Description

The present invention relates generally to magnetic recording and/or reproducing apparatus, and more particularly to an apparatus for recording digital data obtained based on an information signal on a magnetic tape by means of a rotary magnetic head device moving to scan the magnetic tape, for reproducing digital data obtained based on an information signal from a magnetic tape, on which the digital data are recorded, by means of a rotary magnetic head device moving to scan the magnetic tape, or for recording digital data obtained based on an information signal on a magnetic tape and reproducing the digital data recorded on the magnetic tape by means of a rotary magnetic head device moving to scan the magnetic tape.

In the field of a video tape recorder (referred to a VTR, hereinafter) used for recording an information signal, such as a color video signal, on a magnetic tape or for reproducing an information signal from a magnetic tape on which the information signal is recorded, there has been proposed to digitalize various signal processing circuits employed in the VTR for the purpose of improving reliability in operation, reducing power consumption, and miniaturizing and lightening the whole body, and a so-called digital VTR, in which an information signal such as a color video signal is converted to digital data to be recorded on a magnetic tape and the digital data obtained base on the information signal are reproduced from the magnetic tape to be converted to a reproduced information signal, has been put to practical use.

In the case of recording and/or reproducing the color video signal by means of the digital VTR, several recording and/or reproducing operation modes are selectively taken as the need arises. For example, when the color video signal subjected to the recording and/or reproduction is a color televising signal according to the NTSC system, PAL system or SECAM system in usual, a LP operation mode in which the color video signal is converted to digital data having the transmission rate of, for example, 15Mb/s to be recorded on the magnetic tape and the digital data having the transmission rate of 15Mb/s obtained based on the color video signal and recorded on the magnetic tape are reproduced from the magnetic tape, and a SP operation mode in which the color video signal is converted to digital data having the transmission rate of, for example, 30Mb/s to be recorded on the magnetic tape and the digital data having the transmission rate of 30Mb/s obtained based on the color video signal and recorded on the magnetic tape are reproduced from the magnetic tape, are selectively taken respectively for achieving a long-playing record on the magnetic tape and for obtaining high quality reproduced pictures based on the reproduced digital data. Further, when a color television signal according to the high definition television system (HDTV system) in which a signal frequency band is extended by a large margin and a horizontal frequency is raised by a large margin in comparison with the color television signal according to the NTSC system is subjected to the recording and/or reproduction, a HD operation mode in which the color video signal is converted to digital data having the transmission rate of, for example, 60Mb/s in view of the extended signal frequency band thereof to be recorded on the magnetic tape and the digital data having the transmission rate of 60Mb/s obtained based on the color video signal and recorded on the magnetic tape are reproduced from the magnetic tape, is taken.

It would be a great convenience to use a VTR in which the LP operation mode, SP operation mode and HD operation mode can be selected appropriately for recording digital date obtained from a color video signal on a magnetic tape and reproducing the digital data from the magnetic tape. However, it seems that such a VTR in which the LP operation mode, SP operation mode and HD operation mode can be selected appropriately has not been proposed previously.

In the case where it is considered to modify a VTR having a pair of rotary magnetic heads disposed at angular intervals of 180 degrees therebetween for scanning alternately a magnetic tape to form oblique record tracks thereon, which has come into wide use at present, so as to be operative to work in each of the LP, SP and HD operation modes selected as occasion demands, the modified VTR is required to be provided with a head driving mechanism for rotating the magnetic rotary heads at each of different three speeds corresponding respectively to the transmission rates of the digital data treated in the LP, SP and HD operation modes, which includes a high speed rotation device for rotating the rotary magnetic heads at an extremely high speed when the HD operation mode is taken, a tape guide mechanism for guiding the magnetic tape along each of different three running paths which are to be made respectively in the LP,SP and HD operation modes, and three digital data processing circuit arrangements for dealing with the digital data in the LP, SP and HD operation modes, respectively. This results in a disadvantage that the modified VTR is very complicated in its construction. Further, in such a modified VTR as mentioned above, it is considerably difficult to keep each of various mechanisms operating with sufficient reliability and the production cost is undesirably increased due to the high speed rotating device.

EP-A-0 241 227 discloses a video recording and reproduction apparatus suitable for recording and reproducing both NTSC and MUSE video signals and using time-expansion and distribution over two channels of scanning lines to achieve this.

EP-A-0,226,796 discloses a half-wrap helical scan digital video recorder in which a high band width

signal is recorded using the same tape and head speed but additional heads of different azimuth angle.

Accordingly, it is an object of the present invention to provide a magnetic recording and/or reproducing apparatus for recording digital data obtained based on an information signal on a magnetic tape, for reproducing digital data obtained based on an information signal from a magnetic tape and reproducing the digital data from the magnetic tape, which avoids the aforementioned disadvantages and problems encountered with the prior art.

Another object of the present invention is to provide a magnetic recording apparatus for recording digital data obtained based on an information signal on a magnetic tape by means of a rotary magnetic head device, which is operative to work in each of the LP, SP and HD operation modes selected as occasion demands with a relatively simple configuration by which reliability in recording operation can be kept sufficient and obtained at a relatively low cost.

A further object of the present invention is to provide a magnetic reproducing apparatus for reproducing digital data obtained based on an information signal from a magnetic tape, on which the digital data are recorded, by means of a rotary magnetic head device, which is operative to work in each of the LP, SP and HD operation modes selected as occasion demands with a relatively simple configuration by which reliability in reproducing operation can be kept sufficient and obtained at a relatively low cost.

A still further object of the present invention is to provide a magnetic recording and reproducing apparatus for recording digital data obtained based on an information signal on a magnetic tape and reproducing the digital data from the magnetic tape by means of a rotary magnetic head device, which is operative to work in each of the LP, SP and HD operation modes selected as occasion demands with a relatively simple configuration by which reliability in recording or reproducing operation can be kept sufficient and obtained at a relatively low cost.

According to the present invention, there is provided a magnetic recording apparatus acccording to claim 1.

There is also provided, according to the present invention a magnetic reproducing apparatus in accordance with claim 9.

There is further provided, according to the present invention, a magnetic recording and reproducing apparatus comprising a recording and reproducing portion which corresponds to both of the recording portion of the magnetic recording apparatus and the reproducing portion of the magnetic reproducing apparatus mentioned above, and other structural components corresponding to main structural components other than the recording portion of the magnetic recording apparatus and main structural components other than the reproducing portion of the magnetic reproducing apparatus mentioned above.

In the magnetic recording apparatus constituted as described above in accordance with the present invention, the digital data selected from plural kinds of digital data which have the respective different transmission rates are obtained from the encoder. The digital data from the encoder are selectively converted in time base in the time base processor so that the modified digital data having the predetermined transmission rate are obtained, and the modified digital data are supplied to the recording modulator to produce the recording signal. Then, in the recording portion, the recording signal from the recording modulator is recorded in each of the oblique record tracks formed on the magnetic tape, which is transported by the tape driving device at the speed corresponding to the transmission rate of the digital data obtained from the encoder, by the rotary magnetic head device which is rotated by the head driver at the predetermined speed of rotation.

In the magnetic reproducing apparatus constituted as described above in accordance with the present invention, the recording signal is reproduced through the rotary magnetic head device, which is rotated by the head driver at the predetermined speed of rotation, from each of the oblique record tracks formed on the magnetic tape which is transported by the tape driving device at the selected one of the speeds satisfying the predetermined relation of ratio in the reproducing portion. The digital data are obtained based on the recording signal reproduced through the rotary magnetic head device in the reproduced demodulator, and subjected to the time base conversion in the time base processor so that the modified digital data having the predetermined transmission rate which is selected correspondingly to the selected speed of the magnetic tape are obtained. Then, the modified digital data are supplied to the decoder and the reproduced digital data representing the information signal are obtained from the decoder.

Further, in the magnetic reproducing and reproducing apparatus constituted as described above in accordance with the present invention, recording and reproducing operations are carried out similarly to the recording operation and the reproducing operation performed respectively in the magnetic recording apparatus and the magnetic reproducing apparatus as described above.

With the magnetic recording apparatus, magnetic reproducing apparatus, and magnetic recording and reproducing apparatus according to the present invention, when the recording operation for converting the information signal into one of plural kinds of digital data which have the respective transmission rates different from one another and recording the digital data corresponding to the information signal on the magnetic tape by the rotary magnetic head device

or the reproducing operation for obtaining the reproduced digital data through the rotary magnetic head device from the magnetic tape on which the digital data are recorded and reproducing the information signal based on the reproduced digital data is performed, the digital data recorded on the magnetic tape or the reproduced digital data obtained from the magnetic tape are caused to have the predetermined transmission rate, so that the rotary magnetic head device is not required to vary in its speed of rotation. Accordingly, the apparatus according to the present invention can be simplified in configuration and obtained at a relatively low cost with sufficient reliability in the recording or reproducing operation.

In particular, when a color video signal is selected to be the information signal, the apparatus according to the present invention can be operative to work in each of the LP, SP and HD operation modes selected as occasion demands with the relatively simple and cheap configuration which is not provided with a high speed rotating device and by which reliability in the recording or reproducing operation is kept sufficient.

The above, and other objects, features and advantages of the present invention will become apparent from the following detailed description which is to be read in conjunction with the accompanying drawings.

Fig. 1 is a schematic block diagram showing a recording and/or reproducing system including recording and reproducing sections which constitute an embodiment of magnetic recording apparatus, an embodiment of magnetic reproducing apparatus, and an embodiment of magnetic recording and reproducing apparatus each according to the present invention;

Figs. 2A to 2C are time charts used for explaining time base conversion of digital data in the recording and/or reproducing system shown in Fig. 1; and

Figs. 3A to 3C schematic illustrations showing track patterns formed on a magnetic tape by the recording and/or reproducing system shown in Fig. 1.

Fig. 1 shows a recording and/or reproducing system including recording and reproducing sections by which embodiments of magnetic recording apparatus, magnetic reproducing apparatus, and magnetic recording and reproducing apparatus according to the present invention are constituted.

