Description

Background of the invention

Field of the invention

The present invention relates to video recording and playback, and more particularly relates to video recording discs and their playback.

Background art

The videodisc is a storage medium for video information, on which video signals are recorded as spiral or circular tracks of indicia which are readable by way of electrical, optical, or other means. Videodiscs, in particular optical videodiscs which are readable optically by way of an imaged beam of laser light, offer enhanced playback flexibility as compared with video tape. To cite just one example, a videodisc player can be programmed to "search" for a particular frame or field of video, and that search can be effected quite rapidly as the imaged beam of laser light is easily moved in a radial direction across the full span of a disc much more rapidly than a video tape can be cycled from beginning to end even in a fast forward or fast reverse mode.

One limitation imposed by the videodisc, however, at the present level of technology, is in the amount of video information which can be stored on one "side" of a disc. Current optical videodisc standards provide for 54,000 circular or spiral tracks on a disc, with the innermost, limiting track carrying no more than two fields of video. Constant angular velocity ("CAV") discs, which are rotated at a constant angular velocity as they are played, carry two fields of video in each of the 54,000 tracks. Constant linear velocity ("CLV") discs, which are played at a varying angular velocity such that the linear velocity to the reading spot of light along any track on the disc is constant, carry a varying number of fields of video on each track, varying from two on the innermost track to six on the outermost track. The maximum permissible play time for a CLV is approximately one hour per side, while for a CAV disc the play time is limited to approximately one half hour per side.

US—A—4347257 describes a system for reading from a video disc a still video picture with its sound accompaniment. Each track of the video disc comprises n video and n audio information blocks, which are alternatively recorded in n equal sectors of the track. All video information blocks of said one track represent the information relating to the still video picture, whereas all audio information blocks of said one track represent the sound accompaniment of the still video picture for a listening time equal to a plurality of disc revolutions, for example 60 revolutions. Thus, at each revolution of the disc, all video information blocks of each track are scanned, whereas each audio information block is only scanned once during said plurality of revolutions. The signals corresponding to the scanned video and audio information blocks are stored in a memory and read from it a reduced rate so as to form uninterrupted sequences of video and audio information permitting to reconstitute the still video picture with the sound accompaniment associated therewith. This known system has the disadvantage of greatly reduced storage capacity for separate still pictures and thus suffers from a correspondingly reduced playing time.

Arrangements have been proposed to extend the play times of videodiscs. US—A—3 908 080 and US—A—4 135 205 describe systems wherein only one of the video frames of a consecutive plurality of frames is recorded on a videodisc. The sound associated with the recorded video frame and the omitted video frames is multiplexed and written on the disc track along with the recorded frame. On playback, the recorded frame is read repeatedly by the player a sufficient number of times to substitute for the omitted frames and each repeat is accompanied by the sound corresponding to the omitted frames, in proper sequential order. The system disclosed provide a system by which the play time of a videodisc may be extended by a factor of two, three or more times. The system lends itself particularly well to applications wherein one frame is recorded on each spiral track revolution of the videodisc. In this way, the mechanics of repeating a single frame is rendered relatively simple, utilizing the standard technique of "freeze frame" videodisc playback.

DE—A—2 158 983 describes a system which records on a disc a new frame of video signals only if the information content of the new frame differs from the preceeding frame by more than a given degree. While reproducing the video signals the recorded frame is read repeatedly as often as following frames have been omitted.

However, these known systems have limitations. For example, since whole frames are dropped, the maximum motion update rate is 15 per second. This gives marginal motion fidelity. In addition to this, whenever Field 1 and Field 2 of the frame being repeated are different, the transition between the fields is seen the same number of times the frame is repeated, exaggerating the jerking motion.

The object of the present invention is to overcome these problems by providing a method according to claim 1. Further developments are subject of subclaims.

The present invention is particularly useful in connection with a videodisc wherein bandwidth compressed video is recorded thereon such that four fields of video are recorded on each track, and wherein those fields comprise one out of every three fields of video from a standard segment of video. This arrangement allows for an expansion of the play time of a videodisc by a factor of three, thus permitting up to three hours of video program material to be recorded on a single side of a constant angular velocity disc. A novel arrangement permitting the playback of such a disc is disclosed herein.

Providing fields generally noncontiguous with

each of their adjacent fields recorded therewith, and in particular replaying one out of every "N", field only of an otherwise standard segment of video, provides, improved complete frames taken from such otherwise conventional video. For example, such single-field repetition gives motion smoothness superior to repeat-frame systems. Comparing a one out of three skip field with a one out of two skip frame system, the basic motion sampling rate of the skip field system is twenty times per second, as compared with fifteen times per second for the skip frame system. In addition, any transition between dissimilar fields is seen only once with the skip field system, preventing the fluttering motion discontinuity which is possible with the repeat-frame system. The price for this improved motion fidelity would normally be a decrease in vertical resolution. However, in the one out of three skip field system, recorded fields alternate between "ODD-field" scan lines and "EVEN-field" scan lines, thus retaining information covering the entire normal TV vertical resolution. In a continuous running display, "full resolution" and "half resolution" frames will thus alternate, providing on the average, a twenty-five percent reduction in vertical resolution.

