Description

The invention relates to a recording system for recording information, comprising a record carrier of an inscribable type and a recording apparatus comprising write means for recording applied information on the record carrier. The invention further relates to a record carrier and apparatus for use in the system.

Record carriers on which digitised audio information is recorded have been available for a considerable time now. Such a record carrier may be for example, an optically readable disc, such as the "Compact Disc" or a magnetic tape, such as the "DAT" cassette tape. The advantage of digitised audio information is the extremely high quality.

Another property of digitised information is that it can be copied almost endlessly without any significant loss of quality.

This last-mentioned property constitutes a substantial problem in marketing consumer equipment with which digital audio information cannot only be played back but can also be recorded.

Such an apparatus enables the consumer to evade copyrights on a large scale by simply copying the content of a record carrier with digitised audio information.

Since copying does not entail a loss of quality there are hardly any reasons for the consumer to purchase a comparatively expensive original which is subject to copyright if the original, or a copy thereof, is available for copying. This leads to a substantial loss of copyright income.

A system for inhibiting unauthorized copying of information, as defined in the opening paragraph, is known from GB-A 2,104,701. In the system described therein the control-information pattern is recorded on the first part of a magnetic tape. Reading this control-information pattern enables the information specified by said pattern to be copied. Copying such information remains permissible until recording is interrupted by actuating the stop button. This has the disadvantage that if recording is to be resumed it is necessary to rewind the tape to the beginning in order to read the control-information pattern again.

Further Research Disclosure, no 248, December 1984, pages 588 and 589 discloses an information recording system for recording information on an optical or magnetic disc which has been provided with a servo-track, which is used for tracking during the recording of information.

It is an object of the invention to provide means to mitigate this drawback. To this end a system as defined in the opening paragraph is characterized in that the record carrier is provided with a preformed or prerecorded servo track, the control-information pattern taking the form of a preformed or prerecorded track modulation of the servo track in servo track parts intended for recording information, in that the recording apparatus comprises means for scanning the servo track, and in that the read means include means for detecting the track modulation during scanning and for deriving the control information from the detected track modulation. Thus, the control-information pattern can always be read, regardless of the position of the write means relative to the record carrier. Moreover, this embodiment enables the control-information to be tested continually during recording, so that the system becomes highly tamper-proof.

An attractive embodiment of the recording system is characterized in that the recording apparatus comprises at least two input stages for receiving the information to be recorded, and in that the test means are adapted to detect the type of applied information on this basis of the type of input stage used.

This embodiment utilises the fact that different types of information require different input stages, so that the type of information applied can be derived simply from the input stage which is used.

A further embodiment of the recording system is characterized in that the recording apparatus comprises at least two input stages for receiving information of two different types, and selection means for selecting one of the input stages, and in that the test means are adapted to determine the type of applied information on the basis of the selected input stage.

This embodiment advantageously utilises the fact that in a system comprising different input stages the type of information applied can be derived simply from the selected input stage.

An embodiment of the system is characterized in that the record carrier is of an erasable type, the preconditioning control-information pattern being of a non erasable type. Because the control information cannot be erased it is virtually impossible to alter the record carrier destination.

The invention is applicable to all kinds of inscribable record carriers. An embodiment suitable for recordings on optical or magneto-optical record carriers is characterized in that the recording apparatus comprises an optical scanning device for scanning the servo track with a radiation beam for the purpose of recording, the read means comprising a radiation-sensitive detector for detecting the radiation beam which is modulated by the track modulation during scanning.

A further embodiment of the system is characterized in that the control information represented by the track modulation comprises a position information signal which indicates the position of the relevant track portion relative to the beginning of the servo track, in that the recording apparatus

comprises conversion means for converting the applied information, prior to recording into a signal complying with the CD-standard, the control means being adapted to add subcode information to the information to be recorded depending on the position-information being read, and the control means being adapted to supply the subcode information exclusively if the detected type of information presented for recording corresponds to one of the types indicated by the control information being read.

Information cannot be recorded if the addition of subcodes is inhibited. If the addition of subcodes is inhibited it is possible to record a pattern of information symbols on the record carrier, but the recorded pattern cannot be read because the subcode information is necessary for controlling the process of reading information recorded in conformity with the CD format, so that said information may be regarded as not being recorded.

Obviously it is possible to combine the inhibition of adding the subcode information with other methods of inhibiting recording, such as for example disabling the input stage and/or the write-signal generation. However, deriving the subcode information from the position-information signal being read is complex and is generally effected by programmable control means, so that in practice it is very difficult to render this protection inoperative by technical adaptations, which renders the system highly tamper-proof.

A further embodiment of the system is characterized in that the control information represented by the track modulation comprises position information signals and synchronisation signals, which synchronisation signals can be distinguished from the position information signals, the type of synchronisation signal indicating the permissible type(s) of information for the relevant record carrier.

This embodiment enables the types of information which may be recorded to be indicated without the position-information signals being affected thereby.

A further embodiment is characterized in that the control information represented by the track modulation comprises synchronisation signals which can be distinguished from the position-information signals, the type of synchronisation signal indicating the permissible type(s) of information for the relevant record carrier.

This embodiment advantageously utilises the fact that there are several signal patterns which deviate from a "biphase"modulation pattern.

