Description

Field of the Invention

This invention relates to a method and an apparatus for recovering information from video recording discs according to the preamble of claims 1 and 5.

Description of the Prior Art

Prior art apparatus directs a reading beam of light at a selected one of a plurality of spiraling and substantially circular information tracks or concentric circular information tracks on a rotatable recording disc. The intensity of the beam is modulated by the recorded information which includes a unique address signal for each track and the apparatus detects the modulated beam to produce a playback signal indicative of the recorded information.

The known apparatus includes means for selecting a particular target track to be scanned, together with a carriage motor and a movable mirror for moving the reading beam radially toward the target track with coarse and fine movements, respectively. The apparatus further includes means for monitoring the playback signal to detect periodically the track identifying code, or address, of the track currently being scanned. Such current address is compared to the target track identifying code, or address, and the apparatus applies prescribed sequential drive signals to the carriage motor, depending on the remaining distance to the target track. The speed of the carriage motor is stepped successively downwardly as the reading beam reaches predetermined distance thresholds during carriage translation. During the last stage of carriage translation, the movable mirror incremenets the beam radially by one track spacing during each revolution of the disc, thereby "playing" into the target track.

A shortcoming of the prior art concerns the fact that the program material arranged on a videodisc was rather consecutively structured when the disc was made. In other words, information to be communicated to the user was organized in a rather straight forward cascade of information segments. When, for example, appropriate instruction in a learning situation has been given, a series of questions would be presented to the user to test his learning ability, comprehension, and retention of facts. Accordingly, a series of questions would be displayed on the screen or a similar series of questions would be presented audibly to the user. The problem with such a straight forward approach is that the same disc provides the same questions in the same order each time the user reviews the material. To create a wider interest in the learning process, and to prevent cheating by one student user having learned the order of answers from another student user, as well as for many other related reasons, there is a need to provide a randomness to the manner in which questions to tests are given. Of course, there would also be a need for such random presentation of information even out of a test-giving situation to create additional interest for the user and enhance the overall value of recorded programs.

SMPTE Journal, Vol. 86, No, 2, Feb. 1977, pages 80—83 describes a videodisc system with each frame being encoded so that it can be located by an electronic search technique making it possible to provide a fast random access.

DE-A-2 803 599 discloses an apparatus with the capability of random branching among a series of questions and of evaluation the given answers.

Brief Description of the Invention

The object of the invention is to provide a disc player and method for generating a random list of instructions for the disc player, so that random information can be presented to the user when such random instructions are encountered on playback of the disc. For example, the disc can contain at one point in a recorded program a series of ten questions occupying ten different tracks on the disc. If each time the user was quizzed he or she was presented with the same questions, the test would quickly become boring. Furthermore, if it was the intent to ask only a few questions, it would be easy for a person taking the quiz to get answers from a previous user, and this would destroy the value of the quiz given. The random command feature of the present invention should permit branching out at a particlar point in the program material to one of a group of questions in rather random form. A random number generator is provided, and depending upon the number arrived at randomly, a series of questions, for example three randomly picked from the set of ten, would be presented to the viewer. Upon replaying the disc and arriving at the same point of decision to present questions, the random effect would result in presenting the viewer with a different set of three questions from the available ten. Additionally, even each random question, after it is presented, could branch to another random question or the next in line of a series of questions. In the former case, the questions would indeed be randomly selected individually from a large group, and in the latter case a new group of questions would be selected from possibly a large number of question groups. Of course, other practical uses for the random command feature according to this object of the invention are realizable, and the above are merely examples.

In the broadest aspect the invention provides a solution as claimed in claims 1 and 5.

Brief Description of the Drawings

Figure 1 is a general block diagram of the components of a videodisc player which functions to carry out the objects of the invention.

Figure 2 is a more detailed block diagram of the portion of Figure 1 concerning the tracking and track jumping characteristics of the invention;

Figure 3 is an illustration of the relationship between an open loop tracking error signal and the radial cross-section of tracks on a videodisc;

Figure 4 is a block diagram of the circuitry

needed to carry out the random-command function of the present invention; and

Figure 5 is a pictorial representation illustrating one example of the use of the random-command feature of the invention.

Detailed Description of the Preferred Embodiments

Referring now to the drawings, and particularly to Figure 1, there is shown apparatus for moving a reading beam of light 11 in a radial direction relative to a rotating recording disc 13, to recover information from a selected target track on the disc. The disc includes a plurality of closely spaced, ciarcular and concentric recording tracks, and each track records a video signal representing one or more video frames, with a unique frame or track address signal located in each vertical interval (i.e., two address signals per frame).