It will be appreciated from the foregoing that the present invention represents a significant advance in the field of videodisc recording and reproducing systems. In particular, it provides a convenient technique for increasing the effective storage capacity of a recording disc without substantial loss in reproduction fidelity. Other aspects and advantages of the invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings.

Brief description of the drawings

Figure 1 is a diagram depicting the arrangement of fields on a videodisc constructed according to the preferred embodiment of the present invention.

Figure 2 is a diagram showing the arrangement in time of fields of video as they are read off of the disc shown in Figure 1 as compared with the arrangement of fields of such video as they are replayed for viewing on a monitor or receiver.

Figure 3 is a block diagram of circuitry which can be incorporated in a conventional player to permit it to play the videodisc shown in Figure 1.

Figures 4(A)—4(F) are signal diagrams of several signals generated by the circuits shown in Figure 3.

Figures 5(A)—(D) are signal diagrams of further signals generated by the circuits shown in Figure 3.

Figure 6 is a block diagram of a portion of the circuitry shown in Figure 3.

Detailed description of the preferred embodiment

The preferred embodiment of the present invention involves the use of a CAV optical videodisc, in which four fields of video are stored on each spiral track. Figure 1 is a diagram showing the arrangement of fields on such a videodisc 10. The disc 10 is conventional in all aspects except for the arrangement of the video information on the recording surfaces thereof. Thus, the disc has a central aperture 12 of conventional dimensions, and an annular recording surface on each side which extends from an inner circular boundary 14 to an outer circular boundary 16 near the edge of the disc 10. The disc 10 is played such that the reading spot of laser light advances around the disc in the direction depicted by arrow 18.

A standard, conventional CAV optical videodisc has two fields per revolution of the spiral track and is rotated at a rate of approximately 1800 RPM. This results in the video information being read off the disc at a standard NTSC rate. In order to read the disc 10 of the preferred embodiment of the present invention at a rate which would cause the video information to be read off at standard NTSC rate, the disc rotation rate would be approximately 900 RPM. However, according to the principles of the present invention, the disc 10 is rotated at a rate of approximately 1500 RPM.

The reason for this difference is explained by reference to Figure 2, which is a diagram showing the relationship between original fields of video selected (Figure (2A)), fields of video scanned on the disc (Figure 2(B)), fields of video as they are actually regenerated to drive either a television monitor or receiver (Figure 2(C)), and jump back pulses (Figure 2(D)). Frames scanned on the disc are designated by reference numeral 20, while frames provided as output signals are designated by reference numeral 22. The diagram depicts a sequence of play of frames of a given spiral track, designated arbitrarily as track "A". The immediately preceding track is therefore designated "A−1", and the subsequent track "A+1". The first field on a track is designated by "F1", the second field by "F2", and so forth. Field "F1" corresponds to original video Field "OV1", Field "F2" corresponds to original video Field "OV4", and so forth. Original video Fields "OV2", "OV3", "OV5", etc. are skipped, that is, not recorded.

The fields which are recorded on the disc correspond to one out of every three fields of a standard NTSC video format program segment. In playback, a field is read off of the disc 10, digitized, stored, and then read out of storage three times in a row and converted back into an analog signal as it is read out of storage. During the last readout of a field from storage, the next field on the disc is read into storage so that the process can continue uninterrupted in cyclical fashion.

The disc 10 is roated at a rate such that the reading beam of laser light scans 1½ rotations, or tracks, in the time it takes to play three fields of video at NTSC rate. Thus, referring now to Figure 2, it can be seen that during the third and final playback of the fourth field of track "A−1", Field 1 (F1) of track A is being stored in memory. The sequencing is arranged such that the first field of track A is completely stored just as the readout of

the fourth field of track A–1 is completed, or shortly thereafter.

It will be appreciated that five fields of video on the disc are scanned in the time that it takes to play back each stored field of video three times. It will also be appreciated that the special rotation rate of the disc mentioned above makes this overlapping timing scheme possible.

Proper scanning of the reading spot of laser light along the spiral track is assured by the implementation of a Jump Back signal 23, shown in Figure 2(D), which causes the spot of light to jump back to the immediately preceding track, immediately following storage of each field of video.

Audio is stored on the disc with each field as three channels of audio information. With each separate playback of a field of video, a different one of the audio channels is played along with that video. The combination of all three channels provides the complete audio information for the playing of all three fields.

It will be appreciated that whereas conventional CAV discs presently have only two fields per track, in order to fit four fields of video on each spiral of the track, bandwidth compression of the stored video and audio is required, if the same size and spacing indicia are to be employed. In fact, the preferred embodiment of the present invention contemplates a bandwidth compression of two to one. Many conventional bandwidth compression techniques are available and may be used for this purpose.

