Description

Field of the Invention

This invention relates generally to systems for recovering information from video recording discs, and more particularly to a system that moves an information recovery device rapidly, relative to a plurality of information tracks on a videodisc, toward a selected target track on the disc to recover information recorded on the target track.

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 increments the beam radially by one track spacing during each revolution of the disc, thereby "playing" into the target track.

Although the information recovery system described above has proven effective in rapidly moving a reading beam toward a selected target track to recover information recorded thereon, the system does not operate satisfactorily whenever the unique address code for the target track is obliterated or is otherwise not reliably detectable or readable. In prior art disc players of the type described above, in the event that the track identifying code for the target track is obliterated, a "match" of addresses is not possible, and the player either searches to the end of the disc information and idles there or is instructed, under microprocessor command control built into the machine, to perform the search again. In the event that the search function failed on the first pass because it did not receive a proper identifying address code, it is possible that a second search pass will result in success in landing on the target track. This could happen, for example, if the read head was passing laterally of the disc at too fast a rate at the particular time that the address codes contained in the vertical interval portion of the recorded signal was passing by. In such a case, making 2, 3, or even more passes in a search mode could result in an ultimately successful target track "find".

However, no number of retries will result in a successful "find" if the address code for the target track is obliterated due to a surface defect on the disc, or is not readable for any one of a variety of other reasons which can be attributed to the disc making process, the tape to disc transfer process, the tape recording process, and even the encoding equipment used to insert the address codes on the mastering tape in the first instance. In any event, with an obliterated address code for a particular target track, the aforementioned repeated search functioning of the player would be an exercise in futility, since a "match" of addresses would never occur.

It is further to be noted at this point that performing repeated searches in prior art machines required the same amount of time to perform each unsuccessful search, since the search is usually tried for some fixed period of time to locate the designated target track before giving up as unsuccessful. Upon initiation of any search, the time period was set to some fixed constant greater than the longest possible search across the whole disc. In prior art players, this process of unsuccessful searching for a selected target track could span eight seconds of real time. Accordingly, 2 or 3 passes would be an inordinately long length of time for a user to wait for the selected track, even assuming that it could be found eventually. In the event that it was never found, the user would be left with uncertainty as to whether or not the track will eventually be found, and if it is not found, the user must stop the searching process and refigure a new approach to get close to the program material he is desiring to view. In this connection, prior art discloses a searching method and apparatus in which the radial velocity of the search path varies inversely as some function of the difference between the selected target track address and the current address being detected while scanning.

Additionally, GB-A-2056118 illustrates and improved search function by permitting the machine to search for the target track from both directions and with changing velocity depending upon distance from the target track. By permitting the player to search in both directions and at variable speeds, the total search time for finding the target track is substantially reduced. This can be appreciated from the fact that, once the read head passes, relatively speaking, the target track, the player merely reverses the direction of motion of the read head relative to the disc to again search for the target track by detecting its identifying address code. Thus, since the read head is already in the vicinity of the target track when its scan motion is reversed, the length of time necessary to reach the target track in the reverse

direction is substantially reduced, and this analogy can be carried on indefinitely each time the target track is passed during the search mode. Again, however, in the event that the target address code is never detected because it has been obliterated for some reason, the player will continue its search function indefinitely in the vicinity of the target track. This assumes, of course, that the reader of the disc player is able to retrieve and identify track identifying codes in the vicinity of the target track so that the scan control electronics of the player can detect that the read head has overshot its target.

US-A-4199820 also discloses a search system with both a coarse and fine search mode. While in the search mode the player recovers the present address and compares it to the target track. It makes the comparison of the present address with the target track in order to estimate the distance separating the present position of the reader from the desired track. If the device is unable to recover the address at the present position, it jumps one track until it is able to detect an address. This detected address is then stored and compared to the target track in order to estimate the distance between the present position and the target track.

FR-A-2337472 discloses a search in which rough positioning is obtained by subtracting one from the contents of memory A (containing the desired target track address) for each groove or track on the disc that is passed by the beam. A comparison of the contents of memory A is made with the contents of memory B (the initial address), and the beam continues to cross tracks until a comparison of the two memories (A minus B) equals zero. Due to eccentricity in the disc, or other false readings, a track crossing counter (A minus B) is not always accurate. Therefore, when A minus B equals zero, and the player enters a stop-motion mode, the actual address is recovered and compared to the target address. If they are equal, then the player remains in the stop-motion model. If an address is not recovered during a time T, then the "reader begins to operate on normal running."

EP-A-7199 teaches a search method. It discloses varying the rate of the movement of the read head depending upon the separation of the present position of the read head and the target track address.

Whenever the address code of a selected target track is difficult to read or not readable at all, it can be appreciated that prior art disc players suffer from the inability to eventually locate that track or at least to locate a part of the recorded information reasonably close to that originally desired, and additionally such disc players suffer from the inability to stop searching for a target track when it is never to be found. There is thus a need for a system that can provide selection of an information track relatively close to the target track even when the target track identifying code is obliterated, and upon failing that to at least cease searching for an unidentifiable track address after a prescribed length of time has passed in the search mode. There is also a need for a playback system which will, to the extent possible, arrive at a target track even though the target track address identifying code has been obliterated.

Brief Description of the Invention

It is an object of the invention to provide a method and apparatus for a disc player which has the ability to eventually locate a target track, or at least to locate a part of the recorded information reasonably close to the target track, in the event that the information on the disc identifying the track location has been obliterated. In a preferred embodiment, a further object of the invention is to stop searching for a target track when it is never to be found.

Such an improved search feature for a disc player is realized in the present invention by the provision of a "variable landing pad". As used in this description, the term variable landing pad concerns the desire to search for a particular frame on the disc, and in the event that either the frame number or white flag identifier is obliterated at the desired location, to be able to find another adjacent, or close, frame at which the read head of the disc player stops to complete a search function. It is often the case that a particular frame searched for is not necessarily exclusive insofar as the user is concerned, since one or more frames on either side of the selected frame would be just as valuable for the user.

Of course, when viewing a catalog of items wherein each frame is unique, a variable landing pad in the sense described above is not desirable, since only the particular frame searched for is of value to the user. However, by incorporating the landing pad search feature so that a frame close to the selected frame is found, it is possible for the player to then count up or count back a particular number of frames to arrive at the desired, originally selected, frame, even though the frame number or white flag information identifying that selected frame is obliterated.

In the event that exactly locating a specific frame number is not of extreme importance to the user, such that perhaps as many as 30 frames on either side of the selected frame is an acceptable landing point for the read head, then upon failure to find a selected frame, the search direction can be reversed and a retry to find the same frame would be initiated. After failure to find the selected frame in a predetermined length of time, the search mechanism would try to find an adjacent frame with the same kind of back and forth searching motion for a second predetermined length of time, and in the event of a failure to find the adjacent frame, to proceed in like manner to locate the next adjacent frame, and so forth until an acceptable frame number within a prescribed distance from the originally selected frame number is found. Of course, in the event that no closely related frame is found, the read head can be instructed to merely stop after a prescribed number of retries at whatever frame it is at at the

time, or alternatively can be instructed to stop after a predetermined fixed length of time. The advantage of the "retry" function just described is that, since the frame number searched for originally is approached on the first try, each retry can take less search time, so that the ultimate frame landed on will be reached in a substantially shorter time than with a full time period search retry function as has been done in the prior art.

