal 1 for receiving the digital information signal and a second input terminal 2 for receiving a digital auxiliary signal. The input terminal 1 is coupled to a first input 7 of a multiplexer 4. The input terminal 2 is coupled to a second input 9 of the multiplexer 4. An output of the multiplexer 4 is coupled to an input of a channel encoder 6. An output of the channel encoder 6 is coupled to an input of a recording unit 8. The channel encoded information supplied by the channel encoding unit 6 is recorded in slant tracks (not shown) on a magnetic record carrier 10, by means of a rotary head arrangement 12, well known in the art. A central processing unit 14 is present for controlling the functioning of the recording apparatus. The processor unit 14 has an input 16 for receiving a mode selection control signal. This mode selection signal may be generated by a switch (not shown) to be actuated by the user. An output of the processor 14 is coupled to a control input 18 of the multiplexer unit 4. Only the controlling of the multiplexer unit 4 by means of the processing unit 14 will be explained, as this control function relates to the invention to be described hereafter.

As has been explained above, the digital information signal supplied to the terminal 1 may be an MPEG encoded information signal. The recording of such MPEG encoded information signals is the subject of earlier filed patent applications US ser. no. 08/225,193, having a filing date of 08-04-94 (PHN 14.818), document (D4) in the list of related documents, and US ser. no. 08/253,535, having a filing date of 03-06-94 (PHA 21.886), document (D5) in the list of related documents. The digital auxiliary signal may be a(n additional) digital audio signal or a digital data signal.

The apparatus shown in figure 1 has a first mode of operation, selected by the user, in which it is capable of recording the digital information supplied to the input terminal 1 on the record carrier 10. In response to the control signal applied to the input 18, the multiplexer 4 supplies the information signal received via its first input 7 to its output only. (a) in figure 2 shows the format of the tracks resulting from a recording operation in the first recording mode. The left end of the tracks shown in figure 2 are the start of the track and the right end of the tracks are the terminal parts of the tracks. The track in (a) of figure 2 comprises a number of track portions. The track portion denoted by G1 is the preamble track portion. The preamble track portion comprises specific codewords that enables a locking-in of the reproducing electronics upon reproduction in a reproducing apparatus to be described hereafter. An example of the preamble track portion has been described extensively in reference D6, in the list of related documents.

The track portion G1 is followed by a track portion denoted 'SUB'. This track portion comprises subcode information, such as absolute and/or relative time information and a table of contents, all well known in the art. Next, an edit gap G2 is present, that may comprise the same codewords as the ones in the preamble track portion. The edit gap G2 is followed by a track portion TP1 (first track portion) in which the digital information signal, applied to the input terminal 1, can be stored after channel encoding in the encoder 6. Channel encoding a digital information signal is well known in the art, so that no further explanation is required. The final track portion in the track is a postamble track portion G3, that may comprise the same codewords as the ones in the preamble portion G1. The track portion TP1 has a specified length L1, that may be expressed in number of bytes that are stored in the track portion TP1 in a track.

The apparatus shown in figure 1 has at least a second mode of operation, that can be selected by the user. In this mode of operation, the apparatus is capable of recording the digital information supplied to the input terminal 1 and an auxiliary signal supplied to the terminal 2 on the record carrier 10. In response to the control signal applied to the input 18, the multiplexer 4 now alternately supplies the information signal received via its first input 7 and the auxiliary signal applied to its input 9 to its output. (b) in figure 2 shows the format of the tracks resulting from a recording operation in the second recording mode. The track in (b) of figure 2 comprises a number of track portions. The track portion denoted by G1 is again the preamble track portion comprising the specific codewords described above.

The track portion G1 is again followed by the track portion denoted 'SUB' and the edit gap G2. Next, instead of having the track portion TP1, a track portion TP3 (third track portion) is present in which the auxiliary signal is stored, in this case, also after channel encoding. Next, an edit gap G4 is present, that may comprise the same codewords as the ones in the preamble track portion. The edit gap G4 is followed by a track portion TP2 (second track portion) in which the digital information signal, applied to the input terminal 1, can be stored after channel encoding in the encoder 6. The final track portion in the track is again the postamble track portion G3. The track portions TP2, G4 and TP3 have such a combined length, expressed in number of bytes, that it equals the length L1 of the track portion TP1 in (a) of figure 2.

The apparatus shown in figure 1 could have had a third mode of operation, that can be selected by the user. In this mode of operation, the apparatus is capable of recording the digital information supplied to the input terminal 1, a first digital auxiliary signal supplied to the terminal 2 and a second digital auxiliary signal supplied to an additional input 3, see

figure 1, on the record carrier 10. In response to the control signal applied to the input 18, the multiplexer 4 now alternately supplies the information signal received via its first input 7, the first auxiliary signal applied to its input 9, and the second auxiliary signal applied to its input 11, to its output. (c) in figure 2 shows the format of the tracks resulting from a recording operation in the third recording mode. The track in (c) of figure 2 comprises a number of track portions. The track portion denoted by G1 is again the preamble track portion comprising the specific codewords described above.