The apparatus includes a spindle motor 15 for rotating the recording disc 13 at a prescribed constant angular velocity, and an optical system 17 and an objective lens 19 for focusing the reading beam 11 onto a selected track of the rotating disc. The reading beam is reflected by the disc to produce a reflected beam 21 having an intensity that is modulated in accordance with the recorded information. The objective lens and optical system direct this reflected beam to a detector 23 which detects and demodulates the modulated intensity of the beam to produce a baseband video signal corresponding, to the recorded information. This video signal is coupled over line 25 to both a monitor 27 and an address recovery and estimator circuit 29. The monitor provides a real-time display of the video signal recovered from the target track, and the address recovery circuit detects the address signals in the successive vertical intervals of the video signal, using conventional techniques. The address recovery circuit then updates an address register 30 with each detected track address signal.

The apparatus further includes a coarse positioning system and a fine positioning system for controllably moving the reading beam 11 radially relative to the disc 13, toward the selected target track on the disc. The coarse positioning system includes a carriage motor 31 and appropriate gearing 33 for moving the beam at a selected one of two relatively high radial velocities (e.g., 100 and 500 tracks per disc revolution). The fine positioning system includes a movable mirror (not shown) located in the optical system 17 for contrallably adjusting the beam's point of impingement on the disc over a relatively small range (e.g., about 50 tracks in either direction).

When a user desires to recover information recorded on a selected target track on the disc 13, he or she inputs a special target address code signal on line 35, indicating the target track's address. A function generator 37 compares this target address signal with the address signal currently being stored by the address register 30. In accordance with a prescribed algorithm, the function generator determines the radial separation between the current track and the target track, and outputs appropriate control signals to controllably drive the carriage motor 31 and the movable mirror of the optical system 17 so as to move the reading beam 11 toward the target track. These control signals are sequenced such that the beam reaches the target track in a time substantially less than that achieved by prior apparatus of this kind.

The carriage motor 31 is driven at a prescribed velocity (or sequence of velocities) until the reading beam 11 has been moved to within a prescribed number of tracks of the target track, after which the movable mirror of the optical system 17 is conditioned to incrementally jump the beam from one track to the next a plurality of times during each half revolution of the disc 13.

More particularly, the coarse positioning system further includes a track scan driver 39 and a carriage motor tachometer 41 for controllably driving the carriage motor 31 in the prescribed fashion. The function generator 37 outputs a plurality of velocity commands for coupling over lines 43a-d to the track scan driver, which, in turn, controllably adjusts a dc drive signal coupled over line 45 to the carriage motor. The tachometer feeds back to the track scan driver over line 47 a carriage tachometer signal indicating the carriage motor's angular velocity, to enhance control of that velocity. Also, a dc tracking error signal is coupled to the track scan driver over line 49 to controllably move the carriage motor so as to reduce any steady state deflection of the movable mirror of the optical system 17.

Referring again to Figure 1, the fine positioning system further includes a tracking servo in the form of a tracking controller 67 for producing a radial correction signal for coupling over line 69 to the movable mirror of the optical system 17. Depending on the operating mode of the apparatus, this signal either maintains the reading beam 11 aligned with a selected target track, or incrementally jumps the beam from track to track while approaching the target track. The tracking controller receives a plurality of track jump commands supplied on lines 71, 73 and 75 from the function generator 37, along with a tracking error signal supplied on line 77 from the detector 23.

When the apparatus is operating in a mode in which the reading beam 11 is to be maintained in alingment with a selected track, the tracking controller 67 merely amplifies the tracking error signal and couples it directly to the movable mirror of the optical system 17, to form a conventional closed loop tracking servo for controllably aligning the beam with the track. On the other hand, when the apparatus is in a search mode in which the beam is to be moved incrementally from track to track, the tracking error signal is uncoupled from the movable mirror, and a prescribed sequence of pulses is coupled in its place.

The tracking controller 67 is depicted in greater

detail in Figure 2. It includes a disable switch circuit 79, an amplifier 81, and a power driver 83, for amplifying the tracking error signal supplied on line 77 and outputting it as the radial correction signal for coupling over line 69 to controllably position the movable mirror of the optical system 17 (Figure 1). The tracking error signal is coupled through the disable circuit 79 at all times except during the search mode of operation or when jumping multiple tracks in a jump mode to be discussed later. The output of the disable circuit is coupled over line 85 to the negative input terminal of the amplifier 81, and the ouptut of the amplifier is, in turn, coupled over line 87 to the power driver 83, which outputs the radial correction signal. The signal output on line 85 by the disable circuit is also coupled to a low-pass filter 89 to produce the dc tracking error signal for coupling on line 49 to the track scan driver 39 (Figure 1).