An extension of the variable landing pad feature concerns the ability to take alternative action after a fixed search time has passed or after a predetermined number of retries has taken place as indicated above. The option discussed above was to merely stop and play at such time. Alternatively, if the disc had the program material recorded in two or more bands on the disc (obviously good for relatively short programs only), after failure to find a target track in one band, i.e. after several "retries", the player can search for the duplicated target frame in another band by incrementing the target frame address code by a constant. Again, if the updated target track is not found on the first try, the updated target track plus one would be searched for in a manner described above. Note should be made of the fact that the automatic incrementing to another information band upon failure to find a selected target track in the first band is covered by prior art.

The invention in its broadest approach provides method and apparatus as claimed in claims 1 and 7.

Brief Description of the Drawings

Figure 1 is a general block diagram of the components of a videodisc player which function 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 signal flow diagram used in carrying out the basic search algorithm as particularly used with the variable landing pad aspect of the invention;

Figure 5 is a signal flow diagram of the portion of the function generator of Figure 1 used in carrying out the objects of the invention concerning the variable landing pad search mode;

Figure 6 is a graph illustrating the manner in which a read beam functions to search for a target track in the variable landing pad mode of the invention; and

Figure 7 is a block diagram showing the details of the components of a videodisc player involved in performing a stop-motion effect.

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, circular 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 controllably 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 alignment 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 monostable 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.

Variable Landing Pad

Figure 4 illustrates the search algorithm in the form of a signal flow chart where a start command 121 initiates a search mode in the player and outputs a "success" signal if the present position (P) is equal to the target position (T) in step 123 which determines the relationship between P and T. It should be recalled here that the function generator 37 (Figure 1) compares a target address input on line 35 with the present position address from address register 30.

Depending upon which direction from present position the target track is located when the search is initiated, in the event that the address code or white flag information at the target address is obliterated, either a search forward step 125 or a search reverse step 127 will drive the searching elements, carriage motor 31 and tracking mirror of optical system 17, depending upon whether P is less than T or P is greater than T, respectively. The search drive step 129 will continue to drive the searching elements toward the target track at a drive speed which is a function of the distance left to travel to the target track, and if not found will reverse the direction of the search and "look" again, and this procedure will continue indefinitely in the prior art machines. However, the present invention incorporates a step 131 which asks the question "has time elapsed?", and if a prescribed time limit has not passed, the "no" output of step 31 permits a "retry" of the search by initiating another search command at the input to step 123. If the prescribed time has elapsed, then a "yes" output indicates failure to have found the target track searched for.

Turning now to Figure 5, a more detailed description of the variable landing pad search feature of the function generator 37 will now be described. The search algorithm 157 from Figure 4 has been incorporated into the more detailed diagram of Figure 5, and again a "start search" command is given at step 151. The parameters listed in step 153 are then established, where T represents the target track number being searched, R represents the number of retries to perform, and I indicates whether or not the target track identification number should be incremented on each retry. T_o represents the initial (desirable) target track number, and as mentioned earlier, P represents the track number of the track being played at the present position. With these parameters set, a "set time out" step 155 establishes a

first time within which a successful search must be made or alternative action will be taken. In the instant case, and by way of example, step 155 sets the time limit for successfully finding the target track at 4.25 seconds.

The "success" result of step 157 is ultimately utilized to affect the stop search step 161 at which time the next instruction in the instruction set is selected. However, in the "success" path is step 159 which queries whether or not P equals T_o. That is, if the track number of the present position is equal to the initial target track number, then the search is stopped and the next instruction selected as indicated. However, as will be seen later, a track other than the initial target track may be arrived at, in which case step 163 is effective to operate the tracking controller 67 in a manner to jump ($P-T_o$) tracks in the direction toward T_o. In this manner, even though the track number finally searched for and found does not equal the initial track number, the player nevertheless arrives at the initial target track by subsequently jumping the proper number of tracks representing the difference between the track number of the "found" track and the number of the initial target track.

A track other than the desirable target track may be "found" in the following manner. If the identifying code or white flag is obliterated or otherwise not readable at the target track position, a failure will result from step 157, and step 165 will test to determine if there are any retries. A retry is the reversing of the scanning direction after the tracking controller can identify that the difference between the present position track number and the target position track number is increasing, indicating that a successful search was not found as the read beam of the player scans toward the target track and beyond. A prescribed number of retries has already been set in step 153 as indicated earlier. Assuming that a failure to find the target track occurred on the first try, and assuming that the number of retries is greater than zero, a "yes" output from step 165 causes a decrement of the R register in step 167 followed by the setting of a new "time-out" value of 1.5 seconds in step 169. If I=1, the target track number just searched for will be incremented by one in step 173, and the search algorithm step 157 will now perform a further search for a new target track number equalling the previous target track number incremented by one. If, on the other hand, I=0, the target track number is not incremented, and the search step 157 will again search for the same track number as in the previous search step. This process will continue for so long as there are retries left according to step 165 and time has not elapsed in step 131. Since surface blemishes on a disc may span several tracks, it is possible that several adjacent address codes and/or white flags of adjacent tracks will be obliterated. After some number of retries, however, a successful find of the incremented target track may result in a stop search step 161 as previously indicated. Of course, the search function can look for the same target track as previously searched if the target track number is not incremented in step 171. Since a second try for the same target track number can produce success, it is not always necessary to increment the track number in order to obtain success in finding the track searched for.

It should be noted that the initial time out for the search algorithm was 4.25 seconds, and this is considered necessary, since the target track may have been a substantial distance from the initial position when the start search command was given. However, even if the target track is not found within the first prescribed time-out period, the read beam should be in the vicinity of the target track, and therefore the second time-out length of time is set at 1.5 seconds in step 169. The amount of time set in steps 155 and 169 are purely a matter of choice, and for the present preferred embodiment of the invention, each retry after the first will be allowed 1.5 seconds of time. A limitation, however, on the total length of time allowed for searching is the time set in step 131 which is an overall time for search which can be established at, for example 8 seconds, and even if there is at least one retry left in step 165, a "no" output will result from step 165.

Such "no" result sets a "failure" flag in step 175 which normally would end the search as an unsuccessful search in step 183 and cause the read beam to stop anywhere it happened to be at the time time ran out from step 131 and/or the last retry left in step 165 was used up. Alternatively, if the disc contains multiple program segments in a banded arrangement with each band separated from one another and like program material was also separated by a constant K (in terms of track number code), then step 177 results in a "yes" output, and assuming the first band only had been searched to this point, at least one band would be left in step 179 such that step 181 would add a constant K to the value T_o and initiate a new "start search" input to step 153. This process continues until no bands are left, i,e., the target track incremented by the value K, 2K, 3K, etc. was not found in any band, and step 179 outputs a "no" result to again trigger step 183 to cause the read beam to stop anywhere. Note should be made of the fact that, even when all of the possibilities of retrying, incrementing and retrying, incrementing and retrying and jumping to a duplicated bands and retrying result in failure, the "stop anywhere" step 183 may still reasonably satisfy the user, since all of the searching in the later steps of the search function will naturally put the read beam in the vicinity of the target track, incremented target track, duplicate target track, or duplicate incremented target track.