Figure 3 is a block diagram of circuitry constructed in accordance with the preferred embodiment of the present invention, usable in connection with a conventional videodisc player mechanism to permit playback of the optical videodisc shown in Figure 1. The FM signal recovered from the disc is applied to a signal line 30, and is conveyed to a Demodulator and Sync Extractor 32 and to the input of a second, three channel Audio Demodulator 34. The Demodulator and Sync Extractor 32 demodulates the FM signal, and provides as outputs recovered Disc Video and Disc Sync, on lines 36 and 38 respectively.

It will be appreciated from the foregoing discussion that the timing of the Disc Video and Disc Sync is substantially equal to 5/3×NTSC rates. Thus, for example, the burst frequency of the Disc Video is approximately equal to 5.96 megahertz. Other rates, such as horizontal sync, follow the same proportion.

As in a conventional player, the Disc Sync on line 38 is applied to the Spindle Servo circuit of the disc player along with Disc Sync Ref, described below, and serves to ensure the proper rotation rate of the spindle, and thus of the disc, for the FM signal to be read off the disc at the proper rate. Disc Sync on line 38 is also applied to an Active Video Window Generator 42 and to a Load Gate and Jump Back Pulse Generator 44, both of which are discussed in further detail below.

Disc Video on line 36 is applied to a Video Sample Clock Generator 44 and to an A—D Converter 46. The Video Sample Clock Generator 44 generates a square wave Sample Clock signal at a rate equal to three times the burst frequency of the disc "color subcarrier", and phase locked to the burst signal. This Sample Clock signal is applied on line 48 to one input of an AND gate 50. The signal on line 48 is also applied to a Divide-By-150 device 52, the output of which is applied to one input of an AND gate 54. The output of AND gate 54 is applied to the SAMPLE input of a three port A/D Convertor 56, which is described in further detail below. The output of AND gate 50 is applied to the SAMPLE CONVERT input of A/D Convertor 46.

The output of A/D Converter 46 is applied to a FIFO Register 58. The output of the FIFO Register 58 is applied to a Memory device 60. A handshake interconnection between register 58 and 60 is provided by way of Data Stored line 62 and Write Request line 64. The output of Memory 60 is connected to a Buffer Register 66, the output of which is connected to a Digital-To-Analog Converter 68. The output of D/A Converter 68 is applied to a Sync and Color Burst Insert circuit 70. The output of circuit 70 comprises recovered NTSC video.

The output of the Active Video Window Generator 42 comprises a series of pulses which are high during those portions of the Disc Video signal in which visual or data content video signals can occur, that is, excluding horizontal blanking intervals and that portion of the vertical blanking interval extending from 1 through line 9. Although lines 10 through 20 of the vertical blanking interval do not contain visual content video information, they frequently do contain digitally encoded data signals. The output of circuit 42 is applied to one input of an AND gate 72, the output of which is connected to the output of AND gate 50.

The Load Gate and Jump Back Pulse Generator 44 has two outputs. The first output, on line 74 is a Load Gate signal which is high only during the time when a field is to be read from the disc. It is applied to the other inputs of AND gate 54 and 72, and to the input of an Inverter 76, the output of which is applied to the WRITE ADDRESS RESET input of memory 60. The other output of generator 44 is a Jump Back pulse signal and is applied to line 78. This pulse is provided to the read spot jump back circuitry of the player which, in response thereto, causes the reading spot of laser light to jump back to the last preceding track, as is known in the art.

A Reference Timing Generator circuit 80 provides as an output a square wave reference pulse signal at the rate of the Disc Sync. This Signal, Disc Sync Ref, is applied to line 82 which is connected to the Spindle Servo which utilizes it in the control of the rate of rotation of the spindle, as mentioned above. The Reference Timing Generator 80 also has an output, on line 84, which is the Video Memory Cycle Clock signal. This clock signal is a square wave pulse signal at the

rate at which digital words are read out of Memory 60. During one third cycle of the clock the Memory 60 is enabled to read, while the other two thirds of the cycle the Memory 60 is enabled to write, twice if necessary. In this way the Memory 60 is able to continue reading out the stored digital data during the last full field readout of that data, while at the same time reading into storage the digital data corresponding to the next field of video to be played. Such a Memory circuit 60 is known in the art.

Another output of Generator 80 is applied to a further line 86. This output is the Video Read Clock signal. This signal is also a square wave at the frequency at which digital data is read out of Memory 60. Line 86 is applied to the input of a Read Address Counter 88, which in response thereto counts cyclically from zero. The count output of counter 88 is applied to the READ ADDRESS input of Memory 60.

Generator 90 also provides as an output a vertical sync pulse signal ("V Sync") at NTSC rate, which is applied on line 90 to the RESET input of Counter 88.

Generator 80 also provides as an output, on line 92, a series of pulses corresponding to those portions of video omitted through the action of the Active Video Window 42. This output is the Insert Gate pulse signal.