Referring to Fig. 1, in the recording and/or reproducing system, a color video signal is subjected, as an information signal, to recording on a magnetic tape and reproduction from the magnetic tape in one of the LP, SP and HD operation modes, and a head cylinder SLD in which a pair of rotary magnetic heads Ha and Hb close to each other and another pair of rotary magnetic heads Hc and Hd close to each other are disposed to face each other with the center of the head cylinder SLD is provided in common to the recording and reproducing sections.

The pair of rotary magnetic heads Ha and Hb and the pair of rotary magnetic heads Hc and Hd are driven to rotate at a predetermined constant speed of rotation by a head driver 1. The rotary magnetic heads Ha and Hb are provided with respective different gap angles, and the rotary magnetic heads Hc and Hd are also provided with respective different gap angles.

A magnetic tape TP is wound on the head cylinder SLD with a wrapping angle of about 180 degrees under the guidance by guide pins GP and transported at a predetermined speed by a combination of a capstan 3 which is driven by a capstan driver 7 and a pinch roller 5 facing the capstan 3 with the magnetic tape TP between, so as to be scanned alternately by the pair of rotary magnetic heads Ha and Hb and the pair of rotary magnetic heads Hc and Hd.

A tape guide constituted by the outer surface of the head cylinder SLD and the guide pins GP, and a tape driving device constituted by the capstan 3, pinch roller 5 and capstan driver 7 are provided in common to the recording and reproducing sections. A mode designating signal generator 9 is further provided in common to the recording and reproducing sections.

The mode designating signal generator 9 is operative to supply the recording and reproducing sections with a first mode designating signal Ca for causing the recording and reproducing sections to take the LP operation mode, a second mode designating signal Cb for causing the recording and reproducing sections to take the SP operation mode, and a third mode designating signal Cc for causing the recording and reproducing sections to take the HD operation mode, selectively. The first, second and third mode designating signals Ca,Cb and Cc are selectively supplied also to the capstan driver 7 and the capstan driver 7 is operative to cause the magnetic tape TP to run at the predetermined speed which is one of three different speeds corresponding respectively to the first, second and third mode designating signals Ca, Cb and Cc.

In the recording section of the recording and reproducing system shown in Fig. 1, a color television signal S_N according to the NTSC system is applied to an input terminal 10a or a color television signal S_H according to the HD system is applied to an input terminal 10b. The color television signal S_N or S_H applied to the input terminal 10a or 10b is supplied through a switch 11 to an analog to digital (A-D) converter 13. The switch 11 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause a movable contact 11c to be connected to a fixed contact 11a when the first or second mode designating signal Ca or Cb is applied thereto and cause the movable contact 11c to be connected to a fixed contact 11b when the third mode

designating signal Cc is applied thereto. Accordingly, in the case where the first mode designating signal Ca is sent out from the mode designating signal generator 9 so that the LP operation mode is taken or the second mode designating signal Cb is sent out from the mode designating signal generator 9 so that the SP operation mode is taken, the color television signal S_N from the input terminal 10a is supplied through the switch 11 to the A-D converter 13, and in the case where the third mode designating signal Cc is sent out from the mode designating signal generator 9 so that the HD operation mode is taken, the color television signal S_H from the input terminal 10b is supplied through the switch 11 to the A-D converter 13.

The A-D converter 13 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to carry out an A-D converting operation in different manners respectively in the case where the first or second mode designating signal Ca or Cb is supplied thereto and in the case where the third mode designating signal Cc is supplied thereto. Consequently, in the LP or SP operation mode, the color television signal S_N is converted to digital data D_N with a first predetermined number of bits by the A-D converter 13, and in the HD operation mode, the color television signal S_H is converted to digital data D_H with a second predetermined number of bits, which is larger than the first predetermined number of bits, by the A-D converter 13.

The digital data D_N or D_H obtained from the A-D converter 13 are supplied to a bit reduction circuit 15. The bit reduction circuit 15 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the digital data D_N or D_H to be subjected to bit reduction in different manners corresponding respectively to the first, second and third mode designating signals Ca, Cb and Cc so as to convert the digital data D_N or D_H to digital data having one of transmission rates which correspond respectively to LP, SP and HD operation mode. With this bit reduction circuit 15, digital data Da having a first transmission rate which is relatively low is obtained based on the digital data D_N in the LP operation mode, digital data Db having a second transmission rate which is higher than the first transmission rate is obtained based on the digital data D_N in the SP operation mode, and digital data Dc having a third transmission rate which is higher than the second transmission rate is obtained based on the digital data D_H in the HD operation mode.

Each of the digital data Da, Db and Dc is supplied to an encoder 17. The encoder 17 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the digital data Da, Db or Dc to be subjected to encoding, in which processes for adding a parity code for error correction to the digital data Da, Db or Dc and for adding a synchronous signal code to the digital data Da, Db or Dc are included, in response to the first, second or third mode designating signal Ca, Cb or Cc, so as to produce encoded digital data. With this encoder 17, encoded digital data DA having a transmission rate of, for example, 15Mb/s are obtained based on the digital data Da in the LP operation mode, encoded digital data DB having a transmission rate of, for example, 30Mb/s are obtained based on the digital data Db in the SP operation mode, and encoded digital data DC having a transmission rate of, for example, 60Mb/s are obtained based on the digital data Dc in the HD operation mode. Accordingly, the encoded digital data DA, DB and DC formed respectively based on the digital data Da, Db and Dc to have the respective transmission rates which satisfy a relation of ratio represented with 1 : 2 : 4 are selectively derived from the encoder 17 in accordance with each of the LP, SP and HD operation modes.

The encoded digital data DA, DB or DC thus obtained from the encoder 17 are supplied to a time base processor 19. The time base processor 19 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the encoded digital data DA, DB or DC to be subjected to time base conversion so as to produce modified digital data having a predetermined transmission rate based on the encoded digital data DA, DB or DC. The time base conversion for each of the encoded digital data DA, DB and DC is carried out in such a manner as described below in conjunction with Figs. 2A to 2C.

In the case of the LP operation mode wherein the first mode designating signal Ca is sent out from the mode designating signal generator 9, as shown in Fig. 2A, successive data segments a1, a2, a3, a4, a5, - - - of the encoded digital data DA having the transmission rate of 15Mb/s, each of which is divided to be in a period of time of Th corresponding to one complete turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd, are converted in time base in such a manner that each of alternate data segments a1, a3, a5, - - - is compressed in time base to have a transmission rate of 30Mb/s and delayed by a period of time corresponding to 3Th/2 so as to form an arrangement of segmented digital data a1′, a3′, a5′, - - - appearing every 2Th, and each of another alternate data segments a2, a4, - - - is compressed in time base to have a transmission rate of 30Mb/s and delayed by a period of time corresponding to Th/2 so as to form an arrangement of segmented digital data a2′, a4′, - - - appearing every 2Th. The arrangement of segmented digital data a1′, a3′, a5′, - - - is derived from the time base processor 19 as first modified digital data D_1 having the transmission rate 30Mb/s, and the arrangement of segmented digital data a2′, a4′, - - - appearing simultaneously with the arrangement of segmented digital data a1′, a3′, a5′, - - - is also derived from the time base processor 19 as second modified

digital data D_2 having the transmission rate 30Mb/s.

In the case of the SP operation mode wherein the second mode designating signal Cb is sent out from the mode designating signal generator 9, as shown in Fig. 2B, successive data segments b1, b2, b3, b4, - - - b10, - - - of the encoded digital data DB having the transmission rate of 30Mb/s, each of which is divided to be in a period of time corresponding to Th/2, are converted in time base in such a manner that each of alternate data segments b1, b3, b5, - - - is delayed by a period of time corresponding to 3Th/2 so as to form an arrangement of segmented digital data b1′, b3′, b5′, - - - appearing every Th, and each of another alternate data segments b2, b4, - - - is remains to form an arrangement of segmented digital data b2′, b4′, - - - appearing every Th. The arrangement of segmented digital data b1′, b3′, b5′, - - - is derived from the time base processor 19 as first modified digital data D_1 having the transmission rate 30Mb/s, and the arrangement of segmented digital data b2′, b4′, - - - appearing simultaneously with the arrangement of segmented digital data b1′, b3′, b5′, - - - is also derived from the time base processor 19 as second modified digital data D_2 having the transmission rate 30Mb/s.

Further, in the case of the HD operation mode wherein the third mode designating signal Cc is sent out from the mode designating signal generator 9, as shown in Fig. 2C, successive data segments c1, c2, c3, c4, - - - c20, - - - of the encoded digital data DC having the transmission rate of 60Mb/s, each of which is divided to be in a period of time corresponding to Th/2, are converted in time base in such a manner that each of alternate data segments c1, c3, - - - is expanded in time base to have a transmission rate of 30Mb/s and delayed by a period of time corresponding to Th/2 so as to form an arrangement of segmented digital data c1′, c3′, - - - appearing continuously and each of another alternate data segments c2, c4, - - - is expanded in time base to have a transmission rate of 30Mb/s and delayed by a period of time corresponding to Th/4 so as to form an arrangement of segmented digital data c2′, c4′, - - - appearing continuously. The arrangement of segmented digital data c1′, c3′, - - - is derived from the time base processor 19 as first modified digital data D_1 having the transmission rate 30Mb/s, and the arrangement of segmented digital data c2′, c4′, - - - appearinght simultaneously with the arrangement of segmented digital data c1′, c3′, - - - is also derived from the time base processor 19 as second modified digital data D_2 having the transmission rate 30Mb/s.

The first and second modified digital data D_1 and D_2 which are derived from the time base processor 19 as described above in each of the LP, SP and HD operation modes are supplied to recording modulators 21 and 23, respectively, and modulated signal SD_1 and SD_2 are produced based on the first and second modified digital data D_1 and D_2 in the recording modulators 21 and 23. The modulated signals SD_1 and SD_2 are amplified by recording amplifiers 25 and 27, respectively, and then supplied, through an operation selecting switch 31 which is controlled, at that time, to have movable contacts connected to respective fixed contacts R in accordance with a switch control signal Cs applied to a terminal 33, to the rotary magnetic heads Ha and Hb as recording signals SDa and SDb, respectively, and to the rotary magnetic heads Hc and Hd as recording signals SDc and SDd, respectively.