Since the number of retries is variably set in step 153, and since, likewise, the target track can be incremented with each retry, the read beam will ultimately land on a track adjacent to or close to the initial target track, and this flexibility of selecting the number of retries and ability to increment creates a theoretical landing pad which

is variable in width depending upon the number of retries and the time allowed for completing the search.

Figure 6 shows pictorially the theoretical scanning motion of a read beam attempting to locate track T_o starting from track number zero. As the beam initially traverses across the disc, an extremely large number of tracks will be traversed for each second of time, and the scale of Figure 6 has been adapted to illustrate the variable landing pad feature of the invention and is not necessarily to scale. From the initial search path 211, the read beam traverses path 213 searching for track T_o. Having passed it, the player recognizing that the difference between the target track number and the current recovered track number is increasing, it reverses direction and follows path 215. Assuming that the portion of the path 215 is the result of one of the higher speed scanning motions described earlier, an incremented step function, at 217 also described earlier, is used to step the beam to the target tack. Assuming that the target track number (same number) is not found along path portion 217, the scanning beam reverses again to follow path 219, and this procedure continues until a fixed period of time elapses, and in the instant case, the first try as has been just described will terminate at 4.25 seconds, and the beam passing letter A in Figure 6 indicates that T_o was not found during the first try. From position A, the scanning beam continues to search for an additional 1.5 seconds (first retry), but this time a match in function generator 37 is being looked for between the present position track number and T_o+1. If, the first retry time expires, i.e., after 1.5 seconds from termination of the first try, the scanning beam performs a search starting from point B, this time searching for track number T_o+2. Not having found T_o+2, another retry is initiated at letter C, and a success in locating a track number T_o+3 is shown by the letter X in a box at point D. As explained in connection with the description in Figure 5, although it is optional to do so, the initial target track can now be arrived at by calculating the difference between the track number "found" at D and the original target track number sought. This will effectuate a homing-in in a local search mode by incrementally stepping the read beam from point D to point E (at circle X), and this time is relatively short in the example given, having only to have traversed three tracks to arrive at the initially desired track.

After reaching the desired track, the player may either begin playing or may enter a stop-motion mode.

Stop-Motion Mode

Referring to Figure 7, there is shown a block diagram of the stop motion subsystem employed in the videodisc player. The video signal from the FM detector and demodulator 23 is applied to an input buffer stage 271. The output signal from the buffer 271 is applied to a DC restorer 273. The function of the DC restorer 273 is to set the blanking voltage at a constant uniform level. Variations in signal recording and recovery result in video signals with different blanking levels. The output from the DC restorer 273 is applied to a white flag detector circuit 257. The function of the white flag detector 257 is to identify the presence of an all white level video signal existing during an entire line of one or both fields contained in the vertical interval of a frame of video information, although the white flag may take other forms. One such form would be a special number stored in a line. Alternatively, the white flag detector can respond to the address indicia found in each video frame for the same purpose. Other indicia can also be employed. However, the use of an all white level signal during an entire line interval in the picture frame of information has been found to be the most useful and reliable.

The vertical sync signal recovered from the video is applied to a delay circuit 253. The output from the delay circuit 253 is supplied to a vertical window generator 255. The function of the window generator 255 is to generate an enabling signal for application to the white flag detector 257 to coincide with that line interval in which the white flag signal has been stored. The output signal from the generator 255 gates the predetermined portion of the video signal from the FM detector and generates an output white flag pulse whenever the white flag is contained in the portion of the video signal under surveillance. The output from the white flag detector 257 is applied to a stop motion pulse generator 265 through gate 259 and stop motion mode selector 261. The gate 259 has as a second input signal, the stop motion mode enabling signal from the function generator 37 (Figure 1).

The differential tracking error from the detector and demodulator 23 is applied over line 77 (Figure 1) to a zero crossing detector and delay circuit 269. The function of the zero crossing detector circuit 269 is to identify when the lens crosses the mid points 91 between two adjacent tracks as shown with reference to line (a) of Figure 3. This mid point is the point at which the differential tracking error shown in line (b) of Figure 3 corresponds to the mid point 91 between adjacent tracks.

The output of the zero crossing detector and delay circuit 269 is applied to the stop motion pulse generator 265. The stop motion pulse generated in the generator 265 is applied to a plurality of locations, the first of which is as a loop interrupt pulse to the tracking controller servo. A second output signal from the stop motion pulse generator 265 is applied to a stop motion compensation sequence generator 267. The function of the stop motion compensation sequence generator 267 is to generate a compensation pulse waveform for application to the radial tracking mirror in optical system 17 to cooperate with the actual stop motion pulse sent directly to the tracking mirror servo. The stop motion compensation pulse is thus also sent to the tracking servo.

Briefly, the stop motion pulse to the tracking

servo causes the radial tracking mirror to leave the track on which it is tracking and jump to the next sequential track. A short time later, the radial tracking mirror receives a stop motion compensation pulse to remove the added inertia and direct the tracking mirror into tracking the next adjacent track without skipping one or more tracks before selecting a track for tracking.

In order to insure the optimum cooperation between the stop motion pulse from the generator 265 and the stop motion compensation pulse from the generator 267, a loop interrupt pulse is sent to the tracking servo to remove the differential tracking error signal from being applied to the tracking error amplifiers in tracking controller 67 during the period of time that the mirror is purposely caused to leave one track under direction of the stop motion pulse from the generator 265 and to settle upon a next adjacent track under the direction of the stop motion compensation pulse from the generator 267.

Using the arrangement described above, and assuming stop motion selector 261 passes the output from white flag detector 257 to gate 259, a stop motion effect is realized by causing the player to play two fields in repeated fashion, the first field starting after detection of a white flag occurring during the vertical interval following the second field, and the second field having no white flag preceding it. Accordingly, any time a stop motion command is given the player, the first and second fields of a selected frame will be displayed. A frame advance command to the player would result in the player skipping to the next frame, i.e., skipping two fields such that first field displayed is again initiated by a white flag during the vertical interval, following the second field and the second field without an initial white flag.

