

Recording and reproduction of a first signal with a first bitrate and a second information signal with a second bitrate larger than the first bitrate.

The invention relates to an apparatus for recording a first information signal with a first bitrate and a second information signal with a second bitrate, which is larger than the first bitrate, to an apparatus for reproducing the first and the second information signal and to a method for recording the first and the second information signal.

5 As an example, the first information signal can be in the form of an SD (standard definition) video signal and the second information signal can be in the form of an HD (high definition) video signal. The SD and HD video signal could have been incorporated into a first and a second MPEG transport stream, respectively, for recording the first and second MPEG transport streams on the record carrier. The first and second
10 information signals can also be in the form of data signals having first and second bitrates that could have been incorporated in first and second MPEG transport streams.

An apparatus for recording an information signal in slant tracks on a
15 record carrier is described in US ser. no. 08/512,857, filed on 09.08.1995, which corresponds to published international patent application no. WO 96/6426 (PHO 94.513), document D1 in the list of related documents. The apparatus is meant to record an analog video signal in accordance with the VHS recording format on the record carrier and is capable of recording a digital video signal on the record carrier.

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The invention aims at providing a simplified apparatus for recording the first and second information signal in the first and second recording mode, respectively. The apparatus for recording a first information signal with a first bitrate in a first recording mode
25 or a second information signal with a second bitrate in a second recording mode so as to produce slant tracks on a magnetic record carrier, the apparatus comprising

- input means for receiving the first or the second information signal,
- processing means for processing the first or the second information signal so as to produce

a processed first or second information signal respectively,

- writing means for writing the processed first or second information signal in said first and second recording mode, respectively, so as to produce said slant tracks,

- transporting means for transporting the record carrier with a first or a second record carrier

5 speed in said first and second recording mode, respectively, the second record carrier speed being larger than the first and the second bitrate being higher than the first bitrate,

the processing means comprising first and second processing units and a multiplexer unit, the first processing unit being adapted to process the first information signal in said first

recording mode so as to obtain said processed first information signal for recording, the

10 multiplexer unit being adapted to multiplex the second information signal into a first signal component and a second signal component in said second recording mode, the first

processing unit being adapted to process the first signal component into a processed first signal component in said second recording mode, the second processing unit being adapted to

process the second signal component into a processed second signal component in said

15 second recording mode, that the writing means comprise at least one pair of a first and a second write head, having azimuth angles substantially equal to $+\alpha$ and $-\alpha$, respectively, and

at least one pair of a third and a fourth write head having azimuth angles substantially equal to $+\beta$ and $-\beta$, respectively, the writing means being adapted to write in said first recording

mode the processed first information signal on said record carrier using said at least one pair

20 of the first and second write head, the writing means further being adapted to write in said second recording mode said processed first signal component on said record carrier using

said at least one pair of the first and second write head and to write said processed second signal component on said record carrier using said at least one pair of the third and fourth

write head, and that α and β are unequal to each other.

25 The invention is based on the following recognition. For recording the second information signal a larger bitrate is required than for recording the first information signal. A recording apparatus for recording the first information signal is thus generally not capable of recording the second information signal unless special measures are taken. One solution is, to increase the record carrier transport speed and add heads to the rotating head

30 drum. Reference is made in this respect to USP 5,495,369, which corresponds to EP 346,973 (PHN 12.599), document D2 in the list of related documents. Further, in order to process the second information signal so as to enable recording on the record carrier, it is required to increase the clock frequency of the processing electronics. This may not always be possible.

In the further discussion, it will be assumed that the second information signal is an HD video signal that has such an information bitrate that it requires at maximum a recording bitrate which is twice the recording bitrate for recording the first information signal. It should however be noted that this is not an essential requirement. The present
5 invention offers a solution to the above problem that it is not always possible to increase the clock frequency for the processing electronics. In accordance with the invention, in the second recording mode, the incoming HD video signal is split into two separate datastreams and each datastream is processed by a separate processing unit that is normally available for processing the SD video signal. Both processing units can now run at a clock frequency
10 which is the same as in the first recording mode. This offers a simplified apparatus for recording both the first information signal and the second information signal.