On that occasion, the capstan driver 7 is supplied selectively with the first, second and third mode designating signals Ca, Cb and CC and operative to drive the capstan 3 so as to transport the magnetic tape TP at a predetermined speed of Vt in response to the first mode designating signal Ca in the LP operation mode, to transport the magnetic tape TP at a predetermined speed of 2Vt in response to the second mode designating signal Cb in the SP operation mode, to transport the magnetic tape TP at a predetermined speed of 4Vt in response to the third mode designating signal Cc in the HD operation mode. The predetermined speeds Vt, 2Vt and 4Vt satisfy the relation of rate represented with 1 : 2 : 4 in the same manner as the transmission rates of the encoded digital data DA, DB and DC obtained respectively in the LP, SP and HD operation modes.

Each of the rotary magnetic heads Ha, Hb, Hc and Hd is rotated at the predetermined constant speed with a rotational period of Th by the head driver 1 to scan the magnetic tape TP with a predetermined inclination for a period of time almost corresponding to Th/2 for forming oblique record tracks on the magnetic tape TP, in each of which the recording signals SDa, SDb, SDc and SDd are recorded. The recording of the recording signals SDa, SDb, SDc and SDd on the magnetic tape TP is carried out with the oblique record tracks formed as shown in Figs. 3A, 3B and 3C.

In the LP operation mode, each of the recording signals SDa and SDc corresponds to the first modified digital data D_1 as shown in Fig. 2A and each of the recording signals SDb and SDd corresponds to the second modified digital data D_2 as shown in Fig. 2A. Then, in every other scanning periods Tsa each corresponding substantially to Th/2, in which the rotary magnetic heads Ha and Hb close to each other scan the magnetic tape TP, portions of the recording signal SDa corresponding respectively to the segmented digital data a2′, a4′, - - - which forms the first modified digital data D_1 are supplied to the rotary magnetic head Ha and simultaneously portions of the recording signal SDb corresponding respectively to the segmented digital data a1′, a3′, - - - which forms the second modified digital data D_2 are supplied to the rotary magnetic head Hb.

Consequently, as shown in Fig. 3A, in one of the

scanning periods Tsa in which the rotary magnetic heads Ha and Hb scan the magnetic tape TP in the direction indicated with an arrow Rh, the portion of the recording signal SDa corresponding to the segmented digital data a2' forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data a1' forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_n and t_{n+1}. On that occasion, the portion of the recording signal SDc corresponding to the segmented digital data a2' forming the first modified digital data D_1 and the portion of the recording signal SDd corresponding to the segmented digital data a1' forming the second modified digital data D_2 are supplied to the rotary magnetic heads Hc and Hd. However, since the rotary magnetic heads Hc and Hd are positioned not to scan the magnetic tape TP, the recording by the rotary magnetic heads Hc and Hd is not carried out.

Then, in each of a scanning period Tsb succeeding to the scanning period Tsa and corresponding substantially to Th/2, in which the rotary magnetic heads Hc and Hd scan the magnetic tape TP in the direction indicated with the arrow Rh, and successive two scanning periods Tsa and Tsb coming after each of the rotary magnetic heads Ha and Hb has started next one turn, the recording signals SDc and SDd and the recording signals SDa and SDb have their empty portions, and therefore the oblique record track is not formed on the magnetic tape TP. Further, in the scanning period Tsa coming after each of the rotary magnetic heads Ha and Hb has started further next one turn, the portion of the recording signal SDa corresponding to the segmented digital data a4' forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data a3' forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_{n+2} and t_{n+3} in the same manner as the oblique record tracks t_n and t_{n+1}.

Under such a condition, the speed Vt at which the magnetic tape TP is transported is so selected that the magnetic tape TP is moved, in the direction indicated with an arrow Rt in Fig. 3A, by a distance Tt corresponding to a space between two successive oblique record tracks during each one turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd. Accordingly, the oblique record tracks t_{n+2} and t_{n+3} are positioned on the magnetic tape TP to be next to the oblique record tracks t_n and t_{n+1}.

After that, the portion of the recording signal SDa corresponding to the segmented digital data forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data forming the second modified digital data D_2 are recorded simultaneously on the magnetic tape TP to form oblique record tracks t_{n+4} and t_{n+5} and each two oblique record tracks succeeding thereto at every other turn of the rotary magnetic heads Ha and Hb.

Through such recording operation, the encoded digital data DA obtained from the encoder 17 to have the transmission rate of 15Mb/s are converted to the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and then recorded in the oblique record tracks on the magnetic tape TP.

In the SP operation mode, each of the recording signals SDa and SDc corresponds to the first modified digital data D_1 as shown in Fig. 2B and each of the recording signals SDb and SDd corresponds to the second modified digital data D_2 as shown in Fig. 2B. Then, in each scanning period Tsa in which the rotary magnetic heads Ha and Hb scan the magnetic tape TP, portions of the recording signal SDa corresponding respectively to the segmented digital data b2', b4', - - - which forms the first modified digital data D_1 are supplied to the rotary magnetic head Ha and simultaneously portions of the recording signal SDb corresponding respectively to the segmented digital data b1', b3', - - - which forms the second modified digital data D_2 are supplied to the rotary magnetic head Hb.

Consequently, as shown in Fig. 3B, in one of the scanning periods Tsa in which the rotary magnetic heads Ha and Hb scan the magnetic tape TP in the direction indicated with an arrow Rh, the portion of the recording signal SDa corresponding to the segmented digital data b2' forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data b1' forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_n and t_{n+1}. On that occasion, the portion of the recording signal SDc corresponding to the segmented digital data b2' forming the first modified digital data D_1 and the portion of the recording signal SDd corresponding to the segmented digital data b1' forming the second modified digital data D_2 are supplied to the rotary magnetic heads Hc and Hd. However, since the rotary magnetic heads Hc and Hd are positioned not to scan the magnetic tape TP, the recording by the rotary magnetic heads Hc and Hd is not carried out.

Then, in a scanning period Tsb succeeding to the scanning period Tsa and corresponding substantially to Th/2, in which the rotary magnetic heads Hc and Hd scan the magnetic tape TP in the direction indicated with the arrow Rh, the recording signals SDc and SDd have their empty portions and therefore the oblique record track is not formed on the magnetic tape TP. Further, in the scanning period Tsa coming after

each of the rotary magnetic heads Ha and Hb has started next one turn, the portion of the recording signal SDa corresponding to the segmented digital data b4′ forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data b3′ forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_{n+2} and t_{n+3} in the same manner as the oblique record tracks t_n and t_{n+1}.

Under such a condition, the magnetic tape TP is transported at the speed 2Vt and therefore moved in the direction indicated with an arrow Rt in Fig. 3B by a distance 2Tt corresponding to two times as long as a space between two successive oblique record tracks during each one turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd. Accordingly, the oblique record tracks t_{n+2} and t_{n+3} are positioned on the magnetic tape TP to be next to the oblique record tracks t_n and t_{n+1}.

After that, the portion of the recording signal SDa corresponding to the segmented digital data forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data forming the second modified digital data D_2 are recorded simultaneously on the magnetic tape TP to form oblique record tracks t_{n+4} and t_{n+5} and each two oblique record tracks succeeding thereto at every turn of the rotary magnetic heads Ha and Hb.

Through such recording operation, the encoded digital data DB obtained from the encoder 17 to have the transmission rate of 30Mb/s are converted to the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and then recorded in the oblique record tracks on the magnetic tape TP.

In the HD operation mode, each of the recording signals SDa and SDc corresponds to the first modified digital data D_1 as shown in Fig. 2C and each of the recording signals SDb and SDd corresponds to the second modified digital data D_2 as shown in Fig. 2C. Then, in each scanning period Tsa in which the rotary magnetic heads Ha and Hb scan the magnetic tape TP, portions of the recording signal SDa corresponding respectively to alternate ones of the segmented digital data c2′, c4′, c6′, c8′, - - - C18′, - - - which form the first modified digital data D_1, that is, the segmented digital data c2′, c6′, - - -, are supplied to the rotary magnetic head Ha and simultaneously portions of the recording signal SDb corresponding respectively to alternate ones of the segmented digital data c1′, c3′, c5′, c7′, - - - C17′, - - - which form the second modified digital data D_2, that is, the segmented digital data c1′, c5′, - - -, are supplied to the rotary magnetic head Hb. Further, in each scanning period Tsb in which the rotary magnetic heads Hc and Hd scan the magnetic tape TP, portions of the recording signal SDc corresponding respectively to another alternate ones of the segmented digital data c2′, c4′, c6′, c8′, - - - C18′, - - - which form the first modified digital data D_1, that is, the segmented digital data c4′, c8′, - - -, are supplied to the rotary magnetic head Hc and simultaneously portions of the recording signal SDd corresponding respectively to another alternate ones of the segmented digital data c1′, c3′, c5′, c7′, - - - C17′, - - - which form the second modified digital data D_2, that is, the segmented digital data c3′, c7′, - - -, are supplied to the rotary magnetic head Hd.

Consequently, as shown in Fig. 3C, in one of the scanning periods Tsa in which the rotary magnetic heads Ha and Hb scan the magnetic tape TP in the direction indicated with an arrow Rh, the portion of the recording signal SDa corresponding to the segmented digital data c2′ forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data c1′ forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_n and t_{n+1}. Next, in the scanning period Tsb succeeding to the scanning period Tsa, in which the rotary magnetic heads Hc and Hd scan the magnetic tape TP in the direction indicated with the arrow Rh, the portion of the recording signal SDc corresponding to the segmented digital data c4′ forming the first modified digital data D_1 and the portion of the recording signal SDd corresponding to the segmented digital data c3′ forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Hc and Hd on the magnetic tape TP to form oblique record tracks t_{n+2} and t_{n+3}.