Claims

1. A method for manipulating a track reader for recovering information from a selected target track of a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc, each said track containing at least in part a unique track identifying code, said method comprising the steps of: (a) generating a target track identifying code that matches the track identifying code of said target track; (b) rotating the disc in a prescribed fashion; (c) scanning the disc with the track reader at a prescribed radial velocity relative to the disc, toward the target track to recover information recorded thereon including track identifying codes; (d) comparing recovered track identifying codes with said target track identifying code and detecting the difference therebetween; (e) scanning continuously toward said target track until said comparing and detecting step indicates that the recovered track identifying code is within a fixed range of the target track identified code; (f) thereafter moving the track reader incrementally within said range relative to said disc across a prescribed number of tracks during each revolution of the disc, toward the target track; (g) upon passing the target track by detection in said comparing and detection step, that the difference between the recovered track identifying code and the target track identifying code is increasing, reversing the radial scanning direction; characterized by: (h) continuing said incremental scanning while continuing to detect the difference between the recovered track identifying code and the target track identifying code, and continuing to reverse the radial direction of movement upon each detection of an increasing difference between the recovered track identifying code and the target track identifying code until a match is made therebetween, and in the absence of a match in a first prescribed period of time, incrementing the target track identifying code by a fixed value; (i) continuing said incremental scanning toward said target track until a match between the recovered track identifying code and the incremented target track identifying code is found; and (j) after a match is found, ceasing the relative radial movement across the disc and recovering the information from the arrived at track.

2. The method as claimed in Claim 1, including, in the absence of a match in step (i) and before step (j), the further steps of: (k) detecting the difference between the recovered track identifying code and the incremented target track identifying code and continuing to reverse the radial direction of movement upon each detection of an increasing difference between the recovered track identifying code and the incremented target track identifying code until a match is made therebetween, and in the absence of a match in a further prescribed time period, incrementing the incremented target track identifying code by a preset value; and (l) continuing said incremental scanning toward said target track until a match between the recovered track identifying code and the further incremented target track is found.

3. The method as claimed in Claim 2, including, before step (i), the step of: repeating step (j) until a fixed time interval has elapsed from the initiation of step (b); and wherein step (i) includes, after a match is found or after said fixed time interval has elapsed, whichever is first, ceasing the relative radial movement across the disc and recovering the information from the arrived at track.

4. The method as claimed in Claim 1, wherein step (j) includes, after a match is found and before the recovering of information from the track arrived at, the steps of: comparing the last incremented target track identifying code with the first of said target track identifying codes; and moving the track reader toward said target track across a number of tracks equal to the difference between said last incremented target track identifying code and said first target track identifying code.

5. The method as claimed in Claim 1, wherein the record disc contains N duplicate programs on

servo causes the radial tracking mirror to leave the track on which it is tracking and jump to the next sequential track. A short time later, the radial tracking mirror receives a stop motion compensation pulse to remove the added inertia and direct the tracking mirror into tracking the next adjacent track without skipping one or more tracks before selecting a track for tracking.

In order to insure the optimum cooperation between the stop motion pulse from the generator 265 and the stop motion compensation pulse from the generator 267, a loop interrupt pulse is sent to the tracking servo to remove the differential tracking error signal from being applied to the tracking error amplifiers in tracking controller 67 during the period of time that the mirror is purposely caused to leave one track under direction of the stop motion pulse from the generator 265 and to settle upon a next adjacent track under the direction of the stop motion compensation pulse from the generator 267.

Using the arrangement described above, and assuming stop motion selector 261 passes the output from white flag detector 257 to gate 259, a stop motion effect is realized by causing the player to play two fields in repeated fashion, the first field starting after detection of a white flag occurring during the vertical interval following the second field, and the second field having no white flag preceding it. Accordingly, any time a stop motion command is given the player, the first and second fields of a selected frame will be displayed. A frame advance command to the player would result in the player skipping to the next frame, i.e., skipping two fields such that first field displayed is again initiated by a white flag during the vertical interval, following the second field and the second field without an initial white flag.

Claims

1. A method for manipulating a track reader for recovering information from a selected target track of a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc, each said track containing at least in part a unique track identifying code, said method comprising the steps of: (a) generating a target track identifying code that matches the track identifying code of said target track; (b) rotating the disc in a prescribed fashion; (c) scanning the disc with the track reader at a prescribed radial velocity relative to the disc, toward the target track to recover information recorded thereon including track identifying codes; (d) comparing recovered track identifying codes with said target track identifying code and detecting the difference therebetween; (e) scanning continuously toward said target track until said comparing and detecting step indicates that the recovered track identifying code is within a fixed range of the target track identified code; (f) thereafter moving the track reader incrementally within said range relative to said disc across a prescribed number of tracks during each revolution of the disc, toward the target track; (g) upon passing the target track by detection in said comparing and detection step, that the difference between the recovered track identifying code and the target track identifying code is increasing, reversing the radial scanning direction; characterized by: (h) continuing said incremental scanning while continuing to detect the difference between the recovered track identifying code and the target track identifying code, and continuing to reverse the radial direction of movement upon each detection of an increasing difference between the recovered track identifying code and the target track identifying code until a match is made therebetween, and in the absence of a match in a first prescribed period of time, incrementing the target track identifying code by a fixed value; (i) continuing said incremental scanning toward said target track until a match between the recovered track identifying code and the incremented target track identifying code is found; and (j) after a match is found, ceasing the relative radial movement across the disc and recovering the information from the arrived at track.

2. The method as claimed in Claim 1, including, in the absence of a match in step (i) and before step (j), the further steps of: (k) detecting the difference between the recovered track identifying code and the incremented target track identifying code and continuing to reverse the radial direction of movement upon each detection of an increasing difference between the recovered track identifying code and the incremented target track identifying code until a match is made therebetween, and in the absence of a match in a further prescribed time period, incrementing the incremented target track identifying code by a preset value; and (l) continuing said incremental scanning toward said target track until a match between the recovered track identifying code and the further incremented target track is found.

3. The method as claimed in Claim 2, including, before step (i), the step of: repeating step (j) until a fixed time interval has elapsed from the initiation of step (b); and wherein step (i) includes, after a match is found or after said fixed time interval has elapsed, whichever is first, ceasing the relative radial movement across the disc and recovering the information from the arrived at track.

4. The method as claimed in Claim 1, wherein step (j) includes, after a match is found and before the recovering of information from the track arrived at, the steps of: comparing the last incremented target track identifying code with the first of said target track identifying codes; and moving the track reader toward said target track across a number of tracks equal to the difference between said last incremented target track identifying code and said first target track identifying code.

5. The method as claimed in Claim 1, wherein the record disc contains N duplicate programs on

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the same disc side, where N is at least two, and wherein like tracks of each program are separated by K tracks, and wherein step (j) includes, after said fixed time interval has elapsed and a match has not been found, and before said ceasing and recovery steps are performed, the steps of; adding the value K to the first-mentioned target track identifying code to produce an updated track identifying code; scanning continuously toward said updated target track until said comparing step indicates that the recovered track identifying code is within a fixed range of the updated target track identifying code; and scanning incrementally across a prescribed number of tracks during each revolution of the disc, toward the updated target track.

6. The method as claimed in Claim 5 including the steps of: upon passing the updated target track by detecting that the difference between the recovered track identifying code and the updated arget track identifying code is increasing, the step of reversing the radial scanning direction; and repeating the functions of steps (h), (i), and (j), replacing the target track and target track identifying code with said updated target track and updated target track identifying code values, respectively.