These and other objects of the invention will be described in more detail
15 hereafter, in which

figure 1 shows a first embodiment of the recording apparatus,
figure 2 shows the head drum of the recording apparatus of figure 1,
figure 3 shows the track pattern on the record carrier obtained with the
recording apparatus switched into the first recording mode,
20 figure 4 shows the track pattern on the record carrier obtained with the
recording apparatus switched into the second recording mode,
figure 5 shows a further elaboration of the first and second processing
units in the apparatus of figure 1,
figure 6 shows the head drum of another embodiment of the recording
25 apparatus,
figure 7 shows an embodiment of the reproducing apparatus, and
figure 8 shows a further elaboration of the first and second processing
units in the apparatus of figure 7.

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Figure 1 shows an embodiment of a recording apparatus for recording an SD video signal and an HD video signal. The apparatus has an input terminal 1 for receiving the SD video signal or the HD video signal. The input terminal 1 is coupled to an input 2 of a multiplexer unit 4, which multiplexer unit is provided a first and a second output 6 and 8,

respectively. The first output 6 is coupled to an input 10 of a first processing unit 12, which first processing unit 12 has an output 14 coupled to an input 16 of a writing unit 18. The second output 8 of the multiplexer unit 4 is coupled to an input 20 of a second processing unit 22, which second processing unit 22 has an output 24 coupled to an input 26 of a writing unit 18. The apparatus further comprises a clock signal generator 28, which has an output 30 coupled to clock inputs 32 and 34 of the processing units 12 and 22, respectively.

The writing unit 18 comprises a rotatable head drum, an embodiment of which is shown in figure 2. The head drum 36 has four heads positioned at its circumference, a first head H_1 , having a head gap with an azimuth angle $+\alpha$, where α can have a value such as 30° , a second head H_2 , having a head gap with an azimuth angle $-\alpha$, a third head H_3 , having a head gap with an azimuth angle $+\beta$, where β can have a value of $+6^\circ$ and a fourth head H_4 , having a head gap with an azimuth angle $-\beta$. The heads H_1 and H_2 are located diametrically opposite to each other at the periphery of the head drum. In the same way, the heads H_3 and H_4 are located diametrically opposite to each other at the periphery of the head drum 36. The arrow 38 denotes the direction of rotation of the head drum 36 and the arrow 40 denotes the direction of transport of the record carrier 42. The record carrier 42 is wrapped around the head drum 36 over slightly more than 180° . The heads H_1 and H_3 are located on the head drum with a relative height difference equal to one track pitch. The heads H_2 and H_4 are also located on the head drum with a relative height difference equal to one track pitch. The heads H_1 and H_2 are located at the same height and also the heads H_3 and H_4 are located at the same height. As a result, subsequent tracks will be written in the second recording mode by the heads H_1 , H_3 , H_2 and H_4 . It should further be noted that, in another embodiment of the head drum, the two heads H_3 and H_4 could have been interchanged.

Figure 2 further shows a capstan 44 and a pressure roller 46 between which the record carrier is pressed so as to transport the record carrier with a certain velocity. The capstan is rotated by means of a capstan motor 48, which is controlled by a motor control unit 49.

In a first recording mode, an SD video signal is recorded on the record carrier 42. In this recording mode, the processing unit 22 is disabled and also part of the writing unit 18 is disabled. The record carrier is transported by a record carrier transport unit (not shown) with a velocity of v_t and the rotatable head drum 36 is rotated with a predetermined rotational velocity. In the first recording mode, the multiplexer unit 4 is controlled in such a way that an SD video signal received via the input 1 is supplied to the

input 10 of the first processing unit 12. The first processing unit 12 processes the SD video signal in a well known way. When the SD video signal is supplied in the form of MPEG packets in an MPEG transport stream, time stamps are added to the packets, an error correction encoding and a channel encoding is carried out on the SD video signal so as to
5 obtain a processed SD video signal which is suitable for recording on the record carrier. Figure 3 shows the record carrier 42 obtained after having recorded the processed SD video signal in the first recording mode. Figure 3 is only a schematic drawing of the record carrier. For clarity reasons the tracks on the record carrier 42 are shown in a vertical direction, although in reality, the tracks are recorded in a slant direction on the record carrier
10 42.