Generator 80 also produces NTSC Comp Sync and Color Burst, which are output on a further line 94. Lines 92 and 94 are applied to the Sync and Color Burst Insert circuit 70, wherein the NTSC Comp Sync and Color Burst signals are inserted into the Analog Video from the Digital-to-Analog Converter 68.

The Disc FM on line 30 is, as mentioned above, applied to a three channel Demodulator 34. This Demodulator 34 demodulates the three audio channels mentioned previously and applies them separately on three different lines 96 to the three port A/D Converter 56 mentioned above. Each of the three channels of audio is digitized by A/D Converter 56 and the separate outputs thereof are applied by way of lines 97 to a FIFO Register 98. The output of the FIFO Register 98 is applied to the input of an Audio Memory 100, which is analogous to Memory 60. The output of Audio Memory 100 is applied to a Buffer Register 102, the out of which is applied to a Digital-to-Analog Converter 104. The output of D/A Converter 104 comprises the audio output.

Timing Generator 80 provides as an output an Audio Read Clock signal pulse on a line 106 which is applied to the COUNT input of an Audio Read Address Counter 108. Likewise, the load gate signal conditions the next reset to also reset the channel port of the READ ADDRESS to the first channel so that the audio channels may be properly sequenced for readout. V Sync is applied to the RESET input of Counter 108. The COUNT output of Counter 108 is applied to the READ ADDRESS input of Audio Memory 100, while the square wave output of Counter 108 is applied to the READ STROBE input of Audio Memory 100.

Timing Generator 80 also has an output on line 112 an Audio Memory Cycle Clock signal. This signal, like the Read Write Cycle signal on line 84 provides for interlaced writing and reading.

The circuit shown in Figure 3 operates as follows. The Disc FM on line 30 is applied to the Demodulator and Sync Extractor 32 which extracts Disc Sync and applies it on line 38 to the Spindle Servo 40 along with the Disc Sync Reference signal on line 82, as mentioned above. The Disc Video is applied on line 36 to the Video Sample Clock Generator 44 which generates a Sample Clock reference to the burst frequency of the Disc Video. The Disc Sample Clock signal is gated through AND gate 50 and applied to the Sample Convert input of A/D Converter 46. The arrangement of Load Gate and Jump Back Pulse Generator 44, Active Video Window Generator 42, AND gate 72 and AND gate 50 cause the Sample Clock pulses on line 48 to be applied to the A/D Converter 46 only during those portions of active video when the reading beam of laser light in the player is scanning a field to be read and stored.

Figure 4 aids in understanding the timing described in connection with the SAMPLE CONVERT input of A—D converter 46. Figure 4(A) is a signal diagram showing the output of the Active Window Generator 42. As can be seen, the signal is low during pulses 200, corresponding to horizontal blanking intervals, and from the beginning of vertical blanking through line 9 within the vertical blanking interval.

Figure 4(B) shows the output on line 74 from the Load Gate and Pulse and Jump Back Pulse Generator 44. That output is high during the entire time in which a field of video is read off of the disc 10 (Figure 1). The Jump Back Pulse output on line 78 is identical to that on line 74, with the difference that when a stop motion command is received on line 75 the output on line 74 is disabled, and only the Jump Back pulse output is provided. Details of the circuitry in the load gate and jump back pulse generator are provided below in connection with Figure 6.

Figure 4(C) shows that the Video Sample Clock Generator output is a continuous series of pulses at three times the rate of the Disc Video "color subcarrier" burst frequency.

The SAMPLE CONVERT input of A/D Converter 46 is shown in Figure 4(D).

Digital words are generated in the A/D Converter 46 at the rate the pulses are provided to the SAMPLE CONVERT input thereof, and are applied to FIFO Register 58. From FIFO Register 58 they are loaded in a conventional handshake operation into memory 60, as memory write time becomes available. Memory 60 has an internal write address generator which operates in conjunction with the handshake operation just described, and the internal write address is reset to zero following the complete storage of a field. The digitized words of video information are thus stored sequentially in memory 60 starting with address zero.

The combination of the Reference Timing

Generator 80 and Read Address Counter 88 cyclically generate a series of pulses for Memory 60 readout corresponding to the pulses controlling the Memory 60 write operation, however bearing a timing relationship thereto of 5 to 3, and synchronized so that the zero address of the Read Address Counter 88 is generated before the last word of digitized data is converted by A—D Converter 46. A slight delay will occur before the last word of digitized data is stored into Memory 60 following the last conversion of that video data, due to the time sequence in the storage into register 58 and the above-described handshake operation to store the digitized data into memory 60. This does not, however, affect the performance of the system, but rather provides "slack" to the system and thereby helps to relieve the criticality of the relative timing between writing and reading to and from memory 60.