Further embodiments and the advantages thereof will now be described in detail, by way of example, with reference to Figs. 1 to 12, in which

Figs. 1 and 8 show embodiments of the recording system in accordance with the invention,

Figs. 2 and 10 are flow charts of programs performed by a microcomputer incorporated in the recording system,

Fig. 3 shows a record carrier for use in the recording system in accordance with the invention,

Fig. 4a shows a position-information signal which has been prerecorded as a track modulation in a portion of the servo track of the record carrier which is intended for recording,

Fig. 4b illustrates the format of the information represented by the position-information signal,

Figs. 5, 6 and 7 illustrate different methods of recording the control information indicating the record-carrier designation.

Fig. 9 illustrates the CD-ROM format,

Fig. 11 shows an example of a demodulation circuit used in the system, and

Fig. 12 shows an example of a demodulation circuit used in the recording system.

Fig. 1 shows diagrammatically an embodiment of a recording system 1 in accordance with the invention. The recording system comprises a record carrier 2 of an inscribable type, for example a magnetic tape or an inscribable optical record carrier in the form of a magneto-optical disc. The recording system further comprises a recording apparatus 3 for recording information which can be applied via three different input stages 4, 5 and 6. The input stage 4 may comprise, for example, an analog-to digital converter for sampling an analog signal, for example an audio signal, and converting the samples into n-bit information words. The n-bit information words can be applied to an input 8 of a processing circuit 9 via a bus 7, for example an I^2S bus. The processing circuit 9 derives control signals for a write head 10 from the applied digital signal, by means of which write head a pattern of detectable marks is recorded on the record carrier 2, which pattern represents the sequence of n-bit information words applied to the input 8.

The input stage 5 may comprise, for example, a converter which converts a standard digitised audio signal, for example an audio signal in conformity with the "digital audio interface format", into a sequence of n-bit information words each representing an audio sample. The n-bit information words obtained by means of the input stage 5 are also applied to the input 8 of the processing circuit 9 via the bus 7. This input stage 5 may comprise, for example, an integrated circuit which is marketed by Sony under the type number Cx 23053.

The input stage 6 may comprise, for example, a circuit which converts a sequence of information words, for example computer data, into a format suitable for storage, for example the standard CD-ROM format. Such a circuit arranges the applied information words in n-bit data blocks, to which

additional information words in the form of synchronisation words, a header, and additional information words for error correction are added. The sequence of n-bit information words obtained by means of the input stage 6 can be applied to the input 8 of the processing circuit 9 via the bus 7.

For controlling the recording process the recording apparatus 3 comprises a control circuit, for example a microcomputer 11 of a customary type loaded with a suitable control program. The microcomputer 11 comprises a plurality of control outputs which are coupled to the input stages 4, 5 and 6, to the processing circuit 3 and to the read/write head 11. The microcomputer 11 further comprises a keyboard 13 with three keys 14, 15, 16 by means of which one of the input stages can be selected. The microcomputer 11 is further coupled to a read circuit 12 for reading the control information, which has been prerecorded on the record carrier 2 as a control information structure and which indicates for which type of information to be recorded the relevant record carrier is intended. For example, the control information may indicate that the record-carrier

- is intended for recording computer data, or
- is intended for recording computer data and/or information applied in analog form, or
- is intended for recording both computer data, information applied in analog form, and analog information applied in digital form, for example digitised audio information.

The microcomputer 11 is loaded with a suitable program to detect which input stage has been selected by means of the keys 14, 15 and 16 and to ascertain whether the type of information for which the selected input stage is intended corresponds to the type indicated by the control information being read. In the case of correspondence the selected input stage and the processing circuit are activated and the write head 10 is set to the write mode, after which recording can be started. In the case of non-correspondence recording is inhibited because the processing circuit 9 and/or the selected stage and/or the write head are not activated and/or the recording process is not started.

A flow chart of such a program with which these operations can be performed is given in Fig. 2. In step S1 of the program the selection entered via the keyboard 13 is detected. In step S2 the control information read by means of the read circuit 12 is detected. In step S3 it is ascertained whether the detected control information corresponds to the selected input stage. If this is the case, step S3 is followed by step S4, in which the selected input stage, the processing circuit 9 and the write head 10 are activated, after which recording is started in step S5. However, if during step S3 the control information being read and the selected input stage are found not to correspond to each other S3 is followed by step S1.

In this way recording of information of a type for which the record carrier 2 is not intended is inhibited.

Thus, the above system enables a user-dependent charge to be imposed on record carriers. For example, a record carrier on which it is allowed to record audio information presented in digital form may be subject to a charge in order to compensate for the loss of copyrights incurred when, for example, a Compact Disc or a DAT cassette with digitised audio information is copied.

A record carrier which is intended exclusively for the recording of computer data may be exempted from the charge. A record carrier for which the recording of information presented in analog form is allowed but for which the recording of higher quality digitised audio information is not allowed may be subject to a smaller charge than a record carrier on which it is allowed to record the higher quality digitised audio information.

The above system comprises three different input stages, but it will be evident that the invention is equally applicable to systems comprising only one input stage for recording only one type of information.

In the foregoing the type of information to be recorded is detected on the basis of the selected input stage. However, it is alternatively possible to derive the type of information from the information which is actually applied. However, because of the simplicity with which the type of information can be detected on the basis of the selected input stage this method is to be preferred.

Fig. 3 shows an example of a disc-shaped record carrier 2 of an inscribable type for use in the system in accordance with the invention. Fig. 3a is a plan view of the record carrier 2. Fig. 3b shows a small part of the record carrier 2 in a sectional view taken on the line b-b. Figs. 3c and 3e show the portions 22a and 22b of the record carrier 2 to a highly enlarged scale. Fig. 3d shows the part 22a in a sectional view taken on the line d-d.