This is followed by the track portions denoted SUB and G2. Next, the track portion TP3 (third track portion) is present in which a first auxiliary signal AUX1 is stored, in this case, after channel encoding. Next, again the edit gap G4 is present, which is now followed by a track portion TP4, for recording a second auxiliary signal AUX2, in this case, after channel encoding. The track portion TP4 is followed by an edit gap G5, which again may comprise the codewords also stored in the other edit gaps. This edit gap G5 is followed by a track portion TP2' (second track portion) in which the digital information signal, applied to the input terminal 1, can be stored after channel encoding in the encoder 6. The final track portion in the track is again the postamble track portion G3. The track portions TP2', TP3, G4, TP4 and G5 have such a combined length, expressed in number of bytes, that it equals the length L1 of the track portion TP1 in (a) of figure 2.

Figure 3 shows an embodiment of a reproducing apparatus for reproducing the information recorded on the record carrier 10 by means of the apparatus of figure 1. The apparatus comprises a reproducing unit 30 of the helical scan type, for reading the information from the tracks on the record carrier 10. An output of the unit 30 is coupled to an input of a channel decoding unit 32, which has an output coupled to an input of a demultiplexer 34. The demultiplexer 34 has a control signal input 36 and first and second outputs 38 and 40. The outputs 38 and 40 are coupled to output terminals 42 and 44 respectively. The apparatus is further provided with a central processing unit 46, which has a mode selection input 48 for receiving a mode selection signal, eg. generated by a switch (not shown) actuated by a user of the apparatus. A control signal is generated by the processing unit 46 and supplied to an output 50, which output is coupled to the control signal input 36 of the demultiplexer 34.

The apparatus shown in figure 3 has a first mode of operation, selected by the user, in which it is capable of reproducing the digital information recorded on the record carrier as shown in (a) of figure 2, from the record carrier. In response to the control signal applied to the input 36, the demultiplexer 34 supplies the information signal received via its

input 33 to its output 38 only.

The apparatus shown in figure 3 has at least a second mode of operation, that can be selected by the user. In this mode of operation, the apparatus is capable of reproducing the digital information signal and the auxiliary signal recorded on the record carrier in accordance with the format shown in (b) of figure 2. In response to the control signal applied to the input 36, the demultiplexer 34 now supplies the information signal to its first output 38 and the auxiliary signal to its output 40.

The apparatus shown in figure 3 could have had a third mode of operation, that can be selected by the user. In this mode of operation, the apparatus is capable of reproducing the digital information signal and a first and second digital auxiliary signal, recorded on the record carrier in accordance with the format as shown in (c) of figure 2. In response to the control signal applied to the input 36, the demultiplexer 34 now supplies the information signal to its first output 38, the first auxiliary signal to its output 40 and the second auxiliary signal to its output 43.

It should be noted that the control signal for selecting the recording or reproduction mode need not necessarily be generated by a user. It may be possible that the recording apparatus is capable of determining the bitrate of the digital information signal received. When the bitrate is relatively low, the apparatus could decide to switch into the second recording mode, and to switch in the first recording mode, if the bitrate appears to be relatively high. Another possibility is that the information received by the recording apparatus may include a control signal, identifying the information signal received as the digital information signal only, requiring the first recording mode, or identifying the information received as comprising a digital information signal and an auxiliary signal.

Further, it may be possible that the recording apparatus is capable of inserting the control signal identifying the recording mode applied, into the information recorded on the record carrier, such as in the subcode information recorded in the track portion denoted SUB.

The reproducing apparatus may, in an equivalent way, be capable of detecting which kind of record carrier is reproduced. That is: whether the record carrier is a record carrier in accordance with the format shown in (a) of figure 2, or with the format in accordance with (b) or (c) of figure 2. Or, the reproducing apparatus may be capable of detecting the control signal which is inserted in the signal recorded, such as recorded in the subcode track portion SUB.

Related documents

- 5
- (D1) USP 5,142,421 (PHN 13.537)
 - (D2) ISO/IEC 13.818 international standard, part 1 'Systems', dated 13 November 1994.
 - (D3) 'The art of digital audio' by J. Watkinson, 1988 Focal Press, chapter 10.
 - (D4) US ser. no. 08/225,193, filing date 08-04-94 (PHN 14.818)
 - (D5) US ser. no. 08/253,535, filing date 03-06-94 (PHA 21.886)
 - (D6) European application 492.704 (PHN 13.546)