It will be appreciated that the continuous recycling of memory 60 allows for a "freeze-field" video picture image to be maintained, even when the player is "searching" or "seeking" a new track of data and cannot write new data into Mempry 60. It will also be appreciated that because the Video Sample Clock Generator 44 is phase locked to the Disc Video burst signal frequency, and the Read Clock is referenced to generator 80 which generates NTSC synchronized signals, that the circuit of Figure 3 provides automatic time base correction intrinsically in the process of sampling, storage, and readout. In fact, no further time base correction should be necessary for most purposes.

Figure 4(E) shows the read clock output signal.

The D/A Converter 68 converts the digital output from Memory 60, buffered by way of Buffer Register 66, into analog video. Because of the gating action of the Active Video Window Generator 42 and AND gates 72 and 50, the converted analog video output from D/A Converter 68 has "holes" in it during the horizontal blanking intervals and a portion of the vertical blanking interval. The insert gate signal on line 92 is a series of pulses corresponding to those "holes". They provide windows for the Sync and Color Burst Insert circuit 70 during which NTSC comp sync and color burst on line 94 are inserted in those holes in a conventional manner.

An analogous process of demodulation, storage and readout is performed by the circuitry comprising Demodulator 34, A/D Converter 56, FIFO Register 98, Audio Memory 100, Buffer Register 102, and D/A Converter 104. Sampling is done at a rate 150 times slower than that of the video sampling, by virtue of Divide-By-150 device 52. The Sample Clock is gated against the load gate output from Generator 44, by way of AND gate 54. However, since the audio is "active" throughout the field, no window generators are provided, nor are any reinsert circuits provided. In read-out, Audio Memory 100 simply cicles cyclically through the digitized stored audio data of channels 1, 2 and 3, respectively.

Figure 5 is a signal diagram which aids in understanding the relationship of signals utilized in connection with the audio recovery and playback function of the circuit shown in Figure 3. Figure 5(A) shows the Load Gate signal found on line 74. Figure 5(B) represents the Sample Clock output from device 52. Figure 5(C) shows the output of AND gate 54 which is applied to the three part A/D Converter 56. It will be appreciated that the signal represented in Figure 5(C) is merely the Divide-By-150 52 output gated against the Load Gate output on line 74.

Figure 5(D) shows the Audio Read Clock which is a continuous pulse train provided at a frequency substantially equal to 3/5 times the Divide-by-150 52 Sample Clock output shown in Figure 5(B), approximately 70 kHz.

Figure 6 is a circuit diagram of the Load Gate and Jump Back Pulse Generator circuit 44 of Figure 3. Line 38, which carries Disc Sync from the Demodulator and Sync Extractor 32 (Figure 3) is applied to the input of a Vertical Sync Extractor 202. The output of the Vertical Sync Extractor 202 is applied to a Count-To-Four Counter 204. Line 75, carrying the stop motion command signal, is connected to the LOAD VALUE input of Counter 204, and to the input of an Inverter 206. The output of Inverter 206 is connected to the input of an AND gate 208. The Carry output of Counter 204 is connected to the other input of AND gate 208 and to the LOAD ENABLE input of Counter 204. The output of AND gate 208 comprises line 74, and the Carry output of Counter 204 comprises line 78.

In operation, the circuit shown in Figure 6 operates as follows. V-Sync is extracted from the Disc Sync on line 38 and is applied as a pulse input to Counter 204. In the absence of a stop motion command signal, line 75 is low, and consequently Counter 204 counts from zero up to four, i.e., a count of five. With line 75 low, the output of Inverter 206 is high, and thus the Carry output of Counter 204 is passed directly to line 74. The signal contents of lines 74 and 78 are thus substantially identical, as mentioned above.

With each pulse output at the Carry output of Counter 204 the LOAD ENABLE input of Counter 204 is activated and the value on line 75 is loaded into the counter. If a stop motion command is present on line 75, the load value is a 1. In that case, Counter 204 is thus a four count counter, and Inverter 206 provides a low level signal to one input of AND gate 208, thus blocking an output from line 74, yet providing for a trip back once around each revolution of the disc, keeping it from advancing to new tracks.

It will be appreciated that the invention described herein represents a significant advance in the field of video recording generally, and more particularly in videodisc recording and reproducing systems. The invention provides for the production of disc video programs with significantly longer program times than would otherwise be obtainable, and makes efficient use of the storage space on a disc by eliminating redundant video information from the original program, all without significant loss of program content. In addi-

tion, it provides a similar technique for recording a continuous audio information signal, and recreating the continuous audio signal during the reproduction phase.