The record carrier 2 has a servo track 24, for example in the form of a preformed groove or ridge. The servo track 24 comprises a lead in track 24a provided with a preconditioning information structure comprising a pattern of pits 29 (see Fig. 3c). The servo track 24 further comprises a portion 24b intended for information recording. For the purpose of recording the record carrier 2 is provided with a radiation sensitive recording layer 26, for example a magneto-optical layer, which is deposited on a transparent substrate 25 and which is covered with a protective coating 27. The layer 26

may also consist of a radiation-sensitive material other than a magneto-optical material, for example a material which when heated by means of radiation is subjected to a structural change from an amorphous structure to a crystalline structure or vice versa.

The servo track 24 enables a radiation beam which is aimed at a record carrier 1 for the purpose of recording the information to be positioned accurately on the servo track 24, in other words the position of the radiation beam in a radial direction to be controlled, via a servo system which utilises the radiation reflected from the record carrier 1. The measurement system for measuring the radial position of the radiation spot on the record carrier may correspond to one of the systems as described in the book "Principles of optical disc systems"; Adam Hilger; Bristol and London.

To determine the position of the track portion being scanned relative to the beginning of the servo track a position-information signal is recorded as a preformed track modulation, for example in the form of a sinusoidal undulation of the track as shown in Fig. 3e.

An attractive form of track modulation is that where the frequency of the track modulation is modulated in conformity with the position information signal.

Fig. 4 shows an example of a suitable position-information signal comprising position-code signals 32 which alternate with position-synchronisation signals 31. Each position-code signal 32 may comprise a "biphase-mark" modulated signal having a length of 76 channel bits and representing a position-information code of 38 code bits. In the case of a "biphase-mark" modulated signal, each code bit is represented by two successive channel bits. A code bit of a first logic value, in the present example "0", is represented by two bits of the same logic value. The other logic value ("1") is represented by two channel bits of different logic value. Moreover, the logic value of the "biphase-mark" modulated signal changes after every pair of channel bits, so that the maximum number of successive bits of the same logic value is two at the most. The position synchronisation signals 31 are selected in such a way that they can be distinguished from the position code signals 32. This is achieved by selecting the maximum number of successive bits of the same logic value in the position-synchronisation signals 31 to be three.

As already stated, the position-information signal represents a position information code having a length of 38 bits. The 38-bit position-information code may comprise a time code which indicates the time needed to cover the distance from the beginning of the track to the position where the position information signal is situated at the nominal scanning velocity. Such a position information code may comprise, for example, a plurality of successive bytes, for example as used in recording EFM modulated information on CD audio and CD-ROM discs. Fig. 4b shows a position-information code similar to the absolute time code used in CD audio and CD-ROM and comprising a first portion 33 indicating the time in minutes, a second portion 34 indicating the time in seconds, a third portion 35 indicating a subcode frame number, and a fourth portion 36 comprising a plurality of parity bits for the purpose of error detection. Such a position-information code indicating the position in the servo track 24 is attractive if an EFM signal modulated in conformity with the CD audio or CD-ROM standard is to be recorded. In that case the absolute time codes present in the subcode - Q channel are of the same type as the position information code represented by the track modulation.

In the case of record carriers intended for recording EFM signals the control information indicating the type of information for which the record carrier is intended can be included simply in the table of contents (TOC) recorded in the lead in track 24a. For recording this control information one of the subcode channels may be used, suitably the Q channel. This Q channel comprises 98 bits recorded together with the other information in each EFM subcode frame. Fig. 5 illustrates the format of these 98 Q channel bits.

a 2-bit "S0/S1" group
a 4-bit "CONTROL" group
a 4-bit "ADR" group
an 8-bit "TNO" group
an 8-bit "POINT" group
an 8-bit "MIN" group
an 8-bit "SEC" group
an 8-bit "FRAME" group
an 8-bit "ZERO" group
an 8-bit "PMIN" group
an 8-bit "PSEC" group
an 8-bit "PFRAME" group
a 16-bit "CRC" group.The "S0/S1" group is used for synchronisation. The "CONTROL" group is used for control purposes. By means of a (hexadecimal) code "100" the groups "ADR" and "TNO" in the track portion 24a indicate that the relevant track portion forms part of the lead-in track 24a. The group "POINT" characterizes the type of information stored in the groups "MIN", "SEC", "FRAME", "ZERO", "PMIN", "PSEC", and "PFRAME". The group "CRC" is used for error detection. By means of a unique bit combination, for example "F0" (hexadecimal) is possible to indicate that the bits in,for example, the group "PMIN" specify the type of information for which the relevant record carrier is intended.

The type of information for which the record carrier 2 is intended can also be indicated by means of the waveform of the disc-synchronisation signals 32 in the position information signal.

Figs. 6a, 6b and 6c represent three different position-synchronisation signals (and their inverse counterparts), thus enabling three different record carriers to be specified.

Another possibility is illustrated in Fig. 7, in which the number of bits used for error detection is reduced from 14 to 12, the two bits 70 and 71 which then become available being used for specifying the type of information. It will be evident that two or more of said methods may be combined to specify the type of information.

Fig. 8 shows an embodiment of the system in accordance with the invention, employing the disc-shaped record carrier 2 described above.