7. Apparatus for recovering information from a selected target track of a plurality of spiralling and substantially circular information tracks or concentric circular information tracks on a record disc, each said track containing at least in part a unique track identifying code, said apparatus comprising: means for generating a target track identifying code that matches the track identifying code of said target track; means (15) for rotating the disc in a prescribed fashion; a track reader (17, 19) for scanning the rotating disc to recover information recorded thereon; coar-se positioning means (67, 39, 31) for moving the track reader at a prescribed radial velocity relative to the disc, toward the target track; means (37) for comparing recovered track identifying codes with said target track identifying code; means (37) for detecting the difference between said recovered track identifying codes and said target track identifying code; fine positioning means (17), responsive to said detecting means and operable after the coarse positioning means has moved the track reader into within a number L of tracks from the target track, for moving the track reader incrementally across a prescribed number of tracks during each revolution of the disc, toward the target track; means for reversing the radial direction of radial scanning movement upon said detecting means detecting that the difference between the recovered track identifying code and the target track identifying code is increasing, said means for reversing the radial direction of scanning movement continuing to reverse the radial direction of scanning movement upon each detection of an increasing difference between the recovered track identifying code and the target track identifying code until a match is made therebetween by said comparing means; characterized by: means for incrementing the target track identifying code by a fixed value in the absence of a match between the recovered track identifying code and the target track identifying code in a first prescribed period of time; said fine positioning means continuing to move said track reader incrementally across said prescribed number of tracks during each revolution of the disc toward said target track, whereupon said means for comparing compares recovered track identifying codes with the incremented target track identifying code until a match is made therebetween; said apparatus including terminating means for ceasing said relative radial movement when a match is made, said track reader operable to then recover the information recorded on the track whose identifying code matches the incremented target track identifying code.

8. The apparatus as claimed in Claim 7, wherein said means for detecting is operative to detect the difference between the recovered track identifying code and the incremented track identifying code while said fine positioning means continues to reverse the direction of radial movement of the track reader upon each detection of an increasing difference between the recovered track identifying code and the incremented target track identifying code, until said match is made.

9. The apparatus as claimed in Claim 8 wherein: said comparing means compares the last incremented target track identifying code with the first of said target track identifying codes after a match is found and before said track reader recovers information from the track arrived at; and said fine positioning means includes means responsive to said detecting means for moving the track reader towards said target track across a number of tracks equal to the difference between said last target track identifying code and said first target track identifying code.

10. The apparatus as claimed in Claim 7, wherein: said detecting means includes means for continuously detecting the difference between the recovered track identifying code and the incremented target track identifying code; said direction reversing means includes means for continuing to reverse the radial direction of scanning movement upon each detection of an increasing difference between the recovered track identifying code and the incremented target track identifying code until a match is made therebetween; said incrementing means includes means, in the absence of a match in a further prescribed time period, for incrementing the incremented target track identifying code by a preset value; and said comparing means includes means for continuing comparing said recovered track identifying codes with each incremented track identifying code, and said incrementing means includes means for continuing incrementing the target track identifying code until a fixed time interval has elapsed from the initial moving of the track reader by said coarse positioning means.

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Patentansprüche

1. Verfahren zur Bedienung eines Spurenlesers, um Informationen aus einer Zielspur wiederzugewinnen, die auf einer als Aufzeichnungsträger dienenden Platte unter mehreren spiralförmigen und im wesentlichen kreisrunden Informationsspuren oder konzentrischen, kreisrunden Informationsspuren ausgewählt ist, wobei jede Spur wenigstens zum Teil einen einzelnen sie identifizierenden Code enthält, mit den Schritten: (a) einen eine Zielspur identifizierenden Code zu erzeugen, der sich mit dem eine Spur identifizierenden Code der Zielspur deckt, (b) die Platte in einer vorgeschriebenen Weise umlaufen zu lassen, (c) die Platte mit dem Spurenleser bei einer vorgeschriebenen, radialen Geschwindigkeit relativ zu der Platte in Richtung auf die Zielspur abzutasten, um an ihr aufgezeichnete Informationen einschließlich eine Spur identifizierender Codes wiederzugewinnen, (d) wiedergewonnene, eine Spur identifizierende Codes mit dem die Zielspur identifizierenden Code zu vergleichen und die Differenz zwischen ihnen wahrzunehmen, (e) eine ununterbrochene Abtastung in Richtung auf die Zielspur vorzunehmen, bis im Schritt des Vergleichens und Wahrnehmens angezeigt wird, daß sich der wiedergewonnene, eine Spur identifizierende Code innerhalb eines festgesetzten Bereiches des die Zielspur identifizierenden Code befindet, (f) danach während jeder Umdrehung der Platte den Spurenleser in kleinsten zunehmenden Schritten innerhalb des Bereiches relativ zu der Platte über eine vorgeschriebebene Anzahl Spuren in Richtung auf die Zielspur zu bewegen, (g) beim Durchlaufen der Zielspur, was in dem Schritt des Vergleichens und Wahrnehmens dadurch erfaßt wird, daß die Differenz zwischen dem eine Spur identifizierenden Code und dem die Zielspur identifizierenden Code gerade zunimmt, die radiale Abtastrichtung umzukehren, dadurch gekennzeichnet, daß (h) die Abtastung in kleinsten, zunehmenden Schritten gemeinsam mit der Wahrnehmung der Differenz zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und die Zielspur identifizierenden Code und die Umkehrung der radialen Bewegungsrichtung bei jeder Wahrnehmung einer zunehmenden Differenz zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und dem die Zielspur identifizierenden Code fortgesetzt werden, bis eine Übereinstimmung zwischen ihnen hergestellt wird, und, wenn in einer ersten vorgeschriebenen Zeitspanne eine Übereinstimmung ausbleibt, der die Zielspur identifizierende Code um einen festgesetzten Wert schrittweise vergrößert wird, (i) daß die schrittweise zunehmende Abtastung in Richtung auf die Zielspur fortgesetzt wird, bis eine Übereinstimmung zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und dem schrittweise vergrößerten, die Zielspur identifizierenden Code gefunden wird, und (j) daß nach dem Auffinden einer Übereinstimmung die relative Radialbewegung über die Platte abgebrochen wird und die Informationen aus der gerade erreichten Spur wiedergewonnenen werden.

2. Verfahren, wie im Anspruch 1 beansprucht, beim Ausbleiben einer Übereinstimmung in dem Schritt (i) und vor dem Schritt (j) mit den weiteren Schritten (k), in denen die Differenz zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und dem schrittweise vergrößerten, die Zielspur identifizierenden Code wahrgenommen und bei jeder Wahrnehmung einer zunehmenden Differenz zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und dem schrittweise vergrößerten, die Zielspur identifizierenden Code die Umkehrung der radialen Bewegungsrichtung fortgesetzt wird, bis zwischen ihnen eine Übereinstimmung hergestellt wird, und, wenn in einer weiteren vorgeschriebenen Zeitspanne eine Übereinstimmung ausbleibt, der schrittweise vergrößerte, die Zielspur identifizierende Code um einen voreingestellten Wert schrittweise vergrößert wird, und (l), in dem die schrittweise zunehmende Abtastung in Richtung auf die Zielspur fortgesetzt wird, bis eine Übereinstimmung zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und der weiteren schrittweise vergrößerten Zielspur gefunden wird.