Then, in the scanning period Tsa coming after each of the rotary magnetic heads Ha ,Hb, Hc and Hd has started next one turn, the portion of the recording signal SDa corresponding to the segmented digital data c6′ forming the first modified digital data D_1 and the portion of the recording signal SDb corresponding to the segmented digital data c5′ forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_{n+4} and t_{n+5} in the same manner as the oblique record tracks t_n and t_{n+1}. Further, in the scanning period Tsb succeeding to the scanning period Tsa during the next turn of each of the rotary magnetic heads Ha ,Hb, Hc and Hd, the portion of the recording signal SDc corresponding to the segmented digital data c8′ forming the first modified digital data D_1 and the portion of the recording signal SDd corresponding to the segmented digital data c7′ forming the second modified digital data D_2 are recorded simultaneously by the rotary magnetic heads Ha and Hb on the magnetic tape TP to form oblique record tracks t_{n+4} and t_{n+5}.

Under such a condition, the magnetic tape TP is transported at the speed 4Vt and therefore moved in

the direction indicated with an arrow Rt in Fig. 3C by a distance 4Tt corresponding to four times as long as a space between two successive oblique record tracks during each one turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd. Accordingly, the oblique record tracks t_n - - - t_{n+5} - - - are positioned on the magnetic tape TP to be arranged successively.

After that, the portion of the recording signal SDa corresponding to the segmented digital data forming the first modified digital data D_1, the portion of the recording signal SDb corresponding to the segmented digital data forming the second modified digital data D_2, the portion of the recording signal SDc corresponding to the segmented digital data forming the first modified digital data D_1, and the portion of the recording signal SDd corresponding to the segmented digital data forming the second modified digital data D_2 are recorded simultaneously on the magnetic tape TP to form four oblique record tracks at every turn of the rotary magnetic heads Ha, Hb, Hc and Hd.

Through such recording operation, the encoded digital data DC obtained from the encoder 17 to have the transmission rate of 60Mb/s are converted to the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and then recorded in the oblique record tracks on the magnetic tape TP.

In the reproducing section of the recording and reproducing system shown in Fig. 1, the recording signals SDa and SDb, or SDa, SDb, SDc and SDd which are recorded in the oblique record tracks t_n - - - t_{n+5} - - - formed on the magnetic tape TP as described above are reproduced by the rotary magnetic heads Ha and Hb or Ha, Hb, Hc and Hd and the color television signal S_N or S_H is reproduced based on the recording signals SDa and SDb or SDa, SDb, SDc and SDd obtained from the magnetic tape TP under the condition where the LP, SP or HD operation mode is taken.

In the reproduction of the recording signals SDa and SDb or SDa, SDb, SDc and SDd from the magnetic tape TP conducted by the rotary magnetic heads Ha and Hb or Ha, Hb, Hc and Hd, the capstan 3 is driven by the capstan driver 7 to which the first, second and third mode designating signals are selectively supplied from the mode designating signal generator 9, and the magnetic tape TP on which the recording signals SDa and SDb or SDa, SDb, SDc and SDd are recorded is transported by the capstan 3 at the speed Vt in the LP operation mode, at the speed 2Vt in the SP operation mode, and at the speed 4Vt in the HD operation mode. Further, each of the rotary magnetic heads Ha, Hb, Hc and Hd is rotated at the predetermined constant speed with a rotational period of Th by the head driver 1 to scan the oblique record tracks t_n - - - t_{n+5} - - - on the magnetic tape TP running at the speed Vt, 2Vt or 4Vt.

In more detail, in the case of the LP operation mode, each two successive oblique record tracks on the magnetic tape TP which runs at the speed Vt are scanned by the rotary magnetic heads Ha and Hb at every other turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd, and thereby the recording signals SDa and SDb are reproduced simultaneously for a period of time corresponding to Th/2 from each two successive oblique record tracks. The recording signals SDa and SDb thus reproduced are of contents corresponding respectively to the first and second modified digital data D_1 and D_2 shown in Fig. 2A.

In the case of the SP operation mode, each two successive oblique record tracks on the magnetic tape TP which runs at the speed 2Vt are scanned by the rotary magnetic heads Ha and Hb at every turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd, and thereby the recording signals SDa and SDb are reproduced simultaneously for a period of time corresponding to Th/2 from each two successive oblique record tracks. The recording signals SDa and SDb thus reproduced are of contents corresponding respectively to the first and second modified digital data D_1 and D_2 shown in Fig. 2B.

Further, in the case of the HD operation mode, two successive oblique record tracks on the magnetic tape TP which runs at the speed 4Vt are scanned simultaneously by the rotary magnetic heads Ha and Hb and then next two successive oblique record tracks on the magnetic tape TP running at the speed 4Vt are scanned simultaneously by the rotary magnetic heads Hc and Hd at every turn of each of the rotary magnetic heads Ha, Hb, Hc and Hd, and thereby each of the recording signals SDa, SDb, SDc and SDd are reproduced for a period of time corresponding to Th/2 from each four successive oblique record tracks. Each of the recording signals SDa and SDc reproduced through the rotary magnetic heads Ha and Hc respectively is of contents corresponding to the first modified digital data D_1 shown in Fig. 2C and each of the recording signals SDb and SDd reproduced through the rotary magnetic heads Hb and Hd respectively is of contents corresponding to the second modified digital data D_2 shown in Fig. 2C.

The recording signals SDa, SDb, SDc and SDd obtained from the rotary magnetic heads Ha, Hb, Hc and Hd respectively supplied through the operation selecting switch 31 which is controlled, at that time, to have the movable contacts connected to respective fixed contacts P in accordance with the switch control signal Cs applied to the terminal 33, to reproducing amplifiers 41, 43, 45 and 47, respectively. The recording signals SDa and SDc amplified by the reproducing amplifiers 41 and 43 respectively are supplied through an adder 49 to a reproduced signal detector 53 and the modulated signal SD_1 is detected by the reproduced signal detector 53. Similarly, the recording signals SDb and SDd amplified by the reproducing amplifiers 45 and 47 respectively are supplied

through an adder 51 to a reproduced signal detector 55 and the second modulated signal SD_2 is detected by the reproduced signal detector 55.

The modulated signal SD_1 obtained from the reproduced signal detector 53 is demodulated at a reproducing demodulator 57 to produce the first modified digital data D_1 and the modulated signal SD_2 obtained from the reproduced signal detector 55 is demodulated at a reproducing demodulator 59 to produce the second modified digital data D_2. The first and second modified digital data D_1 and D_2 are composed of the segmented digital data a2', a4', - - - having the transmission rate of 30Mb/s as shown in Fig. 2A and the segmented digital data a1', a3', - - - having the transmission rate of 30Mb/s as shown in Fig. 2A in the LP operation mode, of the segmented digital data b2', b4', - - - b10' - - - having the transmission rate of 30Mb/s as shown in Fig. 2B and the segmented digital data b1', b3', - - - b10' - - - having the transmission rate of 30Mb/s as shown in Fig. 2B in the SP operation mode, and of the segmented digital data c2', c4', b6' - - - c18' - - - having the transmission rate of 30Mb/s as shown in Fig. 2C and the segmented digital data c1', c3', c5', - - - c17' - - - having the transmission rate of 30Mb/s as shown in Fig. 2B in the HD operation mode, and supplied to a time base processor 61.

The time base processor 61 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the first and second modified digital data D_1 and D_2 to be subjected to time base conversion so as to produce the encoded digital data DA, DB or DC having the predetermined transmission rate. The time base conversion for the first and second modified digital data D_1 and D_2 is carried out in such a manner as described below.

In the case of the LP operation mode wherein the first mode designating signal Ca is sent out from the mode designating signal generator 9, each of the segmented digital data a1', a3', - - - having the transmission rate of 30Mb/s and constituting the second modified digital data D_2 is expanded in time base to have a transmission rate of 15Mb/s and each of the segmented digital data a2', a4', - - - having the transmission rate of 30Mb/s and constituting the modified digital data D_1 is expanded in time base to have the transmission rate of 15Mb/s and delayed by a period of time corresponding to Th, so that the encoded digital data DA having the transmission rate of 15Mb/s as shown in Fig. 2A are formed in the time base processor 61 and derived therefrom.

In the case of the SP operation mode wherein the second mode designating signal Cb is sent out from the mode designating signal generator 9, each of the segmented digital data b1', b3', - - - b9', - - - having the transmission rate of 30Mb/s and constituting the second modified digital data D_2 is taken out as it is and each of the segmented digital data b2', b4', - - - b10' having the transmission rate of 30Mb/s and constituting the first modified digital data D_1 is delayed by a period of time corresponding to Th/2, so that the encoded digital data DB having the transmission rate of 30Mb/s as shown in Fig. 2B are formed in the time base processor 61 and derived therefrom.

Further, in the case of the HD operation mode wherein the third mode designating signal Cc is sent out from the mode designating signal generator 9, each of the segmented digital data c1', c3', c5', - - - c17', - - - having the transmission rate of 30Mb/s and constituting the second modified digital data D_2 is compressed in time base to have a transmission rate of 60Mb/s and each of the segmented digital data c2', c4', c6', - - - c18', - - - having the transmission rate of 30Mb/s and constituting the first modified digital data D_1 is compressed in time base to have the transmission rate of 60Mb/s and delayed by a period of time corresponding to Th/4, so that the encoded digital data DC having the transmission rate of 60Mb/s as shown in Fig. 2C are formed in the time base processor 61 and derived therefrom.

The encoded digital data DA, DB or DC obtained from the time base processor 61 as described above are supplied to a decoder 63. The decoder 63 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the encoded digital data DA, DB or DC to be subjected to decoding in response to the first, second or third mode designating signal Ca, Cb or Cc, so as to produce decoded digital data. With this decoder 63, the digital data Da having the transmission rate of 15Mb/s are obtained based on the encoded digital data DA in the LP operation mode, the digital data Db having the transmission rate of 30Mb/s are obtained based on the encoded digital data DB in the SP operation mode, and the digital data Dc having the transmission rate of 60Mb/s are obtained based on the encoded digital data DC in the HD operation mode.