In the system shown in Fig. 8 elements corresponding to the elements shown in Fig. 1 bear the same reference numerals. The write head 10 comprises an optical section 10a which generates a radiation beam 80 which is focused to form a tiny scanning spot on the recording layer 26 in order to heat the magneto-optical recording layer 26 to approximately the Curie temperature. The write head 10 further comprises a magnetic section 10b comprising a coil for generating a magnetic field which is oriented perpendicularly to the recording layer 26 and which is modulated in conformity with the information to be recorded, in order to produce a pattern of magnetic domains corresponding to the information in this record carrier 26. The processing circuit 9 comprises three cascaded sections 9a, 9b, 9c. The section 9a comprises a standard "CIRC" circuit for re-arranging the bits of the bit sequence applied to the input 8 in conformity with the CD standard. The section 9b comprises a standard "EFM" modulation circuit for modulating the information supplied by the section 9a, subcode information supplied via a bus 89 being added to the re-arranged bit sequence obtained from the "CIRC" circuit 9a. The section 9c comprises a control circuit for controlling the write head 10a, 10b. The processing circuit 9 and the write head 10a, 10b are described comprehensively in Netherlands Patent Applications NL 8702451, NL 8700304 (PHN 12.294 and PHQ 87.044). The optical section 10a of the write head 10 comprises a radiation sensitive detector 81 for detecting the radiation beam 80 reflected from the recording layer 26. The reflected radiation beam is modulated by the track modulation, so that the radiation sensitive detector generates an electric signal modulated in conformity with the track modulation. This electric signal is applied to a demodulation circuit 82, which derives the position-code signals 32 and the synchronisation signals 31 from the electric signal. A signal which indicates that a synchronisation signal 31 has been detected is applied to a control circuit 85 to control a drive motor 84 for rotating the record carrier 2. Controlling is effected in such a way that a constant phase relationship is maintained between the subcode synchronsiation signals generated by the EFM modulator and the synchronisation signals detected by the detector. The demodulation circuit 82 and the control circuit 85 are described comprehensively in Netherlands Patent Application NL 8800152 (PHN 12.399). The position-code signals 32, which are recovered by the demodulation circuit 82, are applied to the microcomputer 11 via bus 86. These position-code signals 32 indicate the position of the servo track 24 being scanned by the radiation beam by means of an absolute time code which corresponds to the absolute time code to be recorded, together with the other information, in the Q channel of the EFM modulated signal. The microcomputer 11 is loaded with a program which ensures that the absolute time codes represented by the position-code signals 32 are applied to the EFM modulation circuit 9b. The manner in which this is effected is described in detail in the aforementioned Patent Application NL 8800152.

The output signal of the radiation-sensitive detector 81 is applied not only to the demodulation circuit 82 but also to a subcode demodulator 83 of a customary type to recover the subcode information recorded, for example, in the lead in track 24a.

The subcode information recovered by means of the subcode demodulation circuit 83 is applied to the microcomputer 11 via a bus 87. Further, a bus 90 connects the microcomputer 11 to the input stage 6 to supply the absolute time code included in the header of the CD-ROM data blocks. Fig. 9 by way of illustration gives the format of a CD-ROM data block. The CD-ROM data block is divided into bytes of 8 bits each. The first 12 bytes of the block comprise 12 synchronisation bytes. These are followed by 4 bytes, of which the first three bytes represent the address of the block in the form of the absolute time code, the last byte (MODE) indicating how the user data (USER-DATA) are arranged within the block. For MODE 1 the four address bytes are followed by 2048 bytes of user data (USER-DATA), followed by 288 bytes (EDC & ECC) transmitted for the purpose of error detection and error correction. The input stage 6 arranges the incoming user data in conformity with the prescribed CD-ROM format. Such an input stage 6 may comprise, for example, a programmable circuit of a type customary for processing the incoming user data and absolute time codes.

The system shown in Fig. 8 operates as follows. After a new record carrier 2 has been loaded into the recording apparatus the lead-in track 24a is

scanned in customary manner by the radiation beam 80, the microcomputer 11 receiving the subcode information derived by means of the subcode modulator 83. The microcomputer 11 is loaded with a program which selects from the incoming subcode information the control information indicating the type of information for which the relevant record carrier 2 is intended. Fig. 10 gives a flow chart of such a program. In step S100 the subcode frame is read in, after which in step S101 it is ascertained whether the "POINT" group corresponds to "FO" (hexadecimal). If they do not correspond, step 101 is again followed by step S100, in which a subsequent subcode frame is read in. If they correspond the content of the "PMIN" group is stored in the microcomputer memory. As soon as a write instruction is given, it is ascertained whether selection of the selected input stage is allowed for the stored "PMIN" group. If this is not allowed, the write instruction is not started and if it is allowed the write instruction is carried out, the microcomputer 11 setting the intensity of the write beam 80 to the desired high write level. Moreover, the control signal for the magnetic section 10b of the head 10 is applied to the head 10 via a gate 88 which is controlled by the microcomputer, and the detected input stage, the "CIRC" circuit 9a, and the EFM modulator 96 are activated. Moreover, the microcomputer 11 applies the absolute time code derived from the track modulation to the EFM modulator 9b. If recording is not started the said operations are not carried out, so that information recording is not possible. As already described, the type of information for which the record carrier 2 is intended can also be indicated by means of the waveform of the synchronising signals 31, as is shown in Fig. 6.

Fig. 11 shows an example of the demodulation circuit 82 with which the various synchronisation signals can be detected. The demodulation circuit 82 comprises a band-pass filter 110 which transmits those signal components in the output signal of the radiation-sensitive detector 81 which are produced by the FM track modulation.