CLAIMS

1. Apparatus for recording a digital information signal in slant tracks on a longitudinal magnetic record carrier, the apparatus comprising
 - an input terminal for receiving the digital information signal,
 - channel encoding means for carrying out a channel encoding step on the digital information
 - 5 signal so as to obtain a channel encoded digital information signal,
 - writing means for writing the channel encoded digital information signal in a first track portion of the tracks, characterized in that, the apparatus is adapted to function in a first recording mode in which said channel encoded digital information signal is recorded in said first track portions of the tracks and a second recording mode in which the apparatus is
 - 10 adapted to record the channel encoded digital information signal in a second track portion of the tracks and a digital auxiliary signal in a third track portion in the tracks, the second and third track portions lying within said first track portions, the apparatus comprising a second input terminal for receiving the digital auxiliary signal, the writing means being further adapted to write the channel encoded digital information signal and the digital auxiliary signal
 - 15 in said second and third track portions respectively.
2. Apparatus as claimed in claim 1, characterized in that the second and third track portion in the track are separated by an edit gap, and that the total length of the second and third track portion and the edit gap is substantially equal to the length of the first track portion.
- 20 3. Apparatus as claimed in claim 1 or 2, characterized in that the third track portion is located before the second track portion in a track, and that the beginning of the third track portion obtained in the second recording mode is substantially at the same location, viewed in the longitudinal direction of a track, as the beginning of the first track portion obtained in the first recording mode.
- 25 4. Apparatus as claimed in claim 1, characterized in that the apparatus is adapted to function in a first recording mode in which said channel encoded digital information signal is recorded in said first track portions of the tracks, a second recording mode in which the apparatus is adapted to record the channel encoded digital information signal in said second track portion, a first digital auxiliary signal in said third track portion of the tracks, the



second and third track portions lying within said first track portions, and at least a third recording mode in which the apparatus is adapted to record the channel encoded digital information signal in said second track portions of the tracks, said first digital auxiliary signal in said third track portions of the tracks and at least a second digital auxiliary signal in a fourth track portion of the tracks, the second, third and fourth track portions lying within said first track portions, the apparatus comprising at least a third input terminal for receiving the second digital auxiliary signal, the writing means being further adapted to write the channel encoded digital information signal and the first and second digital auxiliary signal in said second, third and fourth track portions respectively.

10 5. Apparatus as claimed in claim 4, characterized in that the second, third and fourth track portion in a track are separated by an edit gap, and that the total length of the second, third and fourth track portions and the edit gaps is substantially equal to the length of the first track portion.

6. Apparatus for reproducing a digital information signal from slant tracks on a longitudinal magnetic record carrier, the digital information signal being recorded in channel encoded form in the tracks, the apparatus comprising

- reading means for reading the channel encoded digital information signal from a first track portion of the tracks,
- channel decoding means for carrying out a channel decoding step on the channel encoded digital information signal so as to obtain a replica of the digital information signal,
- an output terminal for supplying the replica of the digital information signal, characterized in that, the apparatus is adapted to function in a first reproducing mode in which said channel encoded digital information signal is reproduced from said first track portions of the tracks and a second reproducing mode in which the apparatus is adapted to reproduce the channel encoded digital information signal from a second track portion of the tracks and a digital auxiliary signal from a third track portion in the tracks, the second and third track portions lying within said first track portions, the reading means being further adapted to read the channel encoded digital information signal and the digital auxiliary signal from said second and third track portions respectively and the apparatus comprising a second output terminal

25 30 for supplying the digital auxiliary signal.

7. Apparatus as claimed in claim 6, characterized in that the second and third track portion in the track are separated by an edit gap, and that the total length of the second and third track portion and the edit gap is substantially equal to the length of the first track portion.



8. Apparatus as claimed in claim 6 or 7, characterized in that the third track portion is located before the second track portion in a track of the record carrier used in the second reproducing mode, and that the beginning of the third track portion is substantially at the same location, viewed in the longitudinal direction of a track, as the beginning of the first track portion in a track of the record carrier used in the first reproducing mode.

9. Apparatus as claimed in claim 6, characterized in that the apparatus is adapted to function in a first reproducing mode in which said channel encoded digital information signal is reproduced from said first track portions of the tracks, a second reproducing mode in which the apparatus is adapted to reproduce the channel encoded digital information signal from said second track portion, a first digital auxiliary signal from said third track portion of the tracks, the second and third track portions lying within said first track portions, and at least a third reproducing mode in which the apparatus is adapted to reproduce the channel encoded data compressed digital information signal from said second track portions of the tracks, said first digital auxiliary signal from said third track portions of the tracks and at least a second digital auxiliary signal from a fourth track portion of the tracks, the second, third and fourth track portions lying within said first track portions, the writing means being further adapted to read the channel encoded digital information signal and the first and second digital auxiliary signal from said second, third and fourth track portions respectively and the apparatus comprising at least a third output terminal for supplying the second digital auxiliary signal.

10. Apparatus as claimed in claim 9, characterized in that the second, third and fourth track portion in a track are separated by an edit gap, and that the total length of the second, third and fourth track portions and the edit gaps is substantially equal to the length of the first track portion.