

Recording and reproducing an information signal on/from a longitudinal record carrier provided with tracking signals.

The invention relates to a longitudinal record carrier having a first and a second tracking signal of specific frequencies recorded in respective first and second tracks running in the longitudinal direction of the record carrier, to a method for producing such a record carrier, to an apparatus for recording an information signal on such record carrier and to an
5 apparatus for reading the information signal from said record carrier.

A record carrier as defined in the opening paragraph is known from USP 4,318,141, document D1 in the list of documents given at the end of this specification. The tracking signals are prerecorded deeply in tracks lying side-by-side to each other on the
10 record carrier. In a later recording step for recording the information signal, the information signal is recorded in a third track which lies exactly half over the first track and half over the second track.

The invention aims at providing specific marks for indicating the lead-in and the
15 lead-out area of the record carrier. The record carrier in accordance with the invention is characterized in that a lead-in portion of the record carrier is provided with a lead-in mark indicating a start end of the record carrier, a lead-out portion of the record carrier being provided with a lead-out mark indicating the final end of the record carrier, the lead-in mark being obtained by modifying at least one of the first and second tracking signals such that the
20 specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, the lead-out mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged.

More specifically, the record carrier is characterized in that the lead-in mark is obtained by
25 modifying the duty cycle of the said at least one of the first and second tracking signals in said lead-in portion and that the lead-out mark is obtained by modifying the duty cycle of the said at least one of the first and second tracking signals in said lead-out portion.

The invention is based on the following recognition. In prior art record carriers, the start end and the final end of the record carrier are indicated by marks on the record

carrier. In many cases, the record carrier is mounted on two reels in a cassette without being mechanically fastened to those reels. So, when the record carrier would be transported too far in one direction, one runs the risk that the record carrier is completely threaded from the reel, which is unwanted. The marks are provided in order to detect an approach of one end
5 of the record carrier, so that the transport of the record carrier can be halted, or reversed in direction.

The marks can be in the form of a conductive strip on the record carrier. Such conductive strips on the record carrier make it impossible to record information on that portions of the record carrier on which the conductive strips are mounted. In accordance with
10 the invention, the tracking signals are also recorded in the lead-in and the lead-out portions of the record carrier and marks are recorded on the record carrier in the form of a magnetic pattern. More specifically, the marks are realized by modifying the at least one of the first and the second tracking signals. As a result, the tracking frequencies in the lead-in portion and the lead-out portion of the record carrier function as tracking signals and also function,
15 as modified, as marks. Care must be taken that the frequency of the at least one of the first and the second tracking signals remains unchanged so that tracking can still be realized in the lead-in and the lead-out portion of the record carrier. As a result, a larger storage capacity can be realized to store the information signal on the record carrier.

The tracking frequencies are different in USP 4,318,141. Preferably, however,
20 the specific frequencies of the first and second tracking signals are substantially the same and the first and second tracking signals differ in phase.

A recording apparatus in accordance with the invention will be capable of recording an information signal on the record carrier, where the information signal can also be recorded in at least a part of the lead-in portion and the lead-out portion of the record
25 carrier.

A reproducing apparatus in accordance with the invention will be capable of reproducing the information signal from the record carrier, where the information signal can also be reproduced from said at least a part of the lead-in portion and the lead-out portion of the record carrier.

30 It should be noted that tracking signals having the same frequency but different phase are known from USP 4,056,832, document D2 in the list of related documents. Further, it should be noted that the publication 'Different marks for indicating and detecting the beginning and end of a tape' in Research Disclosure, October 1991, p. 726, document D3 in the list of related documents, discloses the use of a magnetic signal as marks. In both

cases, however, there is no indication of a modification of tracking signals in a lead-in or a lead-out portion.

In accordance with the invention, a tracking signal is modified, e.g. by changing the duty cycle. It may be possible to change the duty cycle even within the lead-in or the lead-out area, e.g. to indicate the portion of the lead-in and the lead-out area in which an information signal can be recorded. Such portions will thus adjoin the data area of the record carrier. The change in duty cycle within the lead-in and lead-out areas could be considered as begin-of-data and end-of-data markers.