The demodulation circuit 82 further comprises an FM demodulator 111, which recovers the position-information signal from the output signal of the filter 110. A channel clock regeneration circuit 112 regenerates the channel clock from the recovered position-information signal. The position information signal is further applied to a comparator circuit 113, which converts the position-information signal into a binary signal, which is applied to an 8-bit shift register 114, which is controlled by the channel clock. The parallel outputs of the shift register 83 are fed to a synchronisation-signal detector 115, 116 and 117 to detect whether the bit pattern in the shift register corresponds to the position synchronisation signals shown in Figs. 6a, 6b and 6c respectively. The serial output of the shift register 114 is connected to a "biphase-mark" demodulator 118 for recovering the code bits of the position-information code represented by the "biphase-mark" modulated position-code signal. The recovered code bits are applied to a shift register 119 which has a length corresponding to the number of bits (38) of the position-code signal and which is clocked at half the channel-clock frequency.

The shift register 119 comprises a first section 119a having a length of 14 bits, followed by a second section 119b having a length of 24 bits.

The parallel outputs of the second register section 119b are, applied to a parallel in parallel out register 121.

The position-information code is recovered as follows: as soon as one of the synchronisation-signal detectors 115, 116 and 117 detects that a bit pattern corresponding to a position-synchronisation signal is present in the shift register 114, a detection pulse is generated and applied to a pulse-delay circuit 123 via an OR gate 122. The circuit 123 delays the detection pulse by a specific time corresponding to the processing time of the "biphase-mark" modulator, so that at the instant at which the detection pulse appears on the output of the delay circuit 123 the entire absolute time code is present in the second section 119b of the shift register 119. The delayed detection pulse on the output of the circuit 90 is also applied to the load input of the register 121, so that the 24 bits representing the position information code are loaded into the register 121 in response to the delayed detection pulse. The position information code loaded into the register 121 becomes available on the outputs of the register 121, which are coupled to the microcomputer 11 via the bus 86. The outputs of the synchronisation-signal detectors 115, 116 and 117 can be connected to inputs of the microcomputer 11 via signal lines 124, 125 and 126, so that the microcomputer 11 can detect from the signals on the signal line 124, 125 and 126 for which type of information the record carrier is intended.

The circuit shown in Fig. 11 can be adapted very simply in such a way that the indication of the type of information shown in Fig. 7 can be detected by means of the bits 70 and 71 in the position-code signals.For this purpose the outputs 127 and 128 of the shift register 119, which indicate the logic values of the bits 70 and 71, must be connected to a two-bit parallel-in parallel-out register 129 (see Fig. 12) via the delay circuit 123. The output signals of the register 129 may again be applied to the computer 11 in order to determine the type of information which may be recorded on the record carrier 2. These two last-mentioned

methods of indicating the permissible type of information, the information being derived from the track modulation of the portion 24b of the servo track 24 intended for recording, have the advantage that this information is always available, regardless of the position of the write head 10 relative to the record carrier.

All three embodiments in which the control information about the permissible type of information is recorded in the servo track 24 (lead in track 24a or the portion 24b) have the advantage that for the detection of this type of information they employ almost exclusively components already present in the write apparatus for other purposes. Further, it is to be noted that in principle the record carrier may be provided with the control information in numerous other ways, on condition that appropriate detection equipment for detecting this information is provided.

Moreover, it is to be noted that the various methods of providing control information to indicate the type of information to be recorded can be used separately or in combination. However, it is advantageous to store the control information about the permissible type of information in a number of different ways, for example in the lead-in track and also in the servo track portion intended for recording. Such a multiple storage of the control information renders the system even more violation-proof.

Claims

1. A recording system for recording information, comprising a record carrier (2) of an inscribable type and a recording apparatus(1) comprising write means (10)for recording applied information on the record carrier (2), in which the record carrier is preconditioned, with a control-informtion pattern indicating for which type(s) of information the relevant record carrier is intended, and the recording apparatus (1) comprise means (12;91,92)for reading the control information presented by the control-information pattern means for generating an indication signal indicative for the type of information to be recorded and control means (11) for controlling the recording process in such a way that the applied information is recorded only if the control information being read corresponds to the indication signal, characterized in that the record carrier is provided with a preformed or prerecorded servo track (24b), the control-information pattern taking the form of a preformed or prerecorded track modulation of the servo track in servo track parts intended for recording information, in that the recording apparatus comprises means (10a) for scanning the servo track (24b), and in that the read means (81,82)include means for detecting the track modulation during scanning and for deriving the control information from the detected track modulation.

2. A system as claimed in Claim 1, characterized in that the recording apparatus comprises at least one input stage (4,5,6)for receiving the information to be recorded, and in that the means for generating the indication signal are adapted to derive the indication signal on the basis of the type of input stage (4,5,6) used.

3. A system as claimed in Claim 2, characterized in that the recording apparatus comprises at least two input stages (4,5,6) for receiving the information of two different types, and selection means (13) for selecting one of the input stages(4,5,6), and in that the control means (11) are adapted to detect the type of the information to be recorded on the basis of the selected input state (4,5,6).

4. A system as claimed in Claim 1 to 3, characterized in that the record carrier is of an erasable type, the preconditioning control-information pattern being of a non-erasable type.

5. A system as claimed in Claim 1, characterized in that the control information pattern is also accommodated in a of the servo-track portion (24a) not being the servo-track portion intended for recording the aplied information.