At the beginning stage of each search mode of operation in which the carriage motor 31 moves the reading beam 11 rapidly toward a target track, the tracking error signal experiences wide variations in level as the beam crosses the successive tracks. With reference to Figure 3, which is a fragmentary cross-sectional view of the disc 13 showing three recording tracks along a disc radius, it will be observed that the open-loop tracking error signal is a large amplitude ac signal having a level of zero at the center line 91 of each track. The disable circuit 79 uncouples the tracking error signal from the amplifier 81 at this time, to ensure that the apparatus does not attempt to controllably align the reading beam 11 with any track as it moves radially toward the target track.

In the search mode of operation, the coarse positioning system, which includes the carriage motor 31, operates whenever the distance between the target track and the present track exceeds a prescribed threshold, and the fine positioning system, which includes the movable mirror of the optical system 17, operates whenever this distance does not exceed the threshold. When the coarse positioning system is operating, a tracking disable command is coupled over line 71 from the function generator 37 to the tracking controller 67. This signal is coupled through an OR gate 93, and in turn over line 95 to the disable circuit 79, to uncouple the tracking error signal from the amplifier 81. The radial correction signal output by the tracking controller 67 on line 69 therefore has a level of zero, and the movable mirror remains stationary.

After the reading beam has been moved to a position within a prescribed number of tracks of the target track, the function generator 37 (Figure 1) no longer outputs velocity commands to the track scan driver 39, and the carriage motor 31 is no longer driven at a relatively high speed. A prescribed time delay thereafter, the function generator terminates the tracking disable command previously coupled over line 71 to the tracking controller 67, so that the tracking error signal is again coupled through the tracking controller to form the tracking servo loop for controllably aligning the reading beam 11 with whatever recording track the beam arrives at. Thereafter, the tracking controller outputs a prescribed sequence of pulses to jump the reading beam incrementally from track to track until it reaches the target track.

To effect the incremental jumping, the tracking controller 67 includes a kick generator 97, a zero crossing detector 99, a jumps-down counter 101, and a flip-flop 103. When the incremental jumping is to be initiated, a binary code indicating the number of tracks (e.g., 11 tracks) to be jumped during the next half revolution of the disc 13 is supplied on lines 73 from the function generator 37 and entered into the jumps-down counter. Simultaneously, a jump command signal supplied on line 75 from the function generator is coupled to the set direct input terminal of the flip-flop. This sets the Q output signal into the logical "1" state, and this signal is coupled over line 105 to the OR gate 93, and in turn over line 95 to the disable circuit 79, to open the tracking servo loop.

The $\overline{Q}$ output signal of the flip-flop 103 is coupled over line 107 to the kick generator 97, which responds by outputting a single pulse signal for coupling over line 109 to the positive input terminal of the amplifier 81. This pulse signal is coupled through the amplifier and power driver 83 to the movable mirror of the optical system 17, to accelerate the reading beam 11 in the direction of the target track.

After the reading beam has been accelerated in the direction of the target track by the kick generator 97, the zero crossing detector 99 monitors the open loop tracking error signal (Figure 3b) supplied on line 77 and outputs a clock pulse each time it detects a track crossing by the beam. These successive clock pulses are coupled over line 111 to the clock terminal of the jumps-down counter 101, to decrement the stored count, accordingly. When the count reaches zero, the counter outputs a reset pulse for coupling over line 113 to the reset direct terminal of the flip-flop 103.

The reset pulse coupled over line 113 to the reset direct terminal of the flip-flop 103 returns the $\overline{Q}$ output signal to the logical "1" state, which triggers the kick generator 97 to output a pulse of opposite polarity to that of the original pulse, thereby decelerating the movable mirror. The reset pulse simultaneously returns the Q output signal of the flip-flop to the logical "0" state, so that the tracking servo loop is no longer disabled by the disable circuit 79 and the loop can again function to controllably align the reading beam 11 with the track then being scanned. During this time, the dc tracking error signal is coupled on line 49 to the track scan driver 39, to controllably move the carriage motor 31 so as to reduce the deflection of the movable mirror.

For a low number of tracks to jump, e.g., ten or less, the reading beam 11 preferably traverses the prescribed number of tracks during the vertical interval. Since the monitor screen is then blanked, a noiseless jump will have been effectuated.

The kick generator 97 can include two mono-

stable multivibrator or one-shot circuits, one triggered by a positive-going transition and the other by a negative-going transition. The kick generator can further include appropriate gating circuits to ensure that the successive pulses it produces have the correct polarity to move the reading beam 11 in the direction of the target track. These gating circuits are responsive to the forward and reverse direction commands supplied on lines 43c and 43d, respectively.