The digital data Da, Db or Dc obtained from the decoder 63 are supplied to a bit restoration circuit 65. The bit restoration circuit 65 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to cause the digital data Da, Db or Dc to be subjected to bit restoration in one of different manners corresponding respectively to the first, second and third mode designating signals Ca, Cb and Cc so as to convert the digital data Da, Db or Dc to the digital data D_N or D_H. With this bit restoration circuit 65, the digital data D_N is obtained based on the digital data Da in the LP operation mode, the digital data D_N is obtained based on the digital data Db in the SP operation mode, and the digital data D_H is obtained based on the digital data Dc in the HD operation mode. The digital data D_N or D_H obtained from the bit restoration circuit 65 is supplied to a digital to analog (D-A) converter 67.

The D-A converter 67 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to carry out a D-A converting operation in different manners respectively in the case where the digital data D_N is supplied thereto and in the case where the digital data D_H is supplied thereto. Consequently, in the LP or SP operation mode, the digital data D_N is converted to the color television signal S_N according to the NTSC system to be derived from an output terminal 69, and in the HD operation mode, the digital data D_H is converted to the color television signal S_H according to the HDTV system to be derived from the output terminal 69.

As described above, with the reproducing section of the recording and reproducing apparatus shown in Fig. 1, the color television signal S_N is reproduced based on the encoded digital data DA having the transmission rate of 15Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the LP operation mode, the color television signal S_N is reproduced based on the encoded digital data DB having the transmission rate of 30Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the SP operation mode, and the color television signal S_H is reproduced based on the encoded digital data DC having the transmission rate of 60Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the HD operation mode.

Claims

1. A magnetic recording apparatus comprising:

an input terminal (10a, 10b) to which, in use, an information signal is applied;

encoding means (13, 15, 17) for encoding the information signal supplied from the input terminal (10a, 10b) into a selected one of a plurality of digital data formats (DA, DB, DC) having different instantaneous transmission rates,

modulating means (21, 23) for producing recording signals in two channels,

recording means (25, 27, 31, Ha-Hb) including a rotary magnetic head device having a plurality of recording heads to which said recording signals are supplied and tape guiding means for guiding a magnetic tape on which said recording signals are to be recorded and operative to cause said rotary magnetic head device to contact with the magnetic tape; and

head driving means (1) for rotating said rotary magnetic head device at a predetermined speed of rotation; characterised by

tape driving means (3, 5, 7) for causing the magnetic tape to run at a selected one of a plurality of predetermined speeds according to the transmission rate of encoded digital data obtained from said encoding means (13, 15, 17); and

time base processing means (19) for receiving blocks of data from said encoding means (13, 15, 17), selectively compressing or expanding said received blocks into blocks of a predetermined size and a predetermined substantially constant instantaneous transmission rate, selectively delaying said blocks and directing them alternately between two output channels so that blocks corresponding to each of pairs of temporally adjacent received blocks are output to said modulating means simultaneously in the two channels.

2. A magnetic recording apparatus according to claim 1, wherein said different transmission rates satisfy a predetermined ratio.

3. A magnetic recording apparatus according to claim 1 or 2, wherein said different transmission rates correspond to different operation modes respectively.

4. A magnetic recording apparatus according to claim 1, 2 or 3 wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is wound with a predetermined wrapping angle and at least a pair of rotary magnetic heads (Ha-Hd) disposed to face each other across the centre of the head cylinder (SLD).

5. A magnetic recording apparatus according to claim 4, wherein said time base processing means (19) is operative to produce first and second modified digital data each having said predetermined transmission rate based on the encoded digital data obtained from said encoding means, and said modulating means (21, 23) is operative to produce first and second recording signals which correspond respectively to the first and second modified digital data and are supplied to said pair of rotary magnetic heads (Ha-Hd), respectively.

6. A magnetic recording apparatus according to any one of the preceding claims, wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is

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The D-A converter 67 is supplied selectively with the first, second and third mode designating signals Ca, Cb and Cc and operative to carry out a D-A converting operation in different manners respectively in the case where the digital data D_N is supplied thereto and in the case where the digital data D_H is supplied thereto. Consequently, in the LP or SP operation mode, the digital data D_N is converted to the color television signal S_N according to the NTSC system to be derived from an output terminal 69, and in the HD operation mode, the digital data D_H is converted to the color television signal S_H according to the HDTV system to be derived from the output terminal 69.

As described above, with the reproducing section of the recording and reproducing apparatus shown in Fig. 1, the color television signal S_N is reproduced based on the encoded digital data DA having the transmission rate of 15Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the LP operation mode, the color television signal S_N is reproduced based on the encoded digital data DB having the transmission rate of 30Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the SP operation mode, and the color television signal S_H is reproduced based on the encoded digital data DC having the transmission rate of 60Mb/s which are obtained by causing the first and second modified digital data D_1 and D_2 having the transmission rate of 30Mb/s and reproduced from the magnetic tape TP to be subjected to the time base conversion in the case of the HD operation mode.

Claims

1. A magnetic recording apparatus comprising:

an input terminal (10a, 10b) to which, in use, an information signal is applied;

encoding means (13, 15, 17) for encoding the information signal supplied from the input terminal (10a, 10b) into a selected one of a plurality of digital data formats (DA, DB, DC) having different instantaneous transmission rates,

modulating means (21, 23) for producing recording signals in two channels,

recording means (25, 27, 31, Ha-Hb) including a rotary magnetic head device having a plurality of recording heads to which said recording signals are supplied and tape guiding means for guiding a magnetic tape on which said recording signals are to be recorded and operative to cause said rotary magnetic head device to contact with the magnetic tape; and

head driving means (1) for rotating said rotary magnetic head device at a predetermined speed of rotation; characterised by

tape driving means (3, 5, 7) for causing the magnetic tape to run at a selected one of a plurality of predetermined speeds according to the transmission rate of encoded digital data obtained from said encoding means (13, 15, 17); and

time base processing means (19) for receiving blocks of data from said encoding means (13, 15, 17), selectively compressing or expanding said received blocks into blocks of a predetermined size and a predetermined substantially constant instantaneous transmission rate, selectively delaying said blocks and directing them alternately between two output channels so that blocks corresponding to each of pairs of temporally adjacent received blocks are output to said modulating means simultaneously in the two channels.

2. A magnetic recording apparatus according to claim 1, wherein said different transmission rates satisfy a predetermined ratio.

3. A magnetic recording apparatus according to claim 1 or 2, wherein said different transmission rates correspond to different operation modes respectively.

4. A magnetic recording apparatus according to claim 1, 2 or 3 wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is wound with a predetermined wrapping angle and at least a pair of rotary magnetic heads (Ha-Hd) disposed to face each other across the centre of the head cylinder (SLD).

5. A magnetic recording apparatus according to claim 4, wherein said time base processing means (19) is operative to produce first and second modified digital data each having said predetermined transmission rate based on the encoded digital data obtained from said encoding means, and said modulating means (21, 23) is operative to produce first and second recording signals which correspond respectively to the first and second modified digital data and are supplied to said pair of rotary magnetic heads (Ha-Hd), respectively.

6. A magnetic recording apparatus according to any one of the preceding claims, wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is

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wound with a predetermined wrapping angle, a first pair of rotary magnetic heads (Ha-Hd) close to each other, and a second pair of rotary magnetic heads (Hc, Hd) being disposed to face each other across the centre of the head cylinder (SLD).

7. A magnetic recording apparatus according to claim 5, wherein said time base processing means (19) is operative to produce first and second modified digital data each having said predetermined transmission rate based on the encoded digital data obtained from said encoding means, and said modulating means (21, 23) is operative to produce first and second recording signals corresponding respectively to the first and second modified digital data, said first recording signal being supplied both to one of said first pair of rotary magnetic head (Ha, Hb) and to one of said second pair of rotary magnetic heads (Hc, Hd), and said second recording signal being supplied to both the other one of said first pair of rotary magnetic heads (Ha, Hb) and the other one of said second pair of rotary magnetic heads (Hc, Hd).

8. A magnetic recording apparatus according to any one of the preceding claims, wherein said encoding means includes analog to digital converting means (13) for converting the information signal supplied from said input terminal to digital data, and bit reduction means (15) to causing the digital data obtained from said analog to digital converting means (13) to be subjected to bit reduction so as to produce digital data which are encoded to be said encoded digital data.

9. A magnetic reproducing apparatus comprising:

reproducing means provided with a rotary magnetic head device (SLD) having a plurality of reproduction heads and tape guide means for guiding a magnetic tape on which a recording signal obtained based on digital data having a predetermined instantaneous transmission rate is recorded in each of a number of oblique record tracks and operative to cause the rotary magnetic head device to contact with the magnetic tape for scanning each oblique record track to reproduce the recording signal from the magnetic tape as a block of digital data alternately to two channels;

head driving means (1) for rotating said rotary magnetic head device at a predetermined speed of rotation;

demodulating means (57, 59) for reproducing the digital data based on the recording signal reproduced by the rotary magnetic head device;

tape driving means (7) for causing the magnetic tape to run at a speed selected from a plurality of predetermined speeds satisfying a predetermined ratio;

time base processing means (61) for selectively compressing or expanding and multiplexing the blocks of digital data obtained from the demodulating means (57, 59) so as to produce modified digital data in a single channel having a selected one of a plurality of predetermined transmission rates according to the selected speed of the magnetic tape; and

decoding means (63, 65) for producing, based on the modified digital data obtained from said time base processing means, reproduced digital data representing an information signal.

10. A magnetic recording apparatus according to claim 9, wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is wound with a predetermined wrapping angle and at least a pair of rotary magnetic heads (Ha-Hd) disposed to face each other with the centre of the head cylinder and operative to reproduce first and second recording signals from the magnetic tape, respectively.

11. A magnetic reproducing apparatus according to claim 9 or 10, wherein said demodulating means (57, 59) is operative to reproduce first and second digital data based on said first and second recording signals respectively, and said time base processing means (61) is operative to produce said modified digital data based on both of the first and second digital data obtained from said demodulating means.

12. A magnetic reproducing apparatus according to claim 9, 10 or 11, wherein said rotary magnetic head device comprises a head cylinder (SLD) on which, in use, the magnetic tape is wound with a predetermined wrapping angle, a first pair of rotary magnetic heads (Ha, Hb) close to each other, and a second pair of rotary magnetic heads (Ha, Hd) close to each other, said first pair of rotary magnetic heads (Ha, Hb) and second pair of rotary magnetic heads (Hc, Hd) being disposed to face each other across the centre of the head cylinder (SLD) and being operative to reproduce first to fourth recording signals from the magnetic tape, respectively.