3. Verfahren, wie im Anspruch 2 beansprucht, mit dem vor dem Schritt (i) auszuführenden Schritt einer Wiederholung des Schrittes (j), bis von der Einleitung eines Schrittes (b) an ein festgesetztes Zeitintervall vergangen ist, und wobei in einem Schritt (i) unabhängig davon, ob zuerst eine Übereinstimmung gefunden wird oder das festgesetzte Zeitintervall vergangen ist, die relative Radialbewegung über die Platte beendet wird und die Informationen aus der erreichten Spur wiedergewonnen werden.

4. Verfahren, wie im Anspruch 1 beansprucht, bei dem zu dem Schritt (j) nach dem Auffinden einer Übereinstimmung und vor dem Wiedergewinnen von Informationen aus der erreichten Spur die Schritte gehören, den letzten schrittweise vergrößerten, die Zielspur identifizierenden Code mit dem ersten der die Zielspur identifizierenden Codes zu vergleichen und den Spurenleser in Richtung auf die Zielspur über eine Anzahl Spuren zu bewegen, die gleich der Differenz zwischen dem letzten schrittweise vergrößerten, die Zielspur identifizierenden Code und dem ersten die Zielspur identifizierenden Code ist.

5. Verfahren, wie im Anspruch 1 beansprucht, bei dem die der Aufzeichnung dienende Platte N doppelte Programme auf derselben Plattenseite enthält, wobei N eine Zahl von mindestens zwei ist, bei dem gleiche Spuren jedes Programmes durch K Spuren getrennt sind, und bei dem zu dem Schritt (j) nach dem Verstreichen des festgesetzten Zeitintervalles und nach dem Ausbleiben einer Übereinstimmung und vor der Ausführung der Unterbrechungs- und Wiedergewinnungsschritte die Schritte gehören, zur Erzeugung eines auf den neuesten Stand gebrachten, eine Spur identifizierenden Code den Wert K zu dem zuerst erwähnten, die Zielspur identifizierenden Code zu addieren, eine Abtastung ununterbrochen in Rich-

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tung auf die auf den neuesten Stand gebrachte Zielspur vorzunehmen, bis in dem Vergleichsschritt angezeigt wird, daß der wiedergewonnene, eine Spur identifizierende Code sich innerhalb eines festgesetzten Bereiches des auf den neuesten Stand gebrachten, die Zielspur identifizierenden Code befindet, und während jeder Umdrehung der Platte in kleinsten Schritten zunehmend über eine vorgeschriebene Anzahl Spuren in Richtung der auf den neuesten Stand gebrachten Zielspur eine Abtastung vorzunehmen.

6. Verfahren, wie im Anspruch 5 beansprucht, mit den Schritten, daß bei einem Durchlaufen der auf den neuesten Stand gebrachten Zielspur, was dadurch wahrgenommen wird, daß die Differenz zwischen dem wiedergewonnenen, eine Spur identifizierenden Code und dem auf den neuesten Stand gebrachten, die Zielspur identifizierenden Code gerade zunimmt, die radiale Abtastrichtung umgekehrt wird und die Funktionen der Schritte (h), (i) und (j) unter Ersatz der Zielspur bzw. des die Zielspur identifizierenden Code gegen die auf den neuesten Stand gebrachte Zielspur bzw. gegen die Codewerte wiederholt werden, die die auf den neuesten Stand gebrachte Zielspur identifizieren.

7. Gerät zum Wiedergewinnen von Informationen aus einer Zielspur, die auf einer der Aufzeichnung dienenden Platte unter zahlreichen spiralförmigen und im wesentlichen kreisförmigen Informationsspuren oder konzentrischen, kreisrunden Informationsspuren ausgewählt ist, wobei jede Spur wenigstens zum Teil einen einmaligen, eine Spur identifizierenden Code enthält, mit Hilfsmitteln zur Erzeugung eines die Zielspur identifizierenden Code, der sich mit dem eine Spur identifizierenden Code der Zielspur deckt, mit Hilfsmitteln (15), die die Platte in einer vorgeschriebenen Weise umlaufen lassen, mit einem Spurenleser (17, 19) zur Abtastung der umlaufenden scheibenförmigen Platte, um die auf ihr aufgezeichneten Informationen wiederzugewinnen, mit Grobeinstellmitteln (67, 39, 31) zur Bewegung des Spurenlesers mit einer vorgeschriebenen Radialgeschwindigkeit relativ zu der Platte in Richtung auf die Zielspur, mit Hilfsmitteln (37) zum Vergleichen von eine wiedergewonnene Spur identifizierenden Codes mit dem die Zielspur identifizierenden Code, mit Hilfsmitteln (37) zur Wahrnehmung der Differenz zwischen den eine wiedergewonnene Spur identifizierenden Codes und dem die Zielspur identifizierenden Code, mit auf die Wahrnehmungshilfsmittel ansprechenden Feineinstellhilfsmitteln (17), die betätigbar sind, nachdem die Grobeinstellmittel den Spurenleser in einen Bereich der Zielspur mit einer Anzahl L von Spuren bewegt hat, um den Spurenleser in kleinsten Schritten während jeder Umdrehung der Platte zunehmend in Richtung der Zielspur über eine vorgeschriebene Anzahl von Spuren zu bewegen, mit Hilfsmitteln zur Richtungsumkehr einer radialen Abtastbewegung, die bei der Wahrnehmung durch deren Hilfsmittel, daß die Differenz zwischen dem eine wiedergewonnene Spur identifizierenden Code und dem die Zielspur identifizierenden Code gerade zunimmt, die Umkehr der radialen Richtung einer Abtastbewegung bei jeder Wahrnehmung einer sich vergrößernden Differenz zwischen dem die wiedergewonnene Spur identifizierenden Code und dem die Zielspur identifizierenden Code durch die Wahrnehmungshilfsmittel fortsetzen, bis eine Übereinstimmung zwischen ihnen durch die Vergleichshilfsmittel hergestellt ist, dadurch gekennzeichnet, daß Hilfsmittel zur schrittweisen Hinaufschaltung des die Zielspur identifizierenden Code um einen festgesetzten Wert beim Ausbleiben einer Übereinstimmung zwischen dem eine wiedergewonnene Spur identifizierenden Code und dem die Zielspur identifizierenden Code in einer vorgeschriebenen Zeitspanne vorgesehen sind, daß die Feineinstellhilfsmittel die schrittweise zunehmende Bewegung des Spurenlesers während jeder Umdrehung der Platte über die vorgeschriebene Zahl von Spuren in Richtung auf die Zielspur fortsetzen, worauf die Hilfsmittel zum Vergleichen eine wiedergewonnene Spur identifizierender Codes mit dem die um kleine Schritte vergrößerte Zielspur identifizierenden Code vergleichen, bis eine Übereinstimmung hergestellt ist, daß Hilfsmittel zur Beendigung der relativen Radialbewegung nach der Herstellung einer Überstimmung vorgesehen sind, und daß der Spurenleser betätigbar ist, um dann die Informationen wiederzugewinnen, die auf der Spur aufgezeichnet sind, deren der Identifizierung dienender Code mit dem Code übereinstimmt, durch den die schrittweise vergrößerte Zielspur identifiziert wird.