In the first recording mode, the processed SD video signal is supplied to the heads H_1 and H_2 and the heads record the processed SD video signals on the record carrier 42 so that tracks $T_1, T_2, T_3, T_4, T_5, T_6, T_7, \dots$ are obtained. The odd numbered tracks $T_1, T_3, T_5, T_7, \dots$ have been recorded by the head H_1 with the azimuth angle $+\alpha$ and
15 the even numbered tracks $T_2, T_4, T_6, \dots$ have been recorded by the head H_2 with the azimuth angle $-\alpha$.

The SD video signal applied to the input terminal 1 can be in the form of an MPEG transport stream comprising packets of information of the SD video signal.

In a second recording mode, an HD video signal is recorded on the record
20 carrier 42. The HD video signal applied to the input terminal 1 can also be in the form of an MPEG transport stream comprising packets of information of the HD video signal. The record carrier is transported by a record carrier transport unit (not shown) with a velocity of 2 times v_t and the rotatable head drum 36 is rotated with the same predetermined rotational velocity as in the first recording mode. In the second recording mode, the multiplexer unit 4
25 is controlled in such a way that an HD video signal received via the input 1 is split up into two signal components, a first and a second signal component that roughly have the same bitrate. The first signal component is supplied to the input 10 of the first processing unit 12 and the second signal component is supplied to the input 20 of the second processing unit 22. In the specific embodiment where the HD video signal is in the form of an MPEG transport
30 stream, the multiplexer unit 4 simply distributes the packets received at its input 2 to either its output 6 or to its output 8, resulting in the first and second signal components at its outputs 6 and 8, respectively.

The first processing unit 12 processes the first signal component again in a well known way. When the first signal component is supplied in the form of MPEG

packets in an MPEG transport stream, time stamps are added to the packets, an error correction encoding and a channel encoding is carried out on the first signal component so as to obtain a processed first signal component which is suitable for recording on the record carrier. The second processing unit 22 processes the second signal component in the same well known way. When the second signal component is supplied in the form of MPEG packets in an MPEG transport stream, time stamps are added to the packets, an error correction encoding and a channel encoding is carried out on the second signal component so as to obtain a processed second signal component which is suitable for recording on the record carrier.

Figure 4 shows the record carrier 42 obtained after having recorded the processed first and second signal components in the second recording mode. Figure 4 is again only a schematic drawing of the record carrier. For clarity reasons the tracks on the record carrier 42 are again shown in a vertical direction, although in reality, the tracks are recorded in a slant direction on the record carrier 42.

In the second recording mode, the processed first signal component is supplied to the heads H_1 and H_2 and the heads record the processed first signal component on the record carrier 42 so that tracks $T_1, T_3, T_5, T_7, T_9, T_{11}, T_{13}, \dots$ are obtained. The tracks denoted $T_1, T_5, T_9, T_{13}, \dots$ have been recorded by the head H_1 with the azimuth angle $+\alpha$ and the tracks denoted $T_3, T_7, T_{11}, \dots$ have been recorded by the head H_2 with the azimuth angle $-\alpha$. Further, the second processed signal component is supplied to the heads H_3 and H_4 and those heads record the processed second signal component on the record carrier 42 so that tracks $T_2, T_4, T_6, T_8, T_{10}, T_{12}, \dots$ are obtained. The tracks denoted $T_2, T_6, T_{10}, \dots$ have been recorded by the head H_3 with the azimuth angle $+\beta$ and the tracks denoted $T_4, T_8, T_{12}, \dots$ have been recorded by the head H_4 with the azimuth angle $-\beta$.

The processing of the packets in the MPEG datastream of the first or the second information signal supplied to the input 1 so as to obtain a processed information signal suitable for recording on the record carrier has been extensively described in USP 5,579,183, document D3, and EP-A 763,238, document D4 that can be found in the list of related documents. It is considered appropriate to explain the time stamp generation for the first and the second information signal in the processing units 12 and 22. Reference is made in this respect to figure 5.