13. A magnetic reproducing apparatus according to claim 12, wherein said demodulating means (57, 59) is operative to reproduce first and second digital data based on said first to fourth recording signals, and said time base processing means

(61) is operative to produce said modified digital data based on both of the first and second digital data obtained from said demodulating means.

14. A magnetic reproducing apparatus according to any one of claims 9 to 13 and further comprising bit restoration means (65) for causing the digital data obtained from said decoding means to be subjected to bit restoration so as to produce restored digital data, and digital to analog converting means (67) for converting the restored digital data obtained from said bit restoration means (65) to the information signal.

15. A magnetic recording and reproducing apparatus comprising:

an input terminal (10a, 10b) to which, in use, an information signal is applied, encoding means (13, 15, 17) for encoding the information signal supplied from the input terminal (10a, 10b) in one of a selected plurality of digital data formats (DA, Db, DC) which have different instantaneous transmission rates, respectively;

modulating means (21, 23) for producing recording signals in two channels;

recording and reproducing means provided with a rotary magnetic head device and tape guiding means for guiding a magnetic tape on which the recording signals are to be recorded and operative to cause the rotary magnetic head device to contact with the magnetic tape for forming oblique record tracks to record the recording signals in said two channels on the magnetic tape and for scanning each oblique record track formed on the magnetic tape to reproduce the recorded signal as a block of digital data alternately to two channels;

head driving means (1) for rotating said rotary magnetic head device at a predetermined speed of rotation; and

demodulating means (57, 59) for demodulating the digital data in blocks in two channels based on the recording signal reproduced by the rotary magnetic head device from the magnetic tape, said recording and reproducing apparatus further comprising:

tape driving means (7) for causing the magnetic tape to run at a selected one of a plurality of predetermined speeds according to the transmission rate of encoded digital data obtained from said encoding means;

first time base processing means (19) for receiving blocks of data from said encoding means (13, 15, 17), selectively compressing or expanding said received blocks into blocks of a predetermined size and a predetermined substantially constant instantaneous transmission rate, selectively delaying said blocks and directing them alternately between two output channels so that blocks corresponding to each of pairs of temporally adjacent received blocks are output to said modulating means simultaneously in the two channels,

second time base processing means (61) for selectively compressing or expanding and multiplexing the blocks of digital data obtained from the demodulating means (57, 59) so as to produce modified digital data in a single channel having a predetermined transmission rate selected corresponding to the selected speed of the magnetic tape, and

decoding means (63) for decoding said encoded digital data obtained from said second time base processing means (61) to digital data representing the information signal.

Patentansprüche

1. Magnetische Aufzeichnungsvorrichtung, mit:

einem Eingangsanschluß (10a, 10b), an den bei Verwendung ein Informationssignal angelegt wird;

einer Codiereinrichtung (13, 15, 17) zum Codieren des Informationssignals, das vom Eingangsanschluß (10a, 10b) geliefert wird, in ein ausgewähltes aus mehreren digitalen Datenformaten (DA, DB, DC), die unterschiedliche momentane Übertragungsraten haben;

einer Modulationseinrichtung (21, 23) zur Erzeugung von Aufzeichnungssignalen in zwei Kanälen;

einer Aufzeichnungseinrichtung (25, 27, 31, Ha - Hb) mit einer Drehmagnetkopfeinrichtung, die mehrere Aufzeichnungsköpfe aufweist, zu denen die Aufzeichnungssignale geliefert werden, und einer Bandführungseinrichtung, um ein Magnetband zu führen, auf dem die Aufzeichnungssignale aufzuzeichnen sind, und welche die Drehmagnetkopfeinrichtung veranlassen kann, mit dem Magnetband in Kontakt zu treten; und

einer Kopfansteuereinrichtung (1) zum Drehen der Drehmagnetkopfeinrichtung mit einer vorgegebenen Drehgeschwindigkeit; gekennzeichnet durch

eine Bandantriebseinrichtung (3, 5, 7), um das Magnetband zu veranlassen, daß es mit einer ausgewählten aus mehreren vorgegebenen Geschwindigkeiten entsprechend der Übertragungsrate der codierten digitalen Daten läuft, die von der Codiereinrichtung (13, 15, 17) erhalten werden; und

eine Zeitbasisverarbeitungseinrichtung (19) zum Empfang von Datenblöcken von der Codiereinrichtung (13, 15, 17), die selektiv diese

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empfangenen Blöcke in Blöcke einer vorgegebenen Größe und einer vorgegebenen in etwa konstanten momentanen Übertragungsrate komprimiert oder expandiert, die selektiv diese Blöcke verzögert und sie abwechselnd zwischen zwei Ausgangskanälen so leitet, daß Blöcke, die jedem der Paare von zeitweilig benachbarten empfangenen Blöcken entsprechen, an die Modulationseinrichtung gleichzeitig in den beiden Kanälen ausgegeben werden.

2. Magnetische Aufzeichnungsvorrichtung nach Anspruch 1, wobei die unterschiedlichen Übertragungsraten ein vorgegebenes Verhältnis erfüllen.

3. Magnetische Aufzeichnungsvorrichtung nach Anspruch 1 oder 2, wobei die unterschiedlichen Übertragungsraten jeweils unterschiedlichen Betriebsmoden entsprechen.

4. Magnetische Aufzeichnungsvorrichtung nach Anspruch 1, 2 oder 3, wobei die Drehmagnetkopfeinrichtung einen Kopfzylinder (SLD) aufweist, um den bei Verwendung ein Magnetband mit einem vorgegebenen Umschlingungswinkel geschlungen ist und zumindest ein Paar von Drehmagnetköpfen (Ha - Hd) so angeordnet ist, daß sie einander quer über den Mittelpunkt des Kopfzylinders (SLD) gegenüberliegen.

5. Magnetische Aufzeichnungsvorrichtung nach Anspruch 4, wobei die Zeitbasisverarbeitungseinrichtung (19) die ersten und zweiten modifizierten digitalen Daten, die jeweils die vorgegebene Übertragungsrate auf der Basis der codierten digitalen Daten haben,erzeugen kann, die von der Codiereinrichtung erhalten werden, und wobei die Modulationseinrichtung (21, 23) erste und zweite Aufzeichnungssignale erzeugen kann, die jeweils den ersten und zweiten modifizierten digitalen Daten entsprechen und die jeweils zu dem Paar der Drehmagnetköpfe (Ha - Hd) geliefert werden.

6. Magnetische Aufzeichnungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Drehmagnetkopfeinrichtung einen Kopfzylinder (SLD) aufweist, um den bei Verwendung ein Magnetband mit einem vorgegebenen Umschlingungswinkel geschlungen ist, ein erstes Paar von Drehmagnetköpfen (Ha - Hd), die nahe beieinander sind, und ein zweites Paar von Drehmagnetköpfen (Hc, Hd), die so angeordnet sind, daß sie einander quer über den Mittelpunkt des Kopfzylinders (SLD) gegenüberliegen.

7. Magnetische Aufzeichnungsvorrichtung nach Anspruch 5, wobei die Zeitbasisverarbeitungseinrichtung (19) die ersten und zweiten modifizierten digitalen Daten erzeugen kann, die jeweils die vorgegebene Übertragungsrate auf der Basis der codierten digitalen Daten haben, die von der Codiereinrichtung erhalten werden, und wobei die Modulationseinrichtung (21, 23) erste und zweite Aufzeichnungssignale erzeugen kann, die jeweils den ersten und zweiten modifizierten digitalen Daten entsprechen, wobei das erste Aufzeichnungssignal sowohl zu einem des ersten Paars der Drehmagnetköpfe (Ha, Hb) als auch zu einem des zweiten Paars der Drehmagnetköpfe (Hc, Hd) geliefert wird, und wobei das zweite Aufzeichnungssignal sowohl zu dem anderen einen des ersten Paars der Drehmagnetköpfe (Ha, Hb) als auch zum anderen einen des zweiten Paars der Drehmagnetköpfe (Hc, Hd) geliefert wird.

8. Magnetische Aufzeichnungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Codiereinrichtung eine Analog-Digital-Umwandlungseinrichtung (13) aufweist, um das Informationssignal, das vom Eingangsanschluß geliefert wird, in digitale Daten umzuwandeln, und eine Bitverringerungseinrichtung (15), um zu veranlassen, daß die digitalen Daten, die von der Analog-Digital-Umwandlungseinrichtung (13) erhalten werden, einer Bitverringerung unterworfen werden, um digitale Daten zu erzeugen, die so codiert sind, damit sie diese codierten digitalen Daten sind.

9. Magnetische Wiedergabevorrichtung mit:

einer Wiedergabeeinrichtung, die mit einer Drehmagnetkopfeinrichtung (SLD) versehen ist, die mehrere Wiedergabeköpfe und eine Bandführungseinrichtung aufweist, um ein Magnetband zu führen, auf welchem ein Aufzeichnungssignal, das auf der Basis von digitalen Daten erhalten wird, die eine vorgegebene momentane Übertragungsrate haben, in jeder einer Anzahl von schrägen Aufzeichnungsspuren aufgezeichnet ist, und die bewirken kann, daß die Drehmagnetkopfeinrichtung mit dem Magnetband in Kontakt kommt, um jede schräge Aufzeichnungsspur abzutasten, um das Wiedergabesignal aus dem Magnetband als ein Block von digitalen Daten abwechselnd in zwei Kanälen wiederzugeben;

einer Kopfansteuereinrichtung (1) zum Drehen der Drehmagnetkopfeinrichtung mit einer vorgegebenen Drehgeschwindigkeit;

einer Demodulationseinrichtung (57, 59) zur Wiedergabe der digitalen Daten auf der Basis des Aufzeichnungssignals, das durch die Drehmagnetkopfeinrichtung reproduziert wurde;

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einer Bandansteuereinrichtung (7), um zu veranlassen, daß das Magnetband mit einer Geschwindigkeit läuft, die aus mehreren vorgegebenen Geschwindigkeiten ausgewählt wird, die ein vorgegebenes Verhältnis erfüllen;

einer Zeitbasisverarbeitungseinrichtung (61), um selektiv die digitalen Datenblöcke, die von der Demodulationseinrichtung (57, 59) erhalten werden, zu komprimieren oder zu expandieren und zu multiplexen, um somit modifizierte digitale Daten in einem Einzelkanal zu erzeugen, die eine ausgewählte aus mehreren von vorgegebenen Übertragungsraten gemäß der ausgewählten Geschwindigkeit des Magnetbandes haben; und

einer Decodiereinrichtung (63, 65) zur Erzeugung auf der Basis der modifizierten digitalen Daten, die von der Zeitbasisverarbeitungseinrichtung erhalten werden, reproduzierter digitaler Daten, die ein Informationssignal darstellen.