In an alternative embodiment, the tracking controller 67 radially accelerates and decelerates the reading beam 11 such that it moves by just one track spacing each time.

After the reading beam 11 finally reaches the target track, the apparatus can operate, for example, in a stop-motion mode, to scan the track repeatedly and display the recovered video signal. If the successive tracks are arranged in a spiral pattern the apparatus must jump the beam backward by one track spacing during each disc revolution, preferably during a vertical interval.

Random Command Function

Figure 4 shows a functional block diagram of the random command function acrding to the present invention. Figure 5 illustrates graphically the motion of the read beam when following a series of random command instructions.

When a disc is being played, each operational function of the machine under control of the microprocessor begins in orderly fashion after the conclusion of the preceding instruction. As a result, the orderly sequence of instructions can be thought of as an instruction stream flowing from the microprocessor and being interpreted by the player by analyzing the commands contained in each instruction. Figure 4 illustrates the basic operation of receiving an instruction stream over line 297 and extracting, in command extractor 291, the command portion of the instruction and routing it to command interpreter 292 which then translates the command instruction to functional commands for the player. Likewise, the instruction stream enters argument extractor 293, and the numbers converter 294 extracts the argument portion of the instruction and sets it in shift register 295. The argument, for example a particular frame number in the recorded video program, is sent over line 300 to command interpreter 292 and becomes a part of the command function. Thus, the command output of command interpreter 292 contains a player functional control portion and an argument portion. Generally, the argument portion of the instruction sets forth a particular frame, and the command portion tells the player what to do at or with that frame. In a typical instruction, for example, the instruction "1200 search" is interpreted as commanding the player to carry out its searching function while looking for frame number 1200.

As explained earlier, in instances where the argument portion of the instruction is advantageously an unpredictable or random number, it is necessary that the argument extractor 293 not pass the argument through the command interpreter directly as received from the instruction stream, but rather to supply a random number on line 300.

To accomplish this desired result, a command, for example RND command, recognized by the command extractor 291 is sent over line 298 to a shift register 295 in the argument extractor 293. This recognition of the RND command will load a random number from random number generator 296 into shift register 295. As a result, a random number is outputted over line 300 as an argument to the command interpreter, and the stated objective is met.

If desired, the normal argument in the instruction converted in number converter 294 can be used as a basis for establishing a reference for the random number generator 296. For example, rather than to have any random number produced by generator 296 to be loaded into shift register 295, the number exiting numbers converter 294 can represent a starting number from which a set of random numbers takes reference. Thus, if the argument exiting numbers converter 294 is 1200, the numbers loaded into shift register 295 could be any selectable range of numbers beginning at 1200. If a quiz having ten questions is presented at frames 1200 through 1209, then random numbers generator 296 would merely add, for each random command, any one of numbers 0 through 9 to the 1200 number exiting numbers converter 294, and this would result in loading shift register 295 with one of the numbers randomly selected from the set of numbers 1200 through 1209.

After the command instruction has been executed, a command end signal exiting the command interpreter 292 over line 299 will clear shift register 295 ready for the next instruction. In Figure 5, the line 301 indicates a linear relationship between playing time and the number of the track being played at that time. At some point in time, for example after perhaps 12,000 tracks have been played, a random command instruction could be given to instruct the player to jump to any one of a plurality of tracks in the vicinity of track 25,000. This could happen, for example, if an "autostop" command were initially set at the beginning of playing time in Figure 5, the "autostop" command merely placing the player in a stop motion condition upon recognition of a comparison between a preset frame number and the frame number recovered from the disc while playing. Thus, if the autostop frame number had been chosen at frame 12,000, the player would play along line 301 in Figure 5 until frame 12,000 was identified in the comparator, and reference is made to the previous discussion of Figure 1 concerning blocks 29, 30, and 37 of that figure.