6. A system as claimed in Claim 1, characterized in that the recording apparatus comprises an optical scanning device (10a) for scanning the servo track (24) with a radiation beam for the purpose of recording, the read means including a radiation-sensitive detector (81) for detecting the radiation beam which is modulated by the track modulation during scanning.

7. A system as claimed in Claim 6, characterized in that the control information represented by the track modulation comprises a position-information signal which indicates the position of the relevant track portion relative to the beginning of the servo track (24), in that tile recording apparatus comprises conversion means (9a,9b) for converting the applied information, prior to recording, into a signal complying with the CD standard, the control means (11) being adapted to add subcode information to the information to be recorded, depending on the position information being read, the control means (11) being adapted to supply the subcode information exclusively if the the indica-

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methods of indicating the permissible type of information, the information being derived from the track modulation of the portion 24b of the servo track 24 intended for recording, have the advantage that this information is always available, regardless of the position of the write head 10 relative to the record carrier.

All three embodiments in which the control information about the permissible type of information is recorded in the servo track 24 (lead in track 24a or the portion 24b) have the advantage that for the detection of this type of information they employ almost exclusively components already present in the write apparatus for other purposes. Further, it is to be noted that in principle the record carrier may be provided with the control information in numerous other ways, on condition that appropriate detection equipment for detecting this information is provided.

Moreover, it is to be noted that the various methods of providing control information to indicate the type of information to be recorded can be used separately or in combination. However, it is advantageous to store the control information about the permissible type of information in a number of different ways, for example in the lead-in track and also in the servo track portion intended for recording. Such a multiple storage of the control information renders the system even more violation-proof.

Claims

1. A recording system for recording information, comprising a record carrier (2) of an inscribable type and a recording apparatus(1) comprising write means (10)for recording applied information on the record carrier (2), in which the record carrier is preconditioned, with a control-informtion pattern indicating for which type(s) of information the relevant record carrier is intended, and the recording apparatus (1) comprise means (12;91,92)for reading the control information presented by the control-information pattern means for generating an indication signal indicative for the type of information to be recorded and control means (11) for controlling the recording process in such a way that the applied information is recorded only if the control information being read corresponds to the indication signal, characterized in that the record carrier is provided with a preformed or prerecorded servo track (24b), the control-information pattern taking the form of a preformed or prerecorded track modulation of the servo track in servo track parts intended for recording information, in that the recording apparatus comprises means (10a) for scanning the servo track (24b), and in that the read means (81,82)include means for detecting the track modulation during scanning and for deriving the control information from the detected track modulation.

2. A system as claimed in Claim 1, characterized in that the recording apparatus comprises at least one input stage (4,5,6)for receiving the information to be recorded, and in that the means for generating the indication signal are adapted to derive the indication signal on the basis of the type of input stage (4,5,6) used.

3. A system as claimed in Claim 2, characterized in that the recording apparatus comprises at least two input stages (4,5,6) for receiving the information of two different types, and selection means (13) for selecting one of the input stages(4,5,6), and in that the control means (11) are adapted to detect the type of the information to be recorded on the basis of the selected input state (4,5,6).

4. A system as claimed in Claim 1 to 3, characterized in that the record carrier is of an erasable type, the preconditioning control-information pattern being of a non-erasable type.

5. A system as claimed in Claim 1, characterized in that the control information pattern is also accommodated in a of the servo-track portion (24a) not being the servo-track portion intended for recording the aplied information.

6. A system as claimed in Claim 1, characterized in that the recording apparatus comprises an optical scanning device (10a) for scanning the servo track (24) with a radiation beam for the purpose of recording, the read means including a radiation-sensitive detector (81) for detecting the radiation beam which is modulated by the track modulation during scanning.

7. A system as claimed in Claim 6, characterized in that the control information represented by the track modulation comprises a position-information signal which indicates the position of the relevant track portion relative to the beginning of the servo track (24), in that tile recording apparatus comprises conversion means (9a,9b) for converting the applied information, prior to recording, into a signal complying with the CD standard, the control means (11) being adapted to add subcode information to the information to be recorded, depending on the position information being read, the control means (11) being adapted to supply the subcode information exclusively if the the indica-

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tion signal corresponds to one of the types of information to be recorded indicated by the control information being read.

8. A system as claimed in Claim 6 or 7, characterized in that the control information represented by the track modulation comprises position-information signals (32) and synchronisation signals (31), which synchronisation signals (31) can be distinguished from the position-information signals (32), the type of synchronisation signal (31) indicating the permissible type(s) of information for the relevant record carrier (2).

9. A system as claimed in Claim 8, characterized in that the position information signal (32) is "biphase-mark" modulated, the synchronisation signals (31) having a signal waveform which differs from a "biphase-mark" modulation.

10. A system as claimed in Claim 8 or 9, characterized in that the track modulation is a radial track undulation whose frequency is modulated in conformity with the control signal.

11. A system as claimed in Claim 1, 5 and any one of the Claims 6 to 10, characterized in that the servo track comprises a lead-in portion (24a)in which an information signal in conformity with the CD standard is recorded as a preformed information pattern, said control information being included in the subcode-Q channel.

12. A record carrier comprising all technical record carrier features as defined in the system as claimed in any one of the preceding Claims.

13. A recording apparatus comprising all technical recording apparatus featured as defined in the system as claimed in any one of the Claims 1 to 11.