10. Magnetische Wiedergabevorrichtung nach Anspruch 9, wobei die Drehmagnetkopfeinrichtung einen Kopfzylinder (SLD) aufweist, um den bei Verwendung das Magnetband mit einem vorgegebenen Umschlingungswinkel geschlungen ist, und zumindest ein Paar von Drehmagnetköpfen (Ha - Hd), die so angeordnet sind, daß sie einander über den Mittelpunkt des Kopfzylinders gegenüberliegen,und die jeweils die ersten bzw. zweiten Aufzeichnungssignale vom Magnetband wiedergeben können.

11. Magnetische Wiedergabevorrichtung nach Anspruch 9 oder 10, wobei die Demodulationseinrichtung (57, 59) jeweils die ersten und zweiten digitalen Daten auf der Basis der ersten und zweiten Aufzeichnungssignale reproduzieren kann, und die Zeitbasisverarbeitungseinrichtung (61) die modifizierten digitalen Daten auf der Basis sowohl der ersten als auch der zweiten digitalen Daten erstellen kann, die von der Demodulationseinrichtung erhalten werden.

12. Magnetische Wiedergabevorrichtung nach Anspruch 9, 10 oder 11, wobei die Drehmagnetkopfeinrichtung einen Kopfzylinder (SLD) aufweist, um den bei Verwendung ein Magnetband mit einem vorgegebenen Umschlingungswinkel geschlungen ist, ein erstes Paar von Drehmagnetköpfen (Ha, Hb), die eng beieinander sind, und ein zweites Paar von Drehmagnetköpfen (Hc, Hd), die eng beieinander sind, wobei das erste Paar der Drehmagnetköpfe (Ha, Hb) und das zweite Paar der Drehmagnetköpfe (Hc, Hd) so angeordnet sind, daß sie einander quer über dem Mittelpunkt des Kopfzylinders (SLD) gegenüberliegen und jeweils das erste bis vierte Aufzeichnungssignal aus dem Magnetband reproduzieren können.

13. Magnetische Wiedergabevorrichtung nach Anspruch 12, wobei die Demodulationseinrichtung (57, 59) die ersten und zweiten digitalen Daten auf der Basis der ersten bis vierten Aufzeichnungssignale reproduzieren kann, und die Zeitbasisverarbeitungseinrichtung (61) die modifizierten digitalen Daten auf der Basis sowohl der ersten als auch der zweiten digitalen Daten erstellen kann, die von der Demodulationseinrichtung erhalten werden.

14. Magnetische Wiedergabevorrichtung nach einem der Ansprüche 9 bis 13, die weiter eine Bitwiederherstellungseinrichtung (65) aufweist, um zu veranlassen, daß die digitalen Daten, die von der Decodiereinrichtung erhalten werden, einer Bitwiederherstellung unterworfen werden, um somit wiederhergestellte digitale Daten zu erstellen, und eine Digital-Analog-Umwandlungseinrichtung (67) zum Umwandeln der wiederhergestellten digitalen Daten, die von der Bitwiederherstellungseinrichtung (65) erhalten werden, in das Informationssignal.

15. Magnetische Aufzeichnungs- und Wiedergabevorrichtung, mit:

einem Eingangsanschluß (10a, 10b), an den bei Verwendung ein Informationssignal angelegt wird, einer Codiereinrichtung (13, 15, 17) zur Codierung des Informationssignals, das vom Eingangsanschluß (10a, 10b) geliefert wird, in jeweils eines aus mehreren ausgewählten digitalen Datenformaten (DA, DB, DC), die verschiedene momentane Übertragungsraten haben;

einer Modulationseinrichtung (21, 23) zur Erstellung von Aufzeichnungssignalen in zwei Kanälen;

einer Aufzeichnungs- und Wiedergabeeinrichtung, die mit einer Drehmagnetkopfeinrichtung und einer Bandführungseinrichtung versehen ist, um ein Magnetband zu führen, auf dem die Aufzeichnungssignale aufgezeichnet werden sollen, und die die Drehmagnetkopfeinrichtung veranlassen kann, mit dem Magnetband in Kontakt zu treten, um schräge Aufzeichnungsspuren zu bilden, um die Aufzeichnungssignale in den beiden Kanälen auf dem Magnetband aufzuzeichnen und um jede schräge Aufzeichnungsspur abzutasten, die auf dem Magnetband gebildet ist, um das aufgezeichnete Signal als ein Block von digitalen Daten abwechselnd in beiden Kanälen zu reproduzieren;

einer Kopfansteuereinrichtung (1) zum Drehen der Drehmagnetkopfeinrichtung mit einer vorgegebenen Drehgeschwindigkeit; und

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einer Demodulationseinrichtung (57, 59) zur Demodulierung der digitalen Daten in Blöcke in beiden Kanälen auf der Basis des Aufzeichnungssignals, das durch die Drehmagnetkopfeinrichtung vom Magnetband reproduziert wurde, wobei die Aufzeichnungs- und Wiedergabevorrichtung weiter aufweist:

eine Bandansteuereinrichtung (7), um das Magnetband zu veranlassen, mit einer ausgewählten aus mehreren von vorgegebenen Geschwindigkeiten gemäß der Übertragungsrate der codierten digitalen Daten zu laufen, die von der Codiereinrichtung erhalten werden;

eine erste Zeitbasisverarbeitungseinrichtung (19) zum Empfang von Datenblöcken von der Codiereinrichtung (13, 15, 17), die selektiv die empfangenen Blöcke in Blöcke einer vorgegebenen Größe und einer vorgegebenen in etwa konstanten momentanen Übertragungsrate komprimiert oder expandiert, die die Blöcke selektiv verzögert und sie abwechselnd zwischen zwei Ausgangskanälen leitet, so daß Blöcke, die jedem der Paare der zeitweilig benachbarten empfangenen Blöcke entsprechen, zur Modulationseinrichtung gleichzeitig in den beiden Kanälen ausgegeben werden,

eine zweite Zeitbasisverarbeitungseinrichtung (61) zum selektiven Komprimieren oder Expandieren und Multiplexen der digitalen Datenblöcke, die von der Demodulationseinrichtung (57, 59) erhalten werden, um so die modifizierten digitalen Daten in einem Einzelkanal zu erstellen, die eine vorgegebene Übertragungsrate haben, die gemäß der ausgewählten Geschwindigkeit des Magnetbandes ausgewählt wird, und

eine Decodiereinrichtung (63) zum Decodieren der codierten digitalen Daten, die von der zweiten Zeitbasisverarbeitungseinrichtung (61) erhalten werden, in digitale Daten, die das Informationssignal darstellen.

Revendications

1. Appareil d'enregistrement magnétique comprenant :

un borne d'entrée (10a, 10b) à laquelle, lors de l'utilisation, un signal d'informations est appliqué ;

un dispositif de codage (13, 15, 17) pour coder le signal d'informations fourni par la borne d'entrée (10a, 10b) en un format sélectionné à partir d'une pluralité de formats numériques (DA, DB, DC) ayant différents débits de transmission instantanés,

un dispositif de modulation (21, 23) pour produire des signaux d'enregistrement dans deux canaux,

un dispositif d'enregistrement (25, 27, 31, Ha-Hb) comprenant un dispositif de têtes magnétiques tournantes ayant une pluralité de têtes d'enregistrement sur lesquelles lesdits signaux d'enregistrement sont appliqués et un dispositif de guidage de bande pour guider une bande magnétique sur laquelle lesdits signaux d'enregistrement sont à enregistrer et est fonctionnel pour provoquer le contact dudit dispositif de têtes magnétiques tournantes avec la bande magnétique ; et

dispositif de commande de tête (1) pour mettre en rotation ledit dispositif de têtes magnétiques tournantes à une vitesse de rotation prédéterminée ; caractérisé par

un dispositif de commande de bande (3, 5, 7) pour provoquer le défilement de la bande magnétique à une vitesse sélectionnée d'une pluralité de vitesses prédéterminées en fonction du débit de transmission des données numériques codées obtenues à partir dudit dispositif de codage (13, 15, 17) ; et

un dispositif de traitement de base de temps (19) pour recevoir des blocs de données dudit dispositif de codage (13, 15, 17), compressant ou décompressant sélectivement lesdits blocs reçus en blocs d'une dimension prédéterminée et à un débit de transmission instantané prédéterminé substantiellement constant, en retardant sélectivement lesdits blocs et les dirigeant alternativement entre deux canaux de sortie de sorte que les blocs correspondant à chacune des paires de blocs reçus adjacents temporairement sont fournis audit dispositif de modulation simultanément dans les deux canaux.

2. Appareil d'enregistrement magnétique selon la revendication 1, dans lequel lesdits débits de transmission différents satisfont à un rapport prédéterminé.

3. Appareil d'enregistrement magnétique selon la revendication 1 ou 2, dans lequel lesdits débits de transmission différents correspondent respectivement à des modes de fonctionnement différents.

4. Appareil d'enregistrement et de reproduction selon la revendication 1, 2 ou 3 dans lequel ledit dispositif de têtes magnétiques tournantes comprend un cylindre de tête (SLD) sur lequel, lors de l'utilisation, la bande magnétique est enroulée avec un angle d'enroulement prédéterminé et au moins une paire de têtes magnétiques tournantes (Ha-Hd) disposées en face l'une de l'autre à travers le centre du cylindre de tête (SLD).