At the conclusion of that "autostop" command, the next instruction is assumed to be a random command instruction causing the player to immediately search for a randomly selected one of a plurality of numbers at track 25,000. This is shown at point A in Figure 5. After arriving at the

randomly chosen frame number in the vicinity of track 25,000, the player plays that randomly selected track shown at 302 in the drawing until another command instruction is received. In Figure 5, two possibilities are shown, one at Point B merely being a repetition of the kind of random search instruction given at point A, with the exception that after finding the randomly selected track in the vicinity of track 45,000, the randomly selected track would be played in a stop motion mode indicated at 303 in the figure. Had the random number selected been a different one, it could have followed a different command at the end of playing that segment of the disc identified in the figure as 302, and as a result, a search command could have directed the reading beam to the vicinity of track 20,000 to stop motion at one of an arbitrarily or randomly chosen track in that vicinity, and this is shown at 304 in the drawing. At point D is illustrated the possibility of returning, again randomly, to one of the tracks in the vicinity of track 25,000 in a manner similar to that described in connection with point A in the figure. If the group of tracks at point A were, for example, questions to a quiz, after having passed through points D and/or C, another one of the same group of questions could be presented at point D, and the play mode shown at 305 would be similar to that shown at 302, and the process repeated until all of the question of the quiz, or a predetermined number of them, were asked. In this connection, random number generator 296 can be, if desired, arranged to randomly select a number from a group of numbers without repeating a prior selected number. This would assure that the same question would not be asked twice on a quiz.

Claims

1. A method for recovering information from a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc (13), each said track containing at least in part a unique track identifying code, said method characterized by the steps of: establishing a plurality of reference track identifying codes and a group of related track identifying codes for each one of said plurality of reference track identifying codes; selecting one of said plurality of reference track identifying codes; generating a random-command signal (37); randomly selecting (296), in response to said random-command signal, a single track identifying code from said group of related track identifying codes associated with said selected reference track identifying code; and, playing the track corresponding to the randomly selected track identifying code.

2. The method as claimed in Claim 1, including the steps of: continuing to play the disc from said track corresponding to said randomly selected track identifying code; generating a plurality of successive random-command signals; and, repeatedly branching to successive tracks corresponding to successive, random track identifying codes, in response to said plurality of successive random-command signals.

3. The method as claimed in Claim 1, wherein each random-command signal comprises, randomly, one of two instructions, the first being an instruction to continue to play from the point at which the random-command signal is given and without branching, and the second being to branch to a specified downstream address location and play from that point.

4. The method as claimed in Claim 3, wherein: the randomness of selection of the first and second instructions is uniform to provide a 50% chance for selecting one or the other said first and second instructions; and, one or more further branch instructions are subsequently given after the first random-command signal is detected, the number of branching paths being selected such that the probability of ultimately arriving at any one of N locations on the disc is equal for all locations.

5. Apparatus for recovering information from a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc (13), each said track containing at least in part a unique track identifying code, said apparatus characterized by means for establishing a plurality of reference track identifying codes and a group of related track identifying codes for each one of said plurality of reference track identifying codes; means (37) for selecting one of said plurality of reference track identifying codes; means (37) for generating a random-command signal; means (296), responsive to said random-command signal, for randomly selecting a single track identifying code from said group of related track identifying codes associated with said selected reference track identifying code; and, means for playing the track corresponding to the randomly selected track identifying code.

6. The apparatus as claimed in Claim 5, including: means for continuing to play the disc from said track corresponding to said randomly selected track identifying code; means for generating a plurality of successive random-command signals; and, means for repeatedly branching to successive tracks corresponding to successive, random track identifying codes, in response to said plurality of successive random-command signals.

7. The apparatus as claimed in Claim 5, wherein each random-command signal comprises, randomly, one of two instructions, the first being an instruction to continue to play from the point at which the random-command signal is given and without branching, and the second being to branch to a specified downstream address location and play from that point.

8. The apparatus as claimed in Claim 7, wherein the randomness of selection of the first and second instructions is uniform to provide a 50% chance for selecting one or the other of said first and second instructions; and, wherein said

randomly chosen frame number in the vicinity of track 25,000, the player plays that randomly selected track shown at 302 in the drawing until another command instruction is received. In Figure 5, two possibilities are shown, one at Point B merely being a repetition of the kind of random search instruction given at point A, with the exception that after finding the randomly selected track in the vicinity of track 45,000, the randomly selected track would be played in a stop motion mode indicated at 303 in the figure. Had the random number selected been a different one, it could have followed a different command at the end of playing that segment of the disc identified in the figure as 302, and as a result, a search command could have directed the reading beam to the vicinity of track 20,000 to stop motion at one of an arbitrarily or randomly chosen track in that vicinity, and this is shown at 304 in the drawing. At point D is illustrated the possibility of returning, again randomly, to one of the tracks in the vicinity of track 25,000 in a manner similar to that described in connection with point A in the figure. If the group of tracks at point A were, for example, questions to a quiz, after having passed through points D and/or C, another one of the same group of questions could be presented at point D, and the play mode shown at 305 would be similar to that shown at 302, and the process repeated until all of the question of the quiz, or a predetermined number of them, were asked. In this connection, random number generator 296 can be, if desired, arranged to randomly select a number from a group of numbers without repeating a prior selected number. This would assure that the same question would not be asked twice on a quiz.