In the first recording mode, packets of the first information signal are supplied to the processing unit 12. The processing unit 12 comprises a counter 50 and a

signal combination unit 52. The counter 12 is a counter that counts up in response to a 27 MHz clock frequency, supplied by the clock generator 28. The count values supplied by the counter 50 to the signal combination unit 52 are the time stamps that are incorporated into the packets of the first information signal by the combination unit 52. One time stamp in
5 each packet.

The generation of the time stamps using the 27 MHz clock signal generator 28 and the counter 50 is extensively explained in document D4. It should be noted in this respect that the time stamp counter 50 is synchronised to head drum.

After having added the time stamps to the packets, the datastream
10 obtained is error correction encoded in an ECC encoder unit (not shown) and channel encoded in a channel encoding unit (not shown) so as to make the datastream suitable for recording.

As the apparatus comprises two identical processing units, also the processing unit 22 comprises a counter 54 and a signal combination unit 56. The counter 54
15 also receives the 27 MHz clock frequency supplied by the generator 28. The counter 54 generates count values in response to the clock frequency. The count values are supplied to the signal combination unit 56 as time stamps, for incorporation into packets.

In the second recording mode, the multiplexer unit 4 generates, in response to the second information signal supplied to its input, the first and second signal
20 components that are supplied to its outputs 6 and 8 respectively. The processing unit 12 inserts the time stamps generated by the counter 50 into the packets included in the first signal component of the second information signal and further carries out the ECC encoding step and the channel encoding step, in the way described above for the first recording mode. In an identical way the counter signal combination unit 56 inserts the time stamps generated
25 by the counter 54 in the packets of the second signal component of the second information signal and carries out an ECC encoding step and a channel encoding step so as to obtain a datastream suitable for recording. Also in the second recording mode, the time stamp counter 50 and the head drum are synchronised with each other.

In order to obtain the correct timing between the time stamps generated by
30 the counters 50 and 54, a synchronization unit 58 is available. The synchronization unit 58 has an output 60 on which the synchronization signal is available, which is supplied to synchronization inputs 62 and 64 of the counters 50 and 54, respectively. In response to the synchronization signal, the counters 50 and 54 are synchronized to the same count value, eg. upon the initialisation of the system when switching the apparatus on, or upon switching the

apparatus into the recording mode.

Figure 6 shows the rotatable head drum 68 of another embodiment of the recording apparatus. In this embodiment, the head drum 68 has again heads H_1 , H_2 , H_3 and H_4 , positioned around the circumference of the head drum. The first head H_1 again has a head gap with an azimuth angle $+\alpha$, the second head H_2 again has a head gap with an azimuth angle $-\alpha$, the third head H_3 , again has a head gap with an azimuth angle $+\beta$ and the fourth head H_4 again has a head gap with an azimuth angle $-\beta$. The heads H_1 and H_2 are again located diametrically opposite to each other at the periphery of the head drum. In the same way, again the heads H_3 and H_4 are located diametrically opposite to each other at the periphery of the head drum 36. The difference between the head drum 68 in figure 6 and the head drum 36 in figure 2 is that the head pair H_3, H_4 in figure 6 is rotated over nearly 90° compared to the position of the head pair H_3, H_4 in figure 2. Further, the heads of the head drum of figure 6 are positioned at the same height on the head drum.

The embodiment of the recording apparatus provided with the head drum of figure 6 results in the same track pattern as shown in the figures 3 and 4.

As regards the error correction encoding on the information to be recorded, the following can be said. As explained above, an error correction encoding step can be carried out on the first information signal in the processing unit 12, in the first recording mode. In the error correction encoding step, a block of data of the first information signal is first subjected to a 'vertical' error correction encoding step, or outer error correction encoding, resulting in vertical (or outer) parities and subsequently subjected to a 'horizontal' error correction encoding step, or inner error correction encoding, resulting in 'horizontal' (or inner) parities. The error correction encoded datablock thus obtained is recorded in a number of eg. 6 tracks, such as the tracks T_1 to T_6 .