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5. Appareil d'enregistrement magnétique selon la revendication 4, dans lequel ledit dispositif de traitement de base de temps (19) est fonctionnel pour produire des premières et secondes données numériques modifiées ayant chacune ledit débit de transmission prédéterminé sur la base des données numériques codées obtenues à partir dudit dispositif de codage, et ledit dispositif àe modulation (21, 23) est fonctionnel pour produire des premier et second signaux d'enregistrement qui correspondent respectivement aux premières et secondes données numériques modifiées et sont appliquées respectivement auxdites paires de têtes magnétiques tournantes (Ha-Hd).

6. Appareil d'enregistrement magnétique selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif de têtes magnétiques tournantes comprend un cylindre de tête (SLD) sur lequel, lors de l'utilisation, la bande magnétique est enroulée avec un angle d'enroulement prédéterminé, une première paire de têtes magnétiques tournantes (Ha-Hd) proches l'une de l'autre, et une seconde paire de têtes magnétiques tournantes (Hc, Hd) étant disposées en face l'une de l'autre à travers le centre du cylindre de tête (SLD).

7. Appareil d'enregistrement magnétique selon la revendication 5, dans lequel ledit dispositif de traitement de base de temps (19) est fonctionnel pour produire des premières et secondes données numériques modifiées ayant chacune ledit débit de transmission prédéterminé sur la base desdites données numériques codées obtenues à partir dudit dispositif de codage, et ledit dispositif de modulation (21, 23) est fonctionnel pour produire les premier et second signaux d'enregistrement correspondant respectivement aux premières et secondes données numériques modifiées, ledit premier signal d'enregistrement étant fourni à la fois à une de ladite première paire de têtes magnétiques tournantes (Ha, Hb) et à une de ladite seconde paire de têtes magnétiques tournantes (Hc, Hd), et ledit second signal d'enregistrement étant appliqué à la fois à l'autre de ladite première paire de têtes magnétiques tournantes (Ha, Hb) et à l'autre de ladite seconde paire de têtes magnétiques tournantes (Hc, Hd).

8. Appareil d'enregistrement magnétique selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif de codage comprend un dispositif de conversion analogique numérique (13) pour convertir le signal d'informations fourni par ladite borne d'entrée en des données numériques, et un dispositif de réduction binaire (15) pour provoquer la soumission des données numériques obtenues à la reduction binaire à partir dudit dispositif de conversion analogique numérique (13) afin de produire des données numériques qui sont codées pour être lesdites données numériques codées.

9. Appareil magnétique de reproduction comprenant :

un dispositif de reproduction pourvu d'un dispositif de têtes magnétiques tournantes (SLD) ayant une pluralité de têtes de reproduction et un dispositif de guidage de bande pour guider une bande magnétique sur lequel un signal d'enregistrement obtenu sur la base des données numériques ayant un débit de transmission instantané prédéterminé est enregistré dans chacune d'un nombre de pistes d'enregistrement obliques et est fonctionnel pour provoquer le contact du dispositif de têtes magnétiques tournantes avec la bande magnétique pour balayer chaque piste d'enregistrement oblique pour reproduire le signal d'enregistrement à partir de la bande magnétique comme un bloc de données numériques alternativement sur deux canaux;

un dispositif de commande de tête (1) pour mettre en rotation ledit dispositif de têtes magnétiques tournantes à une vitesse de rotation prédéterminée ;

un dispositif de démodulation (57, 59) pour reproduire les données numériques sur la base du signal enregistrement reproduit par le dispositif de têtes magnétiques tournantes ;

un dispositif de commande de bande (7) pour provoquer le défilement de la bande magnétique à une vitesse sélectionnée à partir d'une pluralité de vitesses prédéterminées satisfaisant un rapport prédéterminé ;

un dispositif de traitement de base de temps (61) pour compresser ou décompresser et multiplexer sélectivement les blocs de données numériques obtenues a partir du dispositif de démodulation (57, 59) afin de produire des données numériques modifiées dans un canal unique ayant un débit sélectionné d'une pluralité de débits de transmission prédéterminés en fonction de la vitesse sélectionnée de la bande magnétique ; et

un dispositif de décodage (63, 65) pour produire, sur la base des données numériques modifiées obtenues à partir dudit dispositif de traitement de base de temps, des données numériques reproduites représentant un signal d'informations.

10. Appareil d'enregistrement magnétique selon la revendication 9, dans lequel ledit dispositif de têtes magnétiques tournantes comprend un cylindre de tête (SLD) sur lequel, lors de l'utilisation,

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la bande magnétique est enroulée avec un angle d'enroulement prédéterminé et au moins une paire de têtes magnétiques tournantes (Ha-Hd) disposées en face l'une de l'autre avec le centre du cylindre de tête et est fonctionnel pour reprduire respectivement des premier et second signaux d'enregistrement à partir de la bande magnétique.

11. Appareil magnétique de reproduction selon la revendication 9 ou 10, dans lequel ledit dispositif de démodulation (57, 59) est fonctionnel pour reproduire des premières et secondes données numériques sur la base desdits premier et second signaux d'enregistrement respectivement, et ledit dispositif de traitement de base de temps (61) est fonctionnel pour produire lesdites données numériques modifiées sur la base des premières et secondes données numériques obtenues à partir dudit dispositif de démodulation.

12. Appareil magnétique de reproduction selon la revendication 9, 10 ou 11, dans lequel ledit dispositif de têtes magnétiques tournantes comprend un cylindre de tête (SLD) sur lequel, lors de l'utilisation, la bande magnétique est enroulée avec un angle d'enroulement prédéterminé, une première paire de têtes magnétiques tournantes (Ha, Hb) proches l'une de l'autre, et une seconde paire de têtes magnétiques tournantes (Ha, Hd) proches l'une de l'autre, ladite première paire de têtes magnétiques tournantes (Ha, Hb) et la seconde paire de têtes magnétiques tournantes (Hc, Hd) étant disposées en face l'une de l'autre à travers le centre du cylindre de tête (SLD) et étant fonctionnelle pour reproduire respectivement les premier au quatrième signaux d'enregistrement à partir de la bande magnétique.

13. Appareil magnétique de reproduction selon la revendication 12, dans lequel ledit dispositif de démodulation (57, 59) est fonctionnel pour reproduire des premières et secondes données numériques sur la base desdits premier au quatrième signaux d'enregistrement, et ledit dispositif de traitement de base de temps (61) est fonctionnel pour produire lesdites données numériques modifiées sur la base à la fois des premières et secondes données numériques obtenues à partir dudit dispositif de démodulation.

14. Appareil magnétique de reproduction selon l'une quelconque des revendications 9 à 13 et ccmprenant en outre un dispositif de restauration binaire (65) pour provoquer la soumission des données numériques obtenues à partir dudit dispositif de décodage à une restauration binaire afin de produire des données numériques restaurées, et un dispositif de conversion numérique analogique (67) pour convertir les données numériques restaurées obtenues à partir dudit dispositif de restauration binaire (65) en signal d'informations.

15. Appareil d'enregistrement et de reproduction magnétique comprenant :

une borne d'entrée (10a, 10b) à laquelle, lors de l'utilisation, un signal d'informations est appliqué, un dispositif de codage (13, 15, 17) pour coder le signal d'informations fourni par la borne d'entrée (10a, 10b) dans un format d'une pluralité de formats de données numériques sélectionnée (DA, DB, DC) qui ont différents débits de transmission instantanés, respectivement ;

un dispositif de modulation (21, 23) pour produire des signaux d'enregistrement dans deux canaux ;

un dispositif d'enregistrement et de reproduction pourvu d'un dispositif de têtes magnétiques tournantes et d'un dispositif de guidage de bande pour guider une bande magnétique sur laquelle les signaux d'enregistrement sont à enregistrer et est fonctionnel pour provoquer le contact du dispositif de têtes magnétiques tournantes avec la bande magnétique pour former des pistes d'enregistrement obliques et enregistrer les signaux d'enregistrement dans lesdits deux canaux sur la bande magnétique et pour balayer chaque piste d'enregistrement oblique formée sur la bande magnétique pour reproduire le signal alternativement enregistré sur deux canaux comme un bloc de données numériques;

un dispositif de commande de tête (1) pour mettre en rotation ledit dispositif de têtes magnétiques tournantes à une vitesse de rotation prédéterminée ; et

un dispositif de démodulation (57, 59) pour démoduler les données numériques en blocs dans deux canaux sur la base du signal d'enregistrement reproduit par le aispositif de têtes magnétiques tournantes à partir de la bande magnétique, ledit appareil d'enregistrement et de reproduction comprenant en outre :

un dispositif de commande de bande (7) pour provoquer le défilement de la bande magnétique à une vitesse sélectionnée d'une pluralité de vitesses prédéterminées en fonction du débit de transmission des données numériques codées obtenues à partir dudit dispositif de codage ;

un premier dispositif de traitement de base de temps (19) pour recevoir des blocs de données à partir dudit dispositif de codage (13, 15, 17) en compressant ou en décompressant sélectivement lesdits blocs reçus en bloc d'une dimension prédéterminée et d'un débit de transmission instantané prédéterminé substantielle-

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ment constant, en retardant sélectivement lesdits blocs et en les dirigeant alternativement entre les deux canaux de sortie de sorte que des blocs correspondant à chaque paire de blocs voisins temporairement reçus sont tournis audit dispositif de modulation simultanément dans les deux canaux,

un second dispositif de traitement de base de temps (61) pour compresser ou décompresser sélectivement et multiplexer les blocs de données numériques obtenus par le dispositif de démodulation (57; 59) afin de produire des données numériques modifiées dans un canal unique ayant un débit de transmission prédéterminé sélectionné correspondant à la vitesse sélectionnée de la bande magnétique, et

un dispositif de décodage (63) pour décoder lesdites données numériques codées obtenues par ledit second dispositif de traitement de base (61) en des données numériques représentant le signal d'informations.