Claims

1. A method for recovering information from a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc (13), each said track containing at least in part a unique track identifying code, said method characterized by the steps of: establishing a plurality of reference track identifying codes and a group of related track identifying codes for each one of said plurality of reference track identifying codes; selecting one of said plurality of reference track identifying codes; generating a random-command signal (37); randomly selecting (296), in response to said random-command signal, a single track identifying code from said group of related track identifying codes associated with said selected reference track identifying code; and, playing the track corresponding to the randomly selected track identifying code.

2. The method as claimed in Claim 1, including the steps of: continuing to play the disc from said track corresponding to said randomly selected track identifying code; generating a plurality of successive random-command signals; and, repeatedly branching to successive tracks corresponding to successive, random track identifying codes, in response to said plurality of successive random-command signals.

3. The method as claimed in Claim 1, wherein each random-command signal comprises, randomly, one of two instructions, the first being an instruction to continue to play from the point at which the random-command signal is given and without branching, and the second being to branch to a specified downstream address location and play from that point.

4. The method as claimed in Claim 3, wherein: the randomness of selection of the first and second instructions is uniform to provide a 50% chance for selecting one or the other said first and second instructions; and, one or more further branch instructions are subsequently given after the first random-command signal is detected, the number of branching paths being selected such that the probability of ultimately arriving at any one of N locations on the disc is equal for all locations.

5. Apparatus for recovering information from a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc (13), each said track containing at least in part a unique track identifying code, said apparatus characterized by means for establishing a plurality of reference track identifying codes and a group of related track identifying codes for each one of said plurality of reference track identifying codes; means (37) for selecting one of said plurality of reference track identifying codes; means (37) for generating a random-command signal; means (296), responsive to said random-command signal, for randomly selecting a single track identifying code from said group of related track identifying codes associated with said selected reference track identifying code; and, means for playing the track corresponding to the randomly selected track identifying code.

6. The apparatus as claimed in Claim 5, including: means for continuing to play the disc from said track corresponding to said randomly selected track identifying code; means for generating a plurality of successive random-command signals; and, means for repeatedly branching to successive tracks corresponding to successive, random track identifying codes, in response to said plurality of successive random-command signals.

7. The apparatus as claimed in Claim 5, wherein each random-command signal comprises, randomly, one of two instructions, the first being an instruction to continue to play from the point at which the random-command signal is given and without branching, and the second being to branch to a specified downstream address location and play from that point.

8. The apparatus as claimed in Claim 7, wherein the randomness of selection of the first and second instructions is uniform to provide a 50% chance for selecting one or the other of said first and second instructions; and, wherein said

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means for initiating random-command signals issues one or more further branch signals after the first random-command signal is detected, the number of branching paths being selected such that the probability of ultimately arriving at any one of N locations on the disc is equal for all locations.

Patentansprüche

1. Verfahren zum Wiederauffinden von Informationen in mehreren spiralförmigen und im wesentlichen kreisrunden Informationsspuren oder in konzentrischen, kreisrunden Informationsspuren auf einer der Aufzeichnung dienenden, scheibenförmigen Platte (13), wobei jede Spur zumindest teilweise einen einmaligen, die Spur identifizierenden Code enthält, gekennzeichnet durch die Schritte, mehrere eine Bezugsspur identifizierenden Codes und für jeden der die Bezugsspur identifizierenden Codes eine Gruppe von Codes aufzustellen, die in Beziehung stehende Spuren identifizieren, einen der die Bezugsspur identifizierenden Codes auszuwählen, ein einen willkürlichen Befehl angebendes Signal (37) zu erzeugen, in Abhängigkeit von diesem einen willkürlichen Befehl angebenden Signal einen eine einzige Spur identifizierenden Code aus einer Gruppe von in Beziehung stehende Spuren identifizierenden Codes zu wählen (296), die dem gewählten, eine Bezugsspur identifizierenden Code zugeordnet ist, und entsprechend dem die willkürlich gewählte Spur identifizierenden Code die Spur abzuspielen.

2. Verfahren, wie im Anspruch 1 beansprucht, zu dem die Schritte gehören, die scheibenförmige Platte an der Spur, die dem die willkürlich gewählte Spur identifizierenden Code entspricht, weiterhin abzuspielen, mehrere aufeinanderfolgende, je einen willkürlichen Befehl angebende Signale zu erzeugen und in Abhängigkeit von mehreren aufeinanderfolgenden, je einen willkürlichen Befehl angebenden Signalen wiederholt auf aufeinanderfolgende Spuren abzuzweigen, die den aufeinanderfolgenden Codes entsprechen, die willkürliche Spuren identifizieren.