In the second recording mode, the processing unit 12 carries out an error correction encoding step on datablocks of the first signal component, resulting in error correction encoded datablocks of the first signal component. Further, the processing unit 22 carries out an error correction encoding step on datablocks of the second signal component, resulting in error correction encoded datablocks of the second signal component. Now, an error correction encoded datablock of the first signal component is recorded in the six tracks T_1 , T_3 , T_5 , T_7 , T_9 and T_{11} and an error correction encoded datablock of the second signal component is recorded in the six tracks T_2 , T_4 , T_6 , T_8 , T_{10} and T_{12} . Thus, a combed structure of the ECC blocks on the record carrier is obtained.

This has the advantage of using two recording ICs in parallel, without the

need of a large internal memory in the ICs.

Figure 7 shows an embodiment of the reproduction apparatus in accordance with the invention. The reproduction apparatus comprises a reading unit 70 for reading the processed first information signal or the processed second information signal in a first and a second reproducing mode, respectively. The apparatus further comprises processing units 72 and 74 having inputs 76 and 78, respectively, coupled to outputs 80 and 82, respectively, of the reading unit 70. Outputs 84 and 86 of the processing units 72 and 74, respectively, are coupled to corresponding inputs 88 and 90, respectively, of a signal combination unit 92, which has an output coupled to an output terminal 94 of the reproduction apparatus. The apparatus further comprises a clock signal generator 98, which has an output 100 coupled to clock inputs 102 and 104 of the processing units 72 and 74, respectively.

The reading unit 70 comprises a rotatable head drum provided with a plurality of heads, such as the head drum configuration shown in figure 2 or 6.

In the first reproduction mode of the apparatus of figure 8, the heads H_1 and H_2 read the information from the tracks $T_1, T_2, T_3, \dots$ on the record carrier of figure 3. The record carrier 42 is transported with the velocity v_t . The processed first information signal read by the heads H_1, H_2 are supplied to the output 80 and thus supplied to the processing unit 72. A processing step inverse to the processing step during recording is carried out on the processed first information signal. That is: a channel decoding step and an error correction step is carried out on the processed first information signal, so as to obtain a replica of the first information signal. The time stamps included in the packets in the replica of the first information signal are retrieved therefrom and compared with time stamps generated in the processing unit 72, so as to determine the exact time instant at which a packet should be outputted to the combination unit 92. The signal combination unit 92 does nothing more than unmodified transfer of the first information signal regenerated to the output terminal 94.

In the second reproduction mode, the record carrier is transported with the velocity $2.v_t$. The heads H_1 and H_2 read the information recorded in the tracks $T_1, T_3, T_5, \dots$ and the heads H_3 and H_4 read the information recorded in the tracks $T_2, T_4, T_6, \dots$, see figure 4. The processed first signal component of the second information signal is thus read by the heads H_1, H_2 and supplied to the output 80 of the reading unit 70. The processed second signal component of the second information signal is thus read by the heads H_3, H_4 and supplied to the output 82 of the reading unit 70.

The processed first signal component is processed in the processing unit 72 in the way described above. The processed second signal component is processed in the processing unit 74 in an inverse way compared to the processing in the processing unit 22 of figure 1. That is: a channel decoding step and an error correction step is carried out on the processed second signal component, so as to obtain a replica of the second signal component. The time stamps included in the packets in the replica of the second signal component are retrieved therefrom and compared with time stamps generated in the processing unit 74, so as to determine the exact time instant at which a packet should be outputted to the combination unit 92. The signal combination unit 92 combines the packets supplied by the processing units 72 and 74 into a single serial datastream of the second information signal which is supplied to the output terminal 94. Because of the correct timing synchronization, the packets in the first and second signal components will be supplied at such time instants to the combination unit 92 that they can be merged so as to obtain the serial datastream of the second information signal.

The processing in the processing units 72 and 74 will be further explained with reference to figure 8.