8. Gerät, wie im Anspruch 7 beansprucht, bei dem die Hilfsmittel zur Wahrnehmung bedienbar sind, um die Differenz zwischen dem eine wiedergewonnene Spur identifizierenden Code und dem die schrittweise vergrößerte Spur identifizierenden Code wahrzunehmen, während die Feineinstellhilfsmittel ununterbrochen die Richtung der Radialbewegung des Spurenlesers bei jeder Wahrnehmung einer zunehmenden Differenz zwischen dem eine wiedergewonnene Spur identifizierenden Code und den die schrittweise vergrößerte Zielspur identifizierenden Code umkehren, bis die Übereinstimmung hergestellt ist.

9. Gerät, wie im Anspruch 8 beansprucht, bei dem die Hilfsmittel zum Vergleichen den letzten, eine vergrößerte Zielspur identifizierenden Code mit dem ersten der die Zielspur identifizierenden Codes nach einer aufgefundenen Übereinstimmung vergleichen, bevor der Spurenleser Informationen aus der erreichten Spur wiedergewinnt, und bei dem die Feineinstellhilfsmittel auf die Hilfsmittel zur Wahrnehmung ansprechende Mittel zur Bewegung des Spurenlesers in Richtung auf die Zielspur über eine Anzahl Spuren enthalten, die gleich der Differenz zwischen dem letzten, die Zielspur identifizierenden Code und dem ersten die Zielspur identifizierenden Code sind.

10. Gerät, wie im Anspruch 7 beansprucht, bei dem die Hilfsmittel zur Wahrnehmung Mittel zur

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ununterbrochenen Wahrnehmung der Differenz zwischen dem eine wiedergewonnene Spur identifizierenden Code und dem eine schrittweise vergrößerte Zielspur identifizierenden Code enthalten, bei dem die die Richtung umkehrenden Hilfsmittel Mittel zur Fortsetzung einer Umkehr der radialen Richtung einer Abtastbewegung bei jeder Wahrnehmung einer zunehmenden Differenz zwischen dem eine wiedergewonnene Spur identifizierenden Code und dem die schrittweise vergrößerte Zielspur identifizierenden Code enthalten, bis eine Übereinstimmung zwischen ihnen hergestellt ist, bei dem die schrittweise vergrößernden Hilfsmittel beim Ausbleiben einer Übereinstimmung in einer weiteren vorgeschriebenen Zeitspanne Mittel zum schrittweisen Hinaufschalten des die schrittweise vergrößerte Zielspur identifizierenden Code um einen voreingestellten Wert wirksam werden lassen, und bei dem die Hilfsmittel zum Vergleichen Mittel zum ununterbrochenen Vergleichen der eine wiedergewonnene Spur identifizierenden Codes mit jedem schrittweise vergrößerten, eine Spur identifizierenden Code enthalten, wobei die schrittweise vergrößernden Hilfsmittel mit Mitteln zum ständigen schrittweisen Vergrößern des die Zielspur identifizierenden Code, bis von der anfänglichen Bewegung des Spurenlesers mit Hilfe der Grobeinstellmittel eine festgesetzte Zeitspanne vergangen ist, versehen sind.

Revendications

1. Procédé pour manipuler un lecteur de piste pour recueillir des informations d'une piste cible choisie d'une pluralité de pistes d'information en spirale et sensiblement circulaires ou de pistes d'information circulaires concentriques sur un disque d'enregistrement, chacune desdites pistes contenant au moins en partie un code unique d'identification de piste, ledit procédé comprenant les étapes de: (a) produire un code d'identification de piste cible qui correspond au code d'identification de piste de ladite piste cible; (b) faire tourner le disque de façon prédéterminée; (c) balayer le disque avec le lecteur de piste à une vitesse radiale prédéterminée par rapport au disque, en direction de la piste cible pour recueillir l'information enregistrée sur celle-ci y compris les codes d'identification de piste; (d) comparer les codes d'identification de piste recueillis avec ledit code d'identification de piste cible et détecter la différence entre eux; (e) balayer en continu en direction de ladite piste cible jusqu'à ce que ladite étape de comparaison et de détection indique que le code d'identification de piste recueilli se trouve à l'intérieur d'un domaine fixé du code identifié de piste cible; (f) ensuite déplacer le lecteur de piste par pas à l'intérieur dudit domaine par rapport audit disque au travers d'un nombre prédéterminé de pistes au cours de chaque rotation du disque, en direction de la piste cible; (g) lors du passage de la piste cible par détection dans ladite étape de comparaison et de détection, que la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible augmente, inverser la direction de balayage radial; caractérisé par: (h) continuer ledit balayage par pas tout en continuant à détecter la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible, et continuer à inverser la direction radiale de mouvement lors de chaque détection d'une différence croissante entre le code d'identification de piste recueilli et le code d'identification de piste cible jusqu'à ce qu'une correspondance se produise entre eux, et en l'absence d'une correspondance dans une première période prédéterminée, augmenter par pas le code d'identification de piste cible d'une valeur fixée; (i) continuer ledit balayage par pas en direction de ladite piste cible jusqu'à ce qu'une correspondance entre le code d'identification de piste recueilli et le code d'identification de piste cible augmenté par pas soit trouvée; et (j) après qu'une correspondance soit trouvée, cesser le mouvement radial relatif en travers du disque et recueillir l'information de la piste à laquelle on est arrivé.

2. Procédé selon la revendication 1, comprenant en l'absence d'une correspondance à l'étape (i) et avant l'étape (j), les étapes supplémentaires de: (k) détecter la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible et continuer à inverser la direction radiale du mouvement lors de chaque détection d'une différence croissante entre le code d'identification de piste recueilli et le code d'identification de piste cible augmenté par pas jusqu'à ce qu'une correspondance se fasse entre eux, et en l'absence d'une correspondance dans une autre période prédéterminée, augmenter le code d'identification de piste cible augmenté par pas d'une valeur prédéterminée; et (l) continuer ledit balayage augmenté par pas en direction de ladite piste cible jusqu'à ce qu'une correspondance soit trouvée entre le code d'identification de piste recueilli et la piste cible encore augmentée par pas.

3. Procédé selon la revendication 2, comprenant, avant l'étape (i), l'étape de: répéter l'étape (j) jusqu'à ce qu'un intervalle de temps fixé se soit écoulé depuis le début de l'étape (b); et dans lequel l'étape (i) comprend, après qu'une correspondance ait été trouvée ou après que ledit intervalle de temps se soit écoulé, n'importe lequel étant le premier, cesser le mouvement radial relatif en travers du disque et recueillir l'information de la piste à laquelle on est arrivé.