Claims

1. A method of displaying video information recorded on a disc as a plurality of substantially circular, substantially concentric information tracks, with N segments of said video information being recorded in each of said information tracks, including the steps of rotating the disc; scanning a reading beam along the information tracks in such a manner as to produce a reflected, modulated beam representative of the video information contained in the scanned tracks; converting the modulated beam into an electrical signal representative of the video information contained in the scanned tracks; transmitting the electrical signal to a memory device for temporary storage thereof, reading the stored segment from the memory device, transmitting the read out segment to a video display device and performing said reading and transmitting step several times; characterized in that the video information is bandwidth-compressed video information, said method being further characterized by the steps of rotating the disc at a prescribed velocity such that the reading beam scans (N+1) tracks in the time required to display (N−1) segments of video information; jumping the beam back by an increment of N segments after (1+1/N) revolutions of the disc; transmitting to said memory device only the electrical signal corresponding to the first segment of video information scanned after execution of said jumping back step for temporary storage thereof; reading the stored segment from the memory device such that the reading of said stored segment from said memory device is at a rate of (N−1)/(N+1) of the rate at which the bandwidth-compressed video information was originally recorded onto the disc such that said reading and transmitting step are performed (N−1) times; and consecutively repeating all of the above characterizing steps a plurality of times.

2. The method as set forth in Claim 1, further characterized by the step of transmitting only the electrical signal corresponding to the first segment of video information scanned after execution of each successive jumping back step before said performing step associated with the previous jumping back step is fully completed, to thereby ensure that the video display is continuous and uninterrupted.

3. The method as set forth in Claim 1, further characterized in that the N segments of video information in each information track are recorded as every (N−1)th segment of an overall video program, the video signals and video sync signals of the N video program segments being recorded at (N+1)/(N−1) of their standard recording speed.

4. The method as set forth in Claim 3, further characterized in that each video program segment is a field of video information.

5. The method as set forth in Claim 3, further characterized in that the audio information associated with each recorded (N−1)th video program segment and the audio information associated with the omitted/unrecorded video program segments consecutive therewith, are recorded in (N−1) separate audio channels in a bandwidth-compressed form, together with each recorded (N−1)th video program segment on the disc, said method being further characterized by the step of playing back a different one of the audio channels with each repetition of the display of the corresponding (N−1)th video program segment.

6. The method as set forth in Claim 4, further characterized in that N is an even number, thereby resulting in (N−1) repetitions of the display of alternate odd and even fields of the video program.

Patentansprüche

1. Verfahren zur Darstellung von Videoinformation, die auf einer Platte als eine Vielzahl von im wesentlichen kreisförmigen, im wesentlichen konzentrischen Informationsspuren aufgezeichnet ist, mit N Segmenten der Videoinformation, die in jeder der Informationsspuren aufgezeichnet wird, mit den Verfahrensschritten: Drehen der Platte; Führen eines Lesestrahls längs der Informationsspuren zur Abtastung in der Art, daß ein reflektierter modulierter Strahl, der repräsentativ für die Videoinformation, die in den abgetasteten Spuren enthalten ist, erzeugt wird; Umwandeln des modulierten Strahls in ein für die in den abgetasteten Spuren enthaltene Videoinformation repräsentatives elektrisches Signals; Übertragen des elektrischen Signals zu einer Speichereinrichtung zu ihrer zeitweiligen Speicherung, Lesen des gespeicherten Segments aus der Speichereinrichtung, Übertragen des ausgelesenen Segments und Ausführen des Lese- und Übertragungsschrittes mehrere Male; dadurch gekennzeichnet, daß die Videoinformation eine bandbreitenverdichtete Videoinformation ist, wobei das Verfahren weiterhin gekennzeichnet ist durch die Schritte: Drehen der Platte bei einer vorgeschriebenen Geschwindigkeit derart, daß der Lesestrahl (N+1) Spuren in der Zeit, die zur Darstellung von (N−1) Segmenten der Videoinformation erforderlich ist, abtastet; sprungweises Zurückführen des Strahls durch ein Inkrement von N Segmenten nach (1+1/N) Umdrehungen der Platte; Übertragen nur des elektrischen Signals an die Speichereinrichtung, das dem ersten Segment der Videoinformation, das nach Ausführung des Rücksprungschritts zu seiner zeitweiligen Speicherung abgetastet wird, entspricht; Lesen des gespeicherten Segments aus der Speichereinrichtung derart, daß das Lesen des gespeicherten Segments aus der Speichereinrichtung bei einer Rate von (N−1)/(N+1) von der Rate, bei welcher die bandbreitenverdichtete Videoinformation ursprünglich auf die Platte aufgezeichnet

tion, it provides a similar technique for recording a continuous audio information signal, and recreating the continuous audio signal during the reproduction phase.

Claims

1. A method of displaying video information recorded on a disc as a plurality of substantially circular, substantially concentric information tracks, with N segments of said video information being recorded in each of said information tracks, including the steps of rotating the disc; scanning a reading beam along the information tracks in such a manner as to produce a reflected, modulated beam representative of the video information contained in the scanned tracks; converting the modulated beam into an electrical signal representative of the video information contained in the scanned tracks; transmitting the electrical signal to a memory device for temporary storage thereof, reading the stored segment from the memory device, transmitting the read out segment to a video display device and performing said reading and transmitting step several times; characterized in that the video information is bandwidth-compressed video information, said method being further characterized by the steps of rotating the disc at a prescribed velocity such that the reading beam scans (N+1) tracks in the time required to display (N−1) segments of video information; jumping the beam back by an increment of N segments after (1+1/N) revolutions of the disc; transmitting to said memory device only the electrical signal corresponding to the first segment of video information scanned after execution of said jumping back step for temporary storage thereof; reading the stored segment from the memory device such that the reading of said stored segment from said memory device is at a rate of (N−1)/(N+1) of the rate at which the bandwidth-compressed video information was originally recorded onto the disc such that said reading and transmitting step are performed (N−1) times; and consecutively repeating all of the above characterizing steps a plurality of times.