3. Verfahren, wie im Anspruch 1 beansprucht, bei dem jedes einen willkürlichen Befehl angebende Signal zufällig eine von zwei Instruktionen enthält, von denen die erste der Fortsetzung des Abspielens von dem Punkt aus, an dem das den willkürlichen Befehl angebende Signal gegeben wird, ohne abzuzweigen, dient und die zweite für eine Abzweigung zu einem vorgeschriebenen, in der Folge tiefer liegenden Adressenplatz bestimmt wird, von dem aus abgespielt wird.

4. Verfahren, wie im Anspruch 3 beansprucht, bei dem eine Auswahl der ersten und zweiten Instruktion vollkommen zufällig vorgenommen wird, um eine 50 %ige Chance für diese Auswahl vorzusehen, und nach der Wahrnehmung des ersten, einen willkürlichen Befehl angebenden Signals eine oder mehrere weitere Abzweiginstruktionen der Reihe nach gegeben werden, wobei die Anzahl der Abzweigbahnen derart gewählt wird, daß die Wahrscheinlichkeit, endgültig an einem von N Plätzen auf der scheibenförmigen Platte anzukommen, für alle Plätze gleich ist.

5. Gerät zum Wiederauffinden von Informationen an mehreren spiralförmigen und im wesentlichen kreisrunden Informationsspuren oder an konzentrischen, kreisrunden Informationsspuren auf einer der Aufzeichnung dienenden, scheibenförmigen Platte (13), die jeweils zumindest teilweise einen einmaligen, die Spur identifizierenden Code enthalten, gekennzeichnet durch Hilfsmittel zum Aufstellen mehrerer je eine Bezugsspur identifizierenden Codes und für jeden dieser je eine Bezugsspur identifizierenden Codes einer Gruppe in Beziehung stehende Spuren identifizierender Codes, durch Hilfsmittel (37) zur Auswahl eines unter den je eine Bezugsspur identifizierenden Codes, durch Hilfsmittel (37) zur Erzeugung eines einen willkürlichen Befehl angebenden Signals, durch Hilfsmittel (296), die auf das einen willkürlichen Befehl angebende Signal ansprechen, um willkürlich einen einzelnen eine Spur identifizierenden Code aus der Gruppe von in Beziehung stehenden, eine Spur identifizierenden Codes auszuwählen, die dem gewählten, eine Bezugsspur identifizierenden Code zugeordnet ist, und durch Hilfsmittel zum Abspielen der Spur, die dem die willkürlich gewählte Spur identifizierenden Code entspricht.

6. Gerät, wie im Anspruch 5 beansprucht, mit Hilfsmitteln zum weiteren Abspielen der scheibenförmigen Platte an der Spur, die dem die willkürlich gewählte Spur identifizierenden Code entspricht, mit Hilfsmitteln zur Erzeugung mehrerer aufeinanderfolgender, einen willkürlichen Befehl angebender Signale und mit Hilfsmitteln, die in Abhängigkeit von aufeinanderfolgenden, einen willkürlichen Befehl angebenden Signalen in Übereinstimmung mit aufeinanderfolgenden, eine willkürliche Spur identifizierenden Codes wiederholt nach aufeinanderfolgenden Spuren hin eine Abzweigung vornehmen.

7. Gerät, wie im Anspruch 5 beansprucht, bei dem jedes einen willkürlichen Befehl angebende Signal zufällig eine von zwei Instruktionen enthält, von denen die eine für die Fortsetzung des Abspielens von dem Punkt aus bestimmt ist, an dem das einen willkürlichen Befehl angebende Signal, ohne eine Abzweigung vorzunehmen, ausgegeben wird, und die andere der Abzweigung zu einem vorgeschriebenen, in der Folge tiefer liegenden Adressenplatz und dem Abspielen von jenem Punkt aus dient.

8. Gerät, wie im Anspruch 7 beansprucht, bei dem die Auswahl der beiden Instruktionen zur Schaffung einer 50 %igen Chance für die Auswahl der einen oder anderen Instruktion vollkommen zufällig ist, und bei dem die Hilfsmittel zur Ingangsetzung von einen willkürlichen Befehl angebenden Signalen ein oder mehrere weitere Abzweigsignale nach der Wahrnehmung des ersten einen willkürlichen Befehl angebenden Signals ausgeben, wobei die Anzahl der Abzweigbahnen derart gewählt ist, daß die Wahrscheinlichkeit, endgültig

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bei einem der N Plätze auf der scheibenförmigen Platte anzukommen, für alle Plätze gleich ist.