Patentansprüche

1. Aufzeichnungssystem zum Aufzeichnen von Information, mit einem Aufzeichnungsträger (2) eines beschreibbaren Typs und einem Aufzeichnungsgerät (1) mit Schreibmitteln (10) zum Aufzeichnen von zugeführter Information auf dem Aufzeichnungsträger (2), bei dem der Aufzeichnungsträger mit einem Steuerinformationsmuster vorkonditioniert ist, das angibt, für welche Art(en) von Information der betreffende Aufzeichnungsträger bestimmt ist, und das Aufzeichnungsgerät (1) Mittel (12; 81,82) zum Lesen der von dem Steuerinformationsmuster repräsentierten Steuerinformation umfaßt, um ein Anzeigesignal zu erzeugen, das die aufzuzeichnende Art der Information anzeigt und Steuerungsmittel (11) zur Steuerung des Aufzeichnungsprozesses in der Weise, daß die zugeführte Information nur dann aufgezeichnet wird, wenn die gelesene Steuerinformation mit dem Anzeigesignal übereinstimmt, dadurch gekennzeichnet, daß der Aufzeichnungsträger mit einer vorgeformten oder zuvor beschriebenen Servospur (24b) versehen ist, wobei das Steuerinformationsmuster in zum Aufzeichnen bestimmten Servospurteilen die Form einer vorgeformten oder voraufgezeichneten Spurmodulation der Servospur hat, daß das Aufzeichnungsgerät Mittel (100) zum Abtasten der Servospur (24b) umfaßt und daß die Lesemittel (81,82) Mittel zum Detektieren der Spurmodulation beim Abtasten und zum Ableiten der Steuerinformation aus der detektierten Spurmodulation umfassen.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß das Aufzeichnungsgerät mindestens eine Eingangsstufe (4, 5, 6) zum Empfangen der aufzuzeichnenden Information umfaßt und daß die Mittel zum Erzeugen des Anzeigesignals für das Ableiten des Anzeigesignals auf Basis der Art der verwendeten Eingangsstufe (4,5, 6) eingerichtet sind.

3. System nach Anspruch 2, dadurch gekennzeichnet, daß das Aufzeichnungsgerät mindestens zwei Eingangsstufen (4,5,6) zum Empfangen der Information zweier unterschiedlicher Arten und Selektionsmittel (13) zum Selektieren einer der Eingangsstufen (4,5,6) umfaßt und daß die Steuerungsmittel (11) zum Detektieren der Art der aufzuzeichnenden Information auf Basis der selektierten Eingangsstufe (4, 5, 6) eingerichtet sind.

4. System nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß der Aufzeichnungsträger von einem löschbaren Typ ist, wobei das vorkonditionierende Steuerinformationsmuster von einem nicht-löschbaren Typ ist.

5. System nach Anspruch 1, dadurch gekennzeichnet, daß das Steuerinformationsmuster auch in einem Teil des Servospurabschnitts (24a) untergebracht ist, der nicht der für das Aufzeichnen der zugeführten Information bestimmte Servospurabschnitt ist.

6. System nach Anspruch 1, dadurch gekennzeichnet, daß das Aufzeichnungsgerät eine op-

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tische Abtasteinrichtung (10a) umfaßt, um zum Aufzeichnen die Servospur (24) mit einem Strahlungsbündel abzutasten, wobei die Lesemittel einen strahlungsempfindlichen Detektor (81) zum Detektieren des von der Spurmodulation beim Abtasten modulierten Strahlungsbündels enthalten.

7. System nach Anspruch 6, dadurch gekennzeichnet, daß die von der Spurmodulation repräsentierte Steuerinformation ein Positionsinformationssignal umfaßt, das die Position des betreffenden Spurabschnitts relativ zum Anfang der Servospur (24) anzeigt, daß das Aufzeichnungsgerät Umsetzungsmittel (9a, 9b) zum Umsetzen der zugeführten Information, vor dem Aufzeichnen, in ein dem CD-Standard entsprechendes Signal umfaßt, wobei die Steuerungsmittel (11) eingerichtet sind, abhängig von der gelesenen Positionsinformation zu der aufzuzeichnenden Information Subcodeinformation hinzuzufügen, und die Steuerungsmittel (11) eingerichtet sind, Subcodeinformation nur zu liefern, wenn das Anzeigesignal mit einer der Arten aufzuzeichnender Information übereinstimmt, die von der gelesenen Steuerinformation angegeben werden.

8. System nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß die von der Spurmodulation repräsentierte Steuerinformation Positionsinformationssignale (32) und Synchronisationssignale (31) umfaßt, wobei die Synchronisationssignale (31) von den Positionsinformationssignalen (32) unterscheidbar sind und die Art des Synchronisationssignals (31) die für den betreffenden Aufzeichnungsträger (2) zulässige(n) Art(en) von Information anzeigt.

9. System nach Anspruch 8, dadurch gekennzeichnet, daß das Positionsinformationssignal "biphase-mark"-moduliert ist, wobei die Synchronisationssignale (31) eine von einer "Biphase-Mark"-Modulation abweichende Signalform haben.

10. System nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die Spurmodulation eine radiale Spurschlingerung ist, deren Frequenz dem Steuersignal entsprechend moduliert worden ist.

11. System nach Anspruch 1,5 oder einem der Ansprüche 6 bis 10, dadurch gekennzeichnet, daß die Servospur einen Anlaufabschnitt (24a) umfaßt, in dem ein Informationssignal nach dem CD-Standard als vorgeformtes Informationsmuster aufgezeichnet ist, wobei die genannte Steuerinformation in dem Subcode-Q-Kanal enthalten ist.