4. Procédé selon la revendication 1, dans lequel l'étape (j) comprend, après qu'une correspondance a été trouvée et avant de recueillir l'information de la piste à laquelle on est arrivé, les étapes de: comparer le dernier code d'indentification de piste cible augmenté par pas avec le premier desdits codes d'identification de piste cible; et de déplacer le lecteur de piste en direction de ladite piste cible en travers d'un nombre de pistes égal à la différence entre ledit dernier code d'identification de piste cible augmenté par pas et ledit premier code d'identification de piste cible.

5. Procédé selon la revendication 1, dans lequel le disque d'enregistrement contient N pro-

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grammes en double sur la même face de disque, N étant égal au moins à deux, et dans lequel les pistes identiques de chaque programme sont séparées par K pistes, et dans lequel l'étape (j) comprend, après que ledit intervalle de temps fixé se soit écoulé et qu'une correspondance n'ait pas été trouvée, et avant que lesdites étapes d'arrêt et de récupération soient réalisées, les étapes de: ajouter la valeur K au code d'identification de piste cible mentionné en premier lieu pour produire un code d'identification de piste mis à jour; de balayer en continu en direction de ladite piste cible mise à jour jusqu'à ce que ladite étape de comparaison indique que le code d'identification de piste recueilli se trouve à l'intérieur d'un domaine fixé du code d'identification de piste cible mis à jour; et de balayer par pas en travers d'un nombre prédéterminé de pistes au cours de chaque rotation du disque, en direction de la piste cible mise à jour.

6. Procédé selon la revendication 5 comprenant les étapes de: lors du passage de la piste cible mise à jour par détection que la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible mis à jour est croissante, l'étape d'inverser la direction de balayage radial, et de répéter les fonctions des étapes (h), (i) et (j), de remplacer la piste cible et le code d'identification de piste cible par la piste cible mise à jour et les valeurs de code d'identification de piste cible mise à jour respectivement.

7. Appareil pour recueillir des informations d'une piste cible choisie d'une pluralité de pistes d'information en spirale et sensiblement circulaires ou de pistes d'information concentriques circulaires sur un disque d'enregistrement, chacune desdites pistes contenant au moins en partie un code unique d'identification de piste, ledit appareil comprenant: des moyens pour produire un code d'identification de piste cible qui correspond au code d'identification de piste de ladite piste cible; des moyens (15) pour faire tourner le disque de façon prédéterminée; un lecteur de piste (17, 19) pour balayer le disque en rotation pour recueillir les informations enregistrées sur celui-ci; des moyens de positionnement grossier (67, 39, 31) pour déplacer le lecteur de piste à une vitesse radiale prédéterminée par rapport au disque, en direction de la piste cible; des moyens (37) pour comparer les codes d'identification de piste recueillis avec ledit code d'identification de piste cible; des moyens (37) pour détecter la différence entre lesdits codes d'identification de piste recueillis et ledit code d'identification de piste cible; des moyens (17) de positionnement fin, sensibles auxdits moyens de détection et actionnables après que le moyen de positionnement grossier ait déplacé le lecteur de piste d'un nombre (L) de pistes depuis la piste cible, pour déplacer le lecteur de piste par pas en travers d'un nombre prédéterminé de pistes au cours de chaque rotation du disque, en direction de la piste cible; des moyens pour inverser la direction radiale du mouvement de balayage radial lorsque ledit moyen de détection détecte que la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible est croissante, ledit moyen pour inverser la direction radiale du mouvement de balayage continuant à inverser la direction radiale du mouvement de balayage lors de chaque détection d'une différence croissante entre le code d'identification de piste recueilli et le code d'identification de piste cible jusqu'à ce qu'une correspondance se fasse entre eux par ledit moyen de comparaison; caractérisé par: des moyens pour augmenter par pas le code d'identification de piste cible d'une valeur fixée en l'absence d'une correspondance entre le code d'identification de piste recueilli et le code d'identification de piste cible dans une première période prédéterminée; ledit moyen de positionnement fin continuant à déplacer ledit lecteur de piste par pas en travers dudit nombre prédéterminé de pistes au cours de chaque rotation du disque en direction de ladite piste cible, après quoi ledit moyen pour comparer compare les codes d'identification de piste recueillis avec le code d'identification de piste cible augmenté par pas jusqu'à ce qu'une correspondance se fasse entre eux; ledit appareil comprenant un moyen de terminaison pour cesser ledit mouvement radial relatif lorsqu'une correspondance se fait, ledit lecteur de piste étant actionnable pour ensuite recueillir l'information enregistrée sur la piste dont le code d'identification correspond au code d'identification de piste cible augmenté par pas.

8. Appareil selon la revendication 7, dans lequel ledit moyen pour détecter est actif pour détecter la différence entre le code d'identification de piste recueilli et le code d'identification de piste augmenté par pas tandis que ledit moyen de positionnement fin continue à inverser la direction de mouvement radial du lecteur de piste lors de chaque détection d'une différence croissante entre le code d'identification de piste recueilli et le code d'identification de piste cible augmenté par pas, jusqu'à ce que ladite correspondance soit faite.

9. Appareil selon la revendication 8, dans lequel: ledit moyen de comparaison compare le dernier code d'identification de piste cible augmenté par pas avec le premier desdits codes d'identification de piste cible après qu'une correspondance soit trouvée et avant que ledit lecteur de piste recueille l'information de la piste à laquelle ont est arrivé; et ledit moyen de positionnement fin comprend un moyen sensible audit moyen de détection pour déplacer le lecteur de piste en direction de ladite piste cible en travers d'un nombre de pistes égal à la différence entre ledit dernier code d'identification de piste cible et ledit premier code d'identification de piste cible.

10. Appareil selon la revendication 7, dans lequel: ledit moyen de détection comprend un moyen pour détecter en continu la différence entre le code d'identification de piste recueilli et le code d'identification de piste cible augmenté par pas; ledit moyen d'inversion de direction comprend un moyen pour continuer à inverser la direction radiale du mouvement de balayage lors

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de chaque détection d'une différence croissante entre le code d'identification de piste recueilli et le code d'identification de piste cible augmenté par pas jusqu'à ce qu'une correspondance se fasse entre eux; ledit moyen d'augmentation par pas comprend un moyen, en l'absence d'une correspondance dans une autre période prédéterminée, pour augmenter par pas le code d'identification de piste cible augmenté par pas d'une valeur prédéterminée; et ledit moyen de comparaison comprend un moyen pour continuer à comparer lesdits codes d'identification de piste recueillis avec chaque code d'identification de piste augmenté par pas, et ledit moyen d'augmentation par pas comprend un moyen pour continuer à augmenter par pas le code d'identification de piste cible jusqu'à ce qu'un intervalle de temps fixé se soit écoulé depuis le déplacement initial du lecteur de piste par ledit moyen de positionnement grossier.

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