Revendications

1. Procédé pour recueillir des informations d'une pluralité de pistes d'information en spirale et sensiblement circulaires ou de pistes d'information circulaires concentriques sur un disque d'enregistrement (13), chacune desdites pistes contenant au moins en partie un code d'identification de piste unique, ledit procédé étant caractérisé par les étapes de: établir une pluralité de codes d'identification de piste de référence et un groupe de codes d'identification de piste correspondants pour chacun de ladite pluralité de codes d'identification de piste de référence; choisir l'un de ladite pluralité de codes d'identification de piste de référence; produire un signal de commande aléatoire (37); choisir de façon aléatoire (296), en réponse audit signal de commande aléatoire, un seul code d'identification de piste dans ledit groupe de codes d'identification de piste correspondants associé audit code d'identification de piste de référence choisi; et, reproduire la piste correspondant au code d'identification de piste choisi de façon aléatoire.

2. Procédé selon la revendication 1, comprenant les étapes de: continuer à reproduire le disque depuis ladite piste correspondant audit code d'identification de piste choisi de façon aléatoire; produire une pluralité de signaux de commande aléatoire successifs; et se brancher de façon répétée sur des pistes successives correspondant à des codes d'identification de piste aléatoires successifs, en réponse à ladite pluralité de signaux de commande aléatoire successifs.

3. Procédé selon la revendication 1, dans lequel chaque signal de commande aléatoire comprend de façon aléatoire une ou deux instructions, la première étant une instruction pour continuer à reproduire à partir du point auquel le signal de commande aléatoire est donné et sans branchement, et la seconde étant de se brancher à une position d'adresse en aval spécifiée et de reproduire à partir de ce point.

4. Procédé selon la revendication 3, dans lequel: le caractère aléatoire de la sélection des première et seconde instructions est uniforme pour fournir une chance de 50% de choisir l'une ou l'autre desdites première et seconde instructions; et, une ou plusieurs autres instructions de branchement sont données ensuite après que le premier signal de commande aléatoire soit détecté, le nombre de trajets de branchement étant choisi de telle façon que la probabilité d'arriver finalement à l'une quelconque des N positions sur le disque soit égale pour toutes les positions.

5. Appareil pour recueillir des informations d'une pluralité de pistes d'information en spirale et sensiblement circulaires ou de pistes d'information circulaires concentriques sur un disque d'enregistrement (13), chacune desdites pistes contenant au moins en partie un code unique d'identification de piste, ledit appareil étant caractérisé par un moyen pour établir une pluralité de codes d'identification de piste de référence et un groupe de codes d'identification de piste correspondants pour chacun de ladite pluralité de codes d'identification de piste de référence; un moyen (37) pour choisir l'un parmi ladite pluralité de codes d'identification de piste de référence; un moyen (37) pour produire un signal de commande aléatoire; un moyen (296), sensible audit signal de commande aléatoire, pour choisir de façon aléatoire un seul codes d'identification de piste dans ledit groupe de codes d'identification de piste correspondants associé audit code d'identification de piste de référence choisi; et un moyen pour reproduire la piste correspondant au code d'identification de piste choisi de façon aléatoire.

6. Appareil selon la revendication 5 comprenant: un moyen pour continuer à reproduire le disque à partir de ladite piste correspondant audit code d'identification de piste choisi de façon aléatoire; un moyen pour produire une pluralité de signaux de commande aléatoire successifs; et un moyen pour se brancher de façon répétée sur des pistes successives correspondant à des codes d'identification de piste aléatoires successifs; en réponse à ladite pluralité de signaux de commande aléatoire successifs.

7. Appareil selon la revendication 5, dans lequel chaque signal de commande aléatoire comprend de façon aléatoire une ou deux instructions, la première étant une instruction de continuer à reproduire à partir du point auquel le signal de commande aléatoire est donné et sans branchement, et la seconde étant de se brancher à une position d'adresse en aval spécifiée et de reproduire à partir de ce point.

8. Appareil selon la revendication 7, dans lequel le caractère aléatoire de la sélection des première et seconde instructions est uniforme pour fournir une chance de 50% de choisir l'une ou l'autre desdites première et seconde instructions; et dans lequel ledit moyen pour amorcer lesdits signaux de commande aléatoire provient d'un ou de plusieurs autres signaux de branchement après que le premier signal de commande aléatoire a été détecté, le nombre de trajets de branchement étant choisi de telle façon que la probabilité d'arriver finalement à l'une quelconque de N positions sur le disque soit égale pour toutes les positions.

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