12. Aufzeichnungsträger mit allen technischen AufzeichnungsträgerMerkmalen, wie sie in dem System nach einem der vorhergehenden Ansprüche definiert worden sind.

13. Aufzeichnungsgerät mit allen technischen Aufzeichnungsgerät-Merkmalen, wie sie in dem System nach einem der Ansprüche 1 bis 11 definiert worden sind.

Revendications

1. Système d'enregistrement d'information comportant un support d'enregistrement (2) de type enregistrable et un appareil d'enregistrement (1) comportant des moyens d'écriture (10) pour enregistrer de l'information reçue sur le support d'enregistrement (2), système dans lequel le support d'enregistrement est conditionné préalablement par une configuration d'information de commande indiquant le(s) type(s) d'information au(x)quel(s) est destiné le support d'enregistrement concerné et dans lequel l'appareil d'enregistrement (1) comporte des moyens (12; 81,82) de lecture de l'information de commande présentée par les configurations d'information de commande pour engendrer un signal d'indication indicatif du type d'information devant être engendré, et des moyens de commande (11) pour commander le processus d'enregistrement de façon que l'information appliquée ne soit enregistrée que si l'information de commande lue correspond au signal d'indication, caractérisé en ce que le support d'enregistrement est pourvu d'une servopiste préalablement formée ou enregistrée (246), la configuration d'information de commande étant formée d'une modulation de piste préalablement formée ou enregistrée de la servopiste, dans des parties de servopiste conçues pour l'enregistrement d'information, en ce que l'appareil comporte des moyens (10a) pour explorer la servopiste (246) et en ce que les moyens de lecture (81,82) comportent des moyens pour détecter la modulation de piste au cours de l'exploration et pour déduire l'information de commande de la modulation de piste détectée.

2. Système selon la revendication 1, caractérisé en ce que l'appareil d'enregistrement comporte au moins deux étages d'entrée (4, 5, 6) pour recevoir l'information devant être enregistrée et en ce que les moyens pour engendrer le signal d'indication sont agencés pour déduire le

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signal d'indication selon le type d'étage d'entrée (4,5,6) utilisé.

3. Système selon la revendication 2, caractérisé en ce que l'appareil d'enregistrement comporte au moins deux étages d'entrée (4,5,6) pour recevoir l'information de deux types différents et des moyens de sélection (13) pour choisir l'un des étages d'entrée (4,5,6), et en ce que les moyens de commande (11) sont agencés pour détecter, selon l'étage d'entrée choisi (4,5,6), le type de l'information devant être enregistrée.

4. Système selon la revendication 1 à 3, caractérisé en ce que le support d'enregistrement est de type effaçable, la configuration d'information de commande de conditionnement préalable étant de type non effaçable.

5. Système selon la revendication 1, caractérisé en ce que la configuration d'information de commande est également prévue dans une partie (24a) de la servopiste qui ne constitue pas la partie de la servopiste destinée à l'enregistrement de l'information présentée.

6. Système selon la revendication 1, caractérisé en ce que l'appareil d'enregistrement comporte un dispositif d'exploration optique (10a) pour explorer la servopiste (24) par un faisceau de rayonnement aux fins de l'enregistrement, les moyens de lecture comportant un détecteur photosensible (81) pour détecter le faisceau de rayonnement modulé, au cours de l'exploration, par la modulation de piste.

7. Système selon la revendication 6, caractérisé en ce que l'information de commande représentée par la modulation de piste comporte un signal d'information de position indiquant la position de la partie de piste concernée par rapport au début de la servopiste (24), en ce que l'appareil d'enregistrement comporte des moyens de conversion (9a, 9b) pour convertir, avant l'enregistrement, l'information reçue en un signal satisfaisant à la norme CD, les moyens de commande (4) étant agencés pour ajouter, selon l'information de position lue, de l'information de sous-code à l'information devant être enregistrée, les moyens de commande (4) étant agencés pour ne fournir l'information de sous-code que si le signal d'indication correspond à l'un des types d'information à enregistrer indiqués par l'information de commande lue.

8. Système selon la revendication 6 ou 7, caractérisé en ce que l'information de commande représentée par la modulation de piste comporte des signaux d'information de position (32) et des signaux de synchronisation (31) , les signaux de synchronisation (31) pouvant être distingués d'entre les signaux d'information de position (32) et le type de signal de synchronisation (31) indiquant le(s) type(s) admissible(s) d'information pour le support d'enregistrement concerné (2).

9. Système selon la revendication 8, caractérisé en ce que le signal d'information de position (32) est modulé à "marques biphasées", les signaux de synchronisation (31) ayant une forme d'onde de signal qui diffère de la modulation à "marques biphasées".

10. Système selon la revendication 8 ou 9, caractérisé en ce que la modulation de piste est une ondulation de piste radiale dont la fréquence est modulée en correspondance avec le signal de commande.

11. Système selon les revendications 1, 5 et l'une quelconque des revendications 6 à 10, caractérisé en ce que la servopiste comporte une partie de départ (24a) dans laquelle un signal d'information selon la norme CD est enregistré sous la forme d'une configuration d'information préalablement formée, ladite information de commande étant insérée dans le canal Q de sous-code.

12. Support d'enregistrement comportant toutes les particularités techniques de support d'enregistrement telles que définies dans l'une quelconque des revendications précédentes.

13. Appareil d'enregistrement comportant toutes les particularités techniques d'appareil d'enregistrement telles que définies dans l'une quelconque des revendications 1 à 11.