10 These and other aspects of the invention will be apparent from and further elucidated with reference to the embodiments described hereafter.

Figure 1 shows an embodiment of the record carrier, provided with the tracks having tracking signals recorded in them,

figure 2 shows schematically the record carrier over its total length,
15 figure 3 shows an example of tracking signals recorded in the lead-in portion of a track,

figure 4 shows an example of tracking signals recorded in the lead-out portion of said track,

figure 5 shows an embodiment of an apparatus for producing a prerecorded
20 record carrier, having the tracking signal recorded in it,

figure 6 shows an embodiment of an apparatus for recording an information signal in the record carrier,

figure 7 shows the record carrier having an information signal recorded on it,
and

25 figure 8 shows an embodiment of an apparatus for reading the information signal from the record carrier.

Figure 1 shows an embodiment of a longitudinal record carrier 2. Only a part of the record carrier is shown. On the record carrier 2, tracks $T_1, T_2, \dots, T_n$ are present.
30 The tracks run parallel to each other in the longitudinal direction of the record carrier. A first tracking signal s_1 has been recorded in the track T_1 . A second tracking signal s_2 has been recorded in the track T_2 . A third tracking signal s_3 has been recorded in the track T_3 . An n-th tracking signal s_n has been recorded in the track T_n .

The tracking signals are signals of relatively low frequency, compared to the

frequency components of the information signal that will be recorded later on the record carrier. As the frequency of the tracking signals is relatively low, those tracking signals will be (have been) recorded deeply in the record carrier so that a later recording of the information signal will not result in an erasing of the tracking signals. The tracking signals in two
5 neighbouring tracks may have different frequencies. Preferably, however, the tracking signals have the same frequency and tracking signals in neighbouring tracks have a different phase. More specifically, the phase difference between the tracking signals of adjacent tracks is 180° .

Figure 2 shows the record carrier 2 again, now schematically over its total
10 length. The start end of the record carrier 2 is indicated by BOT (beginning-of-tape) and the final end is indicated by EOT (end-of-tape). A lead-in portion and a lead-out portion are shown, being the portions between the start end (BOT) of the record carrier and the line l_1 and the final end (EOT) of the record carrier and the line l_2 respectively.

Marks are provided in the lead-in portion and the lead-out portion of the record
15 carrier 2, indicating the start portion and the final portion of the record carrier respectively. The marks are realized by modifying the tracking signals present in at least one of the tracks of the lead-in and the lead-out portion. Preferably, the tracking signals in all the tracks in the lead-in portion are modified in the same way. Preferably, also the tracking signals in the lead-out portion are modified in the same way. The modification in the lead-in portion may
20 be different from the modification in the lead-out portion to make a distinction between the lead-in portion and the lead-out portion possible.

The modification of the tracking signals can be realized by changing the duty cycle of the tracking signals. Figure 3 shows an example of a tracking signal as recorded in a track, having a change in duty cycle to identify a lead-in portion. Figure 3 shows the
25 behaviour of the tracking signal around the right boundary of the lead-in portion of figure 2, that is: around the line l_1 in figure 2. Figure 3 shows a tracking signal in the form of a sinusoid having a specific frequency. This is shown at the right of the line l_1 . The duty cycle of the sinusoid is $1/2$, as usual for a normal sinusoid. At the left of the line l_1 (that is at the location of the lead-in portion), the duty cycle has changed from the value of $1/2$ to a value
30 of x , where x is a value smaller than one. x may have a value of $1/3$, as an example. The frequency of the tracking signal, however, has not changed. Figure 4 shows the behaviour of the tracking signal around the left boundary of the lead-out portion of figure 2, that is: around the line l_2 in figure 2. Figure 4 shows a tracking signal in the form of a sinusoid having a specific frequency, as in figure 3. This is shown at the left of the line l_2 . The duty

cycle of the sinusoid is again $1/2$. At the right of the line l_2 (that is: at the location of the lead-out portion), the duty cycle has changed from the value of $1/2$ to a value of y , where y is a value smaller than one. x may have a value of $2/3$, as an example. Again, the frequency of the signal has not changed. The change in duty cycle is different for the lead-in portion and for the lead-out portion.