In the first reproducing mode, packets comprised in the processed first information signal are supplied to the input 76 of the processing unit 72. The processing unit 72 comprises a channel decoder unit (not shown) so channel decode the datastream received via the input 76, in a way inverse to the channel encoding step carried out in the processing unit 12 of the recording apparatus. Further, the processing unit 72 comprises an error correction unit (not shown) for carrying out an error correction on the channel decoded information. The processing unit 72 further comprises a time stamp retrieval unit 114, a memory unit 116, a counter 110 and a comparator unit 112. The time stamp retrieval unit 114 retrieves the time stamps from the packets in the datastream supplied to the retrieval unit and supplies the time stamps to the comparator unit 112 and supplies the packets to the memory unit 116 in which they are stored for later retrieval. The counter 110 is a counter that counts up in response to a 27 MHz clock frequency, supplied by the clock generator 98. The count values supplied by the counter 110 to the comparator unit 112 are compared in the comparator 112 with the time stamps supplied by the retrieval unit 114. Upon coincidence of a count value with a time stamp, the comparator supplies a control signal at its output 118, which control signal is supplied to the memory 116. In response to this control signal, the memory 116 supplies the packet corresponding to the time stamp for which a coincidence with the count value was established, to the output 84 of the processing unit 72..

As the apparatus comprises two identical processing units, also the processing unit 74 comprises a time stamp retrieval unit 120, a memory unit 122, a counter 124 and a comparator unit 126. The retrieval unit 120 again retrieves the time stamps from the packets supplied to its input and supplies the packets to the memory unit 122 for storage
5 therein for later retrieval. The counter 124 also receives the 27 MHz clock frequency supplied by the generator 98. The counter 124 generates count values in response to the clock frequency. The count values are supplied to the comparator unit 126.

In the second reproduction mode, the reading unit 70 supplies the processed first and second signal components to the inputs 76 and 78, respectively, of the
10 first and second processing units 72 and 74, respectively. The processing unit 72 processes the processed first signal component in the way described above for the first reproducing mode. In an identical way the processing unit 74 processes the processed second signal component.

In order to obtain the correct timing between the time stamps generated by
15 the counters 110 and 124, a synchronization unit 128 is available. The synchronization unit 128 has an output on which the synchronization signal is available, which is supplied to synchronization inputs 130 and 132 of the counters 110 and 124, respectively. In response to the synchronization signal, the counters 110 and 124 are synchronized to the same count value.

20 As a result, packets are supplied by the memory units 116 and 122 such that they do not overlap in time and can be merged precisely into a serial datastream by the combination unit 92.

Whilst the invention has been described with reference to preferred embodiments thereof, it is to be understood that these are not limitative examples. Thus,
25 various modifications may become apparent to those skilled in the art, without departing from the scope of the invention, as defined by the claims. One of the advantages of the recording apparatus in accordance with the invention, is that the recorded signal recorded in the first recording mode can be read by a prior art reproducing apparatus provided with the heads H_1 and H_2 only on the head drum. This has the further advantage that, new features
30 that are scanner dependent and/or tape format dependent, such as the trick play proposal as described in EP patent application no. (PHN 16614), document D5 in the list of related documents, can be added to the recording/reproduction system without any problem.

Further, the invention lies in each and every novel feature or combination of features.

Related documents

- (D1) US ser. no. 08/512,857, filed on 09.08.1995, which corresponds to published international patent application no. WO 96/6426 (PHO 94.513).
- 5 (D2) USP 5,495,369, which corresponds to EP 346,973 (PHN 12.599).
- (D3) USP 5,579,183, that corresponds to EP-A 702,877 (PHN 14.818)
- (D4) US ser. no. 08/622,508, filed on 25.03.1996, that corresponds to EP-A 763.238. (PHN 15.260)
- (D5) EP patent application no. (PHN 16614)

CLAIMS:

1. Apparatus for recording a first information signal with a first bitrate in a first recording mode or a second information signal with a second bitrate in a second recording mode so as to produce slant tracks on a magnetic record carrier, the apparatus comprising
- 5 - input means for receiving the first or the second information signal,
- processing means for processing the first or the second information signal so as to produce a processed first or second information signal respectively,
- writing means for writing the processed first or second information signal in said first and second recording mode, respectively, so as to produce said slant tracks,
- 10 - transporting means for transporting the record carrier with a first or a second record carrier speed in said first and second recording mode, respectively, the second record carrier speed being larger than the first and the second bitrate being higher than the first bitrate, the processing means comprising first and second processing units and a multiplexer unit, the first processing unit being adapted to process the first information signal in said first
- 15 recording mode so as to obtain said processed first information signal for recording, the multiplexer unit being adapted to multiplex the second information signal into a first signal component and a second signal component in said second recording mode, the first processing unit being adapted to process the first signal component into a processed first signal component in said second recording mode, the second processing unit being adapted to
- 20 process the second signal component into a processed second signal component in said second recording mode, that the writing means comprise at least one pair of a first and a second write head, having azimuth angles substantially equal to $+\alpha$ and $-\alpha$, respectively, and at least one pair of a third and a fourth write head having azimuth angles substantially equal to $+\beta$ and $-\beta$, respectively, the writing means being adapted to write in said first recording
- 25 mode the processed first information signal on said record carrier using said at least one pair of the first and second write head, the writing means further being adapted to write in said second recording mode said processed first signal component on said record carrier using said at least one pair of the first and second write head and to write said processed second signal component on said record carrier using said at least one pair of the third and fourth

write head, and that α and β are unequal to each other.

2. Apparatus as claimed in claim 1, wherein the first information signal and the second information signal comprise subsequent packets of information of the first or second information signal respectively, the processing means further comprising time stamp generator means for generating time stamps for insertion in the said packets.
3. Apparatus as claimed in claim 2, wherein said time stamp generator means comprises a first and a second time stamp generator unit, the first time stamp generator unit being comprised in said first processing unit and the second time stamp generator unit being comprised in said second processing unit, the first and second time stamp generator unit each comprising a counter for generating count values as the time stamps, the apparatus comprising synchronizing means for synchronizing both counters so as to have the same count value.
4. Apparatus as claimed in claim 3, wherein the apparatus is provided with clock signal generator means for generating a clock signal for both counters.
5. Apparatus as claimed in claim 1, 2 or 3, wherein the first processing unit is substantially identical to the second processing unit.
6. Apparatus as claimed in claim 1, wherein the first and second information signals are MPEG encoded signals comprising packets of information.
7. Apparatus as claimed in claim 2 or 6, wherein the multiplexer unit is adapted to allocate packets in the second information signal to either the first or the second processing unit in said second recording mode.
8. Apparatus as claimed in claim 1, wherein the writing means comprise one pair of the first and second write head and one pair of the third and fourth write head and that the second record carrier speed is twice the first record carrier speed.
9. Apparatus for reproducing a first information signal with a first bitrate in a first reproducing mode or a second information signal with a second bitrate in a second reproducing mode so as to obtain a reproduced first information signal or a reproduced second information signal respectively, from slant tracks on a record carrier, the apparatus comprising
- reading means for reading a processed first information signal or a processed second information signal from said slant tracks, in said first and second reproducing mode, respectively,
 - processing means for processing the processed first information signal or the processed second information signal so as to obtain said reproduced first and second information signal,



respectively,

- transporting means for transporting the record carrier with a first or a second record carrier speed in said first and second reproducing mode, respectively, the second record carrier speed being larger than the first and the second bitrate being higher than the first bitrate
- 5 the reading means being adapted to read a first and a second processed signal component from said record carrier in said second reproducing mode,
- the processing means comprising first and second processing units and a combination unit, the first processing unit being adapted to process the processed first information signal read from the record carrier so as to obtain said reproduced first information signal in said first
- 10 reproducing mode, the first processing unit being adapted to process the first processed signal component into a reproduced first processed signal component in said second reproducing mode, the second processing unit being adapted to process the second processed signal component into a reproduced second signal component in said second reproducing mode, the combination unit being adapted to combine the reproduced first and second signal
- 15 components into said reproduced second information signal in said second reproducing mode,
- output means for supplying said reproduced first information signal or said reproduced second information signal in said first and second reproducing mode, respectively, that the reading means comprise at least one pair of a first and a second read head, having azimuth angles substantially equal to $+\alpha$ and $-\alpha$, respectively, and at least one pair of a third and a
- 20 fourth read head having azimuth angles substantially equal to $+\beta$ and $-\beta$, respectively, the reading means being adapted to read in said first reproducing mode the processed first information signal from said record carrier using said at least one pair of the first and second read head, the reading means further being adapted to read in said second reproducing mode said processed first signal component from said record carrier using said at least one pair of
- 25 the first and second read head and to read said processed second signal component from said record carrier using said at least one pair of the third and fourth read head, and that α and β are unequal to each other.