2. The method as set forth in Claim 1, further characterized by the step of transmitting only the electrical signal corresponding to the first segment of video information scanned after execution of each successive jumping back step before said performing step associated with the previous jumping back step is fully completed, to thereby ensure that the video display is continuous and uninterrupted.

3. The method as set forth in Claim 1, further characterized in that the N segments of video information in each information track are recorded as every (N−1)th segment of an overall video program, the video signals and video sync signals of the N video program segments being recorded at (N+1)/(N−1) of their standard recording speed.

4. The method as set forth in Claim 3, further characterized in that each video program segment is a field of video information.

5. The method as set forth in Claim 3, further characterized in that the audio information associated with each recorded (N−1)th video program segment and the audio information associated with the omitted/unrecorded video program segments consecutive therewith, are recorded in (N−1) separate audio channels in a bandwidth-compressed form, together with each recorded (N−1)th video program segment on the disc, said method being further characterized by the step of playing back a different one of the audio channels with each repetition of the display of the corresponding (N−1)th video program segment.

6. The method as set forth in Claim 4, further characterized in that N is an even number, thereby resulting in (N−1) repetitions of the display of alternate odd and even fields of the video program.

Patentansprüche

1. Verfahren zur Darstellung von Videoinformation, die auf einer Platte als eine Vielzahl von im wesentlichen kreisförmigen, im wesentlichen konzentrischen Informationsspuren aufgezeichnet ist, mit N Segmenten der Videoinformation, die in jeder der Informationsspuren aufgezeichnet wird, mit den Verfahrensschritten: Drehen der Platte; Führen eines Lesestrahls längs der Informationsspuren zur Abtastung in der Art, daß ein reflektierter modulierter Strahl, der repräsentativ für die Videoinformation, die in den abgetasteten Spuren enthalten ist, erzeugt wird; Umwandeln des modulierten Strahls in ein für die in den abgetasteten Spuren enthaltene Videoinformation repräsentatives elektrisches Signals; Übertragen des elektrischen Signals zu einer Speichereinrichtung zu ihrer zeitweiligen Speicherung, Lesen des gespeicherten Segments aus der Speichereinrichtung, Übertragen des ausgelesenen Segments und Ausführen des Lese- und Übertragungsschrittes mehrere Male; dadurch gekennzeichnet, daß die Videoinformation eine bandbreitenverdichtete Videoinformation ist, wobei das Verfahren weiterhin gekennzeichnet ist durch die Schritte: Drehen der Platte bei einer vorgeschriebenen Geschwindigkeit derart, daß der Lesestrahl (N+1) Spuren in der Zeit, die zur Darstellung von (N−1) Segmenten der Videoinformation erforderlich ist, abtastet; sprungweises Zurückführen des Strahls durch ein Inkrement von N Segmenten nach (1+1/N) Umdrehungen der Platte; Übertragen nur des elektrischen Signals an die Speichereinrichtung, das dem ersten Segment der Videoinformation, das nach Ausführung des Rücksprungschritts zu seiner zeitweiligen Speicherung abgetastet wird, entspricht; Lesen des gespeicherten Segments aus der Speichereinrichtung derart, daß das Lesen des gespeicherten Segments aus der Speichereinrichtung bei einer Rate von (N−1)/(N+1) von der Rate, bei welcher die bandbreitenverdichtete Videoinformation ursprünglich auf die Platte aufgezeichnet

wurde, erfolgt, so daß der Lese- und Übertragungsschritt (N−1) Male ausgeführt wird; und fortlaufendes Wiederholen aller oben genannten kenn zeichnenden Verfahrensschritte eine Vielzahl von Malen.

2. Verfahren nach Anspruch 1, weiterhin gekennzeichnet durch den Verfahrensschritt der Übertragung nur des elektrischen Signals, das dem ersten Segment der Videoinformation entspricht, das nach Ausführung von jedem aufeinanderfolgenden Rücksprungschritt bevor der mit dem vorherigen Rücksprungschritt verbundene Ausführungsschritt vollständig abgeschlossen ist, abgetastet wird, um dadurch zu sichern, daß die Videodarstellung kontinuierlich und ununterbrochen ist.

3. Verfahren nach Anspruch 1, weiterhin durch gekennzeichnet, daß die N Segmente von Videoinformation in jeder Informationsspur als jedes (N−1)te Segment eines Gesamtvideoprogramms aufgezeichnet werden, und die Videosignale und Videosynchronsignale der N Videoprogrammsegmente bie (N+1)/(N−1) von ihrer Standardaufzeichnungsgeschwindigkeit aufgezeichnet werden.