The modified tracking signals in the lead-in and the lead-out portions are such that they can still be used as tracking signals, for the reason that the frequency and the phase relationship of the tracking signals has remained the same. Moreover, the modification of the tracking signals can be detected, so that it can be established that the head is located on the lead-in or the lead-out portion of the record carrier. The figures 3 and 4 thus show the tracking signal recorded in one of the tracks on the record carrier, such as the first tracking signal recorded in the track T_1 of figure 1 and 2. In a neighbouring track, another tracking frequency is recorded, such as the second tracking frequency in the track T_2 . This second tracking frequency can have the same shape as the first tracking frequency shown in the figures 3 and 4, but with an opposite polarity (or: the two tracking frequencies have a phase difference of 180°).

Figure 5 shows schematically an embodiment of an apparatus for producing a prerecorded longitudinal record carrier as described above with reference to the figures 1 to 4. More specifically, figure 5 shows an embodiment for generating the tracking frequency of the figures 3 and 4 for one track and a tracking signal of inverse polarity for a neighbouring track. The apparatus comprises a frequency generator 10, such as an oscillator for generating a signal of a specific frequency. An output of the oscillator 10 is coupled to an input of a modifier circuit 12. The apparatus comprises a write head arrangement 14 having n write heads h_1 to h_n . The output of the modifier circuit 12 is coupled to the odd numbered heads $h_1, h_3, h_5, \dots$ of the write head arrangement 14. The output of the modifier circuit 12 is further coupled to the even numbered heads $h_2, h_4, h_6, \dots$ of the write head arrangement 14 via an inverter 16. The apparatus of figure 5 further comprises a control unit and functions as follows.

The apparatus of figure 5 is capable of generating a prerecorded record carrier as shown in figure 2, where the first and second tracking signals of specific frequencies are tracking signals having the same frequency but different phase, more specifically a phase difference of 180° . To that purpose, the control signal generates an enable signal which is supplied to the modifier 12. The generator 10 supplies the signal of specific frequency to the modifier 12 which modifies the signal such that its duty cycle is changed from $1/2$ to x , e.g.

1/3, in response to a duty cycle control signal from the control unit 18. The odd numbered heads record this modified signal into the odd numbered tracks $T_1, T_3, \dots$. The modified signal supplied by the modifier 12 is also fed to the inverter 16, which inverts the polarity of the signal. As a result, a modified signal which is inverted in polarity compared to the signal supplied by the modifier 12, is supplied to the even numbered heads and recorded in the even numbered tracks $T_2, T_4, \dots$. This results in the lead-in mark being recorded in the lead-in portion of the record carrier, to the left of the line l_1 . Next, the modifier is disabled by the enable/disable control signal from the control unit 18. The signal supplied by the generator 10, having a duty cycle of 1/2, is supplied directly, that is: without modification, to the odd numbered heads and recorded in the odd numbered tracks. Further, after signal inversion in the inverter 16, an inverted tracking signal is supplied to the even numbered heads and thus recorded in the even numbered tracks. Next, the control signal generates an enable signal which is supplied to the modifier 12. The modifier 12 now modifies the signal such that its duty cycle is changed from 1/2 to y , e.g. 2/3, in response to another duty cycle control signal from the control unit 18. The odd numbered heads record this modified signal into the odd numbered tracks $T_1, T_3, \dots$. The modified signal supplied by the modifier 12 is also fed to the inverter 16, which inverts the polarity of the signal. As a result, a modified signal which is inverted in polarity compared to the signal supplied by the modifier 12, is supplied to the even numbered heads and recorded in the even numbered tracks $T_2, T_4, \dots$. This results in the lead-out mark being recorded in the lead-out portion of the record carrier, to the right of the line l_2 .

