A set of original claims.

What is claimes is.

~~1. A data recording apparatus for recording a~~ predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording apparatus comprising:

interleaving means for interleaving each of the frames with an interleave length that is a multiple of the predetermined number and forming interleaved frames;

encoding means for encoding the interleaved frames with an error encoding code and for forming encoded interleaved frames; and

recording means for recording the encoded interleaved frames on the record medium.

2. A data reproducing apparatus for reproducing data from a record medium on which a predetermined number of encoded interleaved frames have been recorded, the encoded interleaved frames being generated by interleaving and encoding frames, one frame being composed of information data and a sub-code corresponding to the information data, additional ~~information corresponding to a predetermined number of~~

~~frames being composed of a predetermined number of sub-~~ codes, the data recording apparatus comprising:

reproducing means for reproducing the encoded interleaved frames from the record medium and outputting the encoded interleaved frames;

decoding means for decoding the encoded interleaved frames so as to form interleaved frames; and

deinterleaving means for deinterleaving the interleaved frames with an interleave length that is a multiple of the predetermined number and for forming frames.

3. A data recording method for recording a predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording method comprising the steps of:

interleaving each of the frames with an interleave length that is a multiple of the predetermined number and forming interleaved frames;

encoding the interleaved frames with an error encoding code and for forming encoded interleaved ~~frames; and~~

recording the encoded interleaved frames on the record medium.

4. A data reproducing method for reproducing data from a record medium on which a predetermined number of encoded interleaved frames have been recorded, the encoded interleaved frames being generated by interleaving and encoding frames, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data reproducing method comprising the steps of:

reproducing the encoded interleaved frames from the record medium and outputting the encoded interleaved frames;

decoding the encoded interleaved frames so as to form interleaved frames; and

deinterleaving the interleaved frames with an interleave length that is a multiple of the predetermined number and for forming frames.

5. A data sending method for sending a predetermined number of frames through a communication path at a time, one frame being composed of information data and a sub-code corresponding to the information

data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording method comprising the steps of:

interleaving each of the frames with an interleave length that is a multiple of the predetermined number and forming interleaved frames;

encoding the interleaved frames with an error encoding code and for forming encoded interleaved frames; and

sending the encoded interleaved frames to the communication path.

6. A data receiving method for receiving a predetermined number of encoded interleaved frames from a communication path at a time, the encoded interleaved frames being generated by interleaving and encoding frames, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data reproducing method comprising the steps of:

receiving the encoded interleaved frames from the communication path;

decoding the encoded interleaved frames so as to form interleaved frames; and

deinterleaving the interleaved frames with an interleave length that is a multiple of the predetermined number and for forming frames.

7. A record medium for recording a predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, each of the frames being interleaved with an interleave length that is a multiple of the predetermined number so as to form interleaved frames, the interleaved frames being encoded with an error encoding code so as to form encoded interleaved digital data, the encoded interleaved frames being recorded on the record medium.

8. The recording apparatus as set forth in claim 1, wherein each of the frames is composed of a plurality of symbols, and wherein said interleaving means is adapted for delaying the symbols with at least a first delay amount and a second delay amount so as to form the interleaved frames.

9. A data recording apparatus for recording a

predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording apparatus comprising:

interleaving means for interleaving each of the frames with an interleave length that is smaller than a multiple of the predetermined number and forming interleaved frames;

encoding means for encoding the interleaved frames with an error encoding code and for forming encoded interleaved frames; and

recording means for recording the encoded interleaved frames on the record medium.

10. The recording apparatus as set forth in claim 9, wherein each of the frames is composed of a plurality of symbols, and wherein said interleaving means is adapted for delaying each of symbols of the frames with delay amounts that vary for each of symbols by a unit delay amount D so as to interleave the frames with an interleave length that is smaller than a multiple of the predetermined number and form the deinterleaved frames.

~~11. The recording apparatus as set forth in claim~~ 10, wherein said interleaving means is adapted for delaying the symbols with a multiple of 7 of the unit delay amount D.

12. The recording medium as set forth in claim 1, wherein each of the frames is encoded with another error correction code different from the error correction code and includes a parity symbol generated by the encoding process.

13. The recording apparatus as set forth in claim ~~1, wherein the predetermined number is 98~~.

~~14.~~ A data recording apparatus for recording a predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording apparatus comprising:

first interleaving means for interleaving each of the frames with an interleave length that is equal to or smaller than a multiple of the predetermined number and forming first interleaved frames;

second interleaving means for interleaving each of the frames with an interleave length that is larger than a multiple of the predetermined number and forming second interleaved frames;

inputting means for inputting an interleave length signal that represents the interleave length for each of the frames;

selecting means for selecting the output of said first interleaving means corresponding to the interleave length signal when the interleave length is equal to or smaller than a multiple of the predetermined number or for selecting the output of said second interleaving means when the interleave length is larger than a multiple of the predetermined number;

inserting means for inserting interleave length information representing the interleave length into the frames; and

recording means for recording the encoded interleaved frames on the record medium.

12. A data reproducing apparatus as set forth in claim 1, wherein for reproducing data from a record medium on which a predetermined number of encoded interleaved frames have been recorded, the encoded interleaved frames being generated by interleaving and encoding frames, one frame being composed of information data and a sub-code

corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, the data recording apparatus comprising:

reproducing means for reproducing the encoded interleaved frames from the record medium and outputting the encoded interleaved frames;

decoding means for decoding the encoded interleaved frames so as to form interleaved frames;

first deinterleaving means for deinterleaving the interleaved frames with a first interleave length that is equal to or smaller than a multiple of the predetermined number and forming first type frames;

second deinterleaving means for deinterleaving the interleaved frames with a second interleave length that is larger than a multiple of the predetermined number and forming second type frames;

detecting means for determining whether the encoded interleaved frames have been interleaved with the first interleave length or the second interleave length and for outputting interleave length information; and

selecting means for selecting the output of said first deinterleaving means or the output of said second deinterleaving means corresponding to the interleave length information.

~~16.~~ 3 A record medium as set forth in claim 1, wherein for recording two or more units of a predetermined number of frames on a record medium at a time, one frame being composed of information data and a sub-code corresponding to the information data, additional information corresponding to a predetermined number of frames being composed of a predetermined number of sub-codes, each of the frames with an interleave length that is equal to or smaller than a multiple of the predetermined number being interleaved so as to form interleaved frames, the interleaved frames being encoded with an error encoding code so as to form first encoded interleaved frames, the first encoded interleaved frames being recorded on the record medium, each of the frames with an interleave length that is larger than a multiple of the predetermined number being interleaved so as to form interleaved frames, the interleaved frames being encoded with an error encoding code so as to form second encoded interleaved frames, the second encoded interleaved frames being recorded on the record medium.