4. Verfahren nach Anspruch 3, weiterhin dadurch gekennzeichnet, daß jedes Videoprogrammsegment ein Feld einer Videoinformation ist.

5. Verfahren nach Anspruch 3, weiterhin dadurch gekennzeichnet, daß die mit jedem aufgezeichneten (N−1)ten Videoprogrammsegment verbundene Audioinformation und die Audioinformation, die mit den weggelassenen/unaufgezeichneten damit parallel laufenden Videoprogrammsegmenten verbunden ist, in (N−1) separaten Audiokanälen in einer bandbreitenverdichten Form zusammen mit jedem aufgezeichneten (N−1)ten Videoprogrammsegmet auf der Platte aufgezeichnet werden, wobei das Verfahren weiterhin durch den Schritt der Wiedergabe eines anderen der Audiokanäle mit jeder Wiederholung der Darstellung des entsprechenden (N−1)ten Videoprogrammsegments gekennzeichnet ist.

6. Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß N eine gerade Zahl ist, und sich dadurch (N−1) Wiederholungen der Darstellung von abwechselnd ungeradzahligne und geradzahligen Feldern des Videoprogramms ergeben.

Revendications

1. Procédé de visualisation d'informations vidéo enregistrées sur un disque en un certain nombres de pistes d'informations sensiblement circulaires, sensiblement concentriques, avec N segments d'informations vidéo enregistrées dans chacune des pistes d'informations, comprenant les étapes d'entraîner en rotation le disque; balayer un faisceau de lecture le long des pistes d'informations de manière à produire un faisceau réfléchi, modulé, représentatif de l'information vidéo contenue dans les pistes balayées; convertir le faisceau modulé en un signal électrique représentatif de l'information vidéo contenue dans les pistes balayées; transmettre le signal électrique à un dispositif mémoire pour enregistrement temporaire de celui-ci, lire le segment enregistré du dispositif mémoire, transmettre le segment lu à un dispositif de visualisation vidéo et accomplir les étapes de lecture et de transmission plusieurs fois; caractérisé en ce que l'information vidéo est une information vidéo compressée sur largeur de bande, le procédé étant de plus caractérisé par les étapes d'entraîner en rotation le disque à une vitesse prescrite telle que le faisceau de lecture balaye (N+1) pistes dans le temps requis pour visualiser (N−1) segments d'information vidéo; sauter en arrière le faisceau d'un incrément de N segments après (1+1/N) tours du disque; transmettre au dispositif mémoire seulement le signal électrique correspondant au premier segment d'information vidéo balayée après exécution de l'étape de saut en arrière pour enregistrement temporaire de celui-ci; lire le segment enregistré du dispositif mémoire de façon que la lecture du segment enreigstré du dispositif mémoire soit à une fréquence de (N−1)/(N+1) de la fréquence à laquelle l'information vidéo comprimée en largeur de bande a été enregistrée à l'origine sur le disque de façon que les étapes de lecture et de transmission soient accomplies (N−1) fois; et répéter consécutivement toutes les étapes caractéristiques ci-dessus plusieurs fois.

2. Procédé selon la revendication 1, caractérisé de plus par l'étape de transmettre seulement le signal électrique correspondant au premier segment d'information vidéo balayé après exécution de chaque étape successive de saut en arrière après que l'étape d'accomplissement associé à l'étape prévue de saut en arrière soit accomplie complètement, pour assurer de la sorte que la visualisation vidéo soit continue et ininterrompue.

3. Procédé selon la revendication 1, caractérisé de plus en ce que les N segments d'information vidéo dans chaque piste d'informations sont enregistrés comme tout (N−1)ème segment d'un programme vidéo complet, les signaux vidéo et les signaux de synchronisation vidéo des N segments du programme vidéo étant enregistrés à (N+1)/(N−1) de leur vitesse d'enregistrement standard.

4. Procédé selon la revendication 3, caractérisé de plus en ce que chaque segment de programme vidéo est une trame d'information vidéo.

5. Procédé selon la revendication 3, caractérisé de plus en ce que l'information du son associée à chaque (N−1)ème segment de programme vidéo enregistré et l'information du son associée aux segments du programme vidéo omis/non enregistrés consécutifs à celui-ci, sont enregistrées dans (N−1) canaux audio séparés sous forme comprimée en largeur de bande, ensemble avec chaque (N−1)ème segment du programme vidéo enregistré sur le disque, le procédé étant de plus caractérisé par l'étape de lire l'un différent des canaux audio avec chaque répétition de la visuali-

sation du (N−1)ème segment correspondant du programme vidéo.

6. Procédé selon la revendication 4, caractérisé de plus en ce que N est un nombre pair, résultant de la sorte en (N−1) répétitions de la visualisation de trames alternées impaires et paires du programme vidéo.