10. Apparatus as claimed in claim 9, wherein the processed first information signal and the processed second information signal comprise subsequent packets of
- 30 information of the first and second information signal respectively, said packets comprising a time stamp, the processing means further comprising
- retrieval means for retrieving said time stamps from said packets,
 - time stamp generator means for generating time stamps,
 - comparator means for comparing said time stamps from said time stamp generator means



with the time stamps retrieved from the packets, and for generating a control signal upon coincidence of both time stamps,

the combination unit being adapted to combine said packets into said reproduced first or second information signal, in response to said control signal.

- 5 11. Apparatus as claimed in claim 10, wherein said time stamp generator means comprises a first and a second time stamp generator unit comprised in said first and second processing unit, respectively, the first and second time stamp generator unit each comprising a counter for generating count values as the time stamps, the apparatus comprising synchronizing means for synchronizing both counters so as to have the same
10 count value, and where in said second reproducing mode, the combination unit is adapted to combine the packets supplied by said first and second processing units into said reproduced second information signal, in response to said control signal.

12. Apparatus as claimed in claim 11, wherein the apparatus is provided with clock signal generator means for generating a clock signal for both counters.

- 15 13. Apparatus as claimed in claim 9, wherein the reading means comprise one pair of the first and second read head and one pair of the third and fourth read head and that the second record carrier speed is twice the first record carrier speed.

14. Apparatus as claimed in claim 9, wherein the first processing unit is substantially identical to the second processing unit.

- 20 15. Apparatus as claimed in claim 9, wherein the reproduced first and second information signals are MPEG encoded signals comprising packets of information.

16. Apparatus as claimed in claim 10 or 15, wherein the combination unit is adapted to merge the packets in the reproduced first and second signal components into one serial datastream so as to obtain said reproduced second information signal in said second
25 reproducing mode.

17. Method of recording a first information signal in a first recording mode or a second information signal in a second recording mode so as to produce slant tracks on a magnetic record carrier, the method comprising the steps of

- receiving the first information signal or the second information signal,
30 - processing the first or the second information video signal so as to produce a processed first or second information signal respectively,
- writing the processed first or second information signal in said first and second recording mode, respectively, so as to produce said slant tracks,
- transporting the record carrier with a first or a second record carrier speed in said first and



second recording mode, respectively, the second record carrier speed being larger than the first,

the processing step comprising first and second processing substeps and a multiplexing step, the first processing substep comprises processing the first information signal in said first

5 recording mode, the multiplexing step comprising a multiplexing of the second information signal into a first signal component and a second signal component in said second recording mode, the first processing substep comprises processing the first signal component into a processed first signal component in said second recording mode, the second processing substep comprising processing the second signal component into a processed second signal

10 component in said second recording mode, that the writing step comprises writing signals with at least one pair of a first and a second write head, having azimuth angles substantially equal to $+\alpha$ and $-\alpha$, respectively, and with at least one pair of a third and a fourth write head having azimuth angles substantially equal to $+\beta$ and $-\beta$, respectively, the writing step comprising the step to write in said first recording mode the processed first information

15 signal on said record carrier using said at least one pair of the first and second write head, and the step to write in said second recording mode said processed first signal component on said record carrier using said at least one pair of the first and second write head and to write said processed second signal component on said record carrier using said at least one pair of the third and fourth write head, and that α and β are unequal to each other.