Figure 6 shows an embodiment of an apparatus for recording an information signal on the record carrier 1 of figure 1 and 2, which has the tracking signals prerecorded on it. Figure 7 shows how the information signal is recorded on the record carrier 1. A track T_a is recorded exactly on the boundary line between two adjacent tracks of tracking signals, such as the tracks T_1 and T_2 . The apparatus of figure 6 has an input terminal 30 for receiving the information signal. The input terminal is coupled to an input of a formatter unit 32, which converts the information signal into a format suitable for recording on the record carrier 1. An output of the formatter unit 32 is coupled to a write/read head 34. The formatted information signal is supplied to the write/read head 34 and recorded in the track T_a on the record carrier 1. The head 34 is further adapted to read the tracking signals recorded in the tracks T_1 and T_2 . The tracking signals are supplied to a filter unit 36, which has a bandpass filter characteristic with a centre frequency equal to the specific frequency of the tracking signals. As the frequency of the tracking signals is low relative to the frequency

content of the formatted information signal, it is possible to read the tracking signals from the tracks T_1 and T_2 , while writing the formatted information signal into the track T_3 .

When the head 34 is located exactly half way on the tracks T_1 and T_2 , tracking signals of equal amplitude but opposite phase are read from the tracks T_1 and T_2 . As a result, a substantially zero amplitude signal is supplied by the filter 36 to the generator unit 38. The generator unit 38 supplies a control signal to an actuator unit 40 in response to the signal applied by the filter 36. The actuator unit 40 may comprise a positioning unit (not shown) to position the head 34 in a direction transverse to the tracks. In the situation described above, where the head is positioned exactly half way on the two tracks T_1 and T_2 , no repositioning of the head 34 is required. If the head is positioned for a larger part on the track T_1 , the tracking signal read from the track T_1 will have a larger amplitude than the signal read from the track T_2 . This means that a non-zero amplitude signal will be supplied by the filter 36 to the generator unit 38. The generator unit 38 now generates a control signal for the actuator unit 40, such that the head 34 is moved in a specific direction towards a position leading to an decrease in amplitude of the signal applied by the filter 36 to the generator 38.

If the head 34 is positioned for a larger part on the track T_2 , the tracking signal read from the track T_2 will have a larger amplitude than the signal read from the track T_1 . This means that, again, a non-zero amplitude signal will be supplied by the filter 36 to the generator unit 38. The generator unit 38 now generates a control signal for the actuator unit 40, such that the head 34 is moved in the other direction towards a position leading to an decrease in amplitude of the signal applied by the filter 36 to the generator 38.

A detector unit 42 is present for detecting the fact that the tracking signals are modified in the lead-in and the lead-out portions of the record carrier. The detector unit 42 comprises any detector (not shown) to detect the modification in one or more of the tracking signals in one or more of the tracks. As an example, an additional read head (not shown) may be present to read the tracking signal from the track T_1 only. Further, the detector 42 may comprise an integrator. In another example, the additional head is located on another track, having the same tracking signal recorded in it as the track T_1 .

Suppose that the tracking signal in the lead-in portion of the track T_1 is modified as shown in figure 3. It will be clear that, when integrating the tracking signal read from the track T_1 , the integrated output signal is zero for positions outside the lead-in and the lead-out portions, as the duty cycle is $1/2$. When reading the tracking signal in the lead-in portion, the detector 42 detects the modified tracking signal shown in figure 3 to the left of

the line l_1 . The duty cycle is $1/3$ in the example. That means that the negative portion in each wavelength is larger than the positive portion. Upon integrating the modified tracking signal, this leads to a negative output signal, which is the identification of the lead-in portion of the record carrier.

5 Suppose that the tracking signal in the lead-out portion of the track T_1 is modified as shown in figure 4. It will be clear that, when reading the tracking signal in the lead-out portion, the detector 42 detects the modified tracking signal shown in figure 4 to the right of the line l_2 . The duty cycle is $2/3$ in the example. That means that the positive portion in each wavelength is larger than the negative portion. Upon integrating the modified
10 tracking signal, this leads to a positive output signal, which is the identification of the lead-out portion of the record carrier.

 When recording the information signal in the track T_a , the record carrier is transported by the motor transport unit 44 in a direction from the lead-in portion towards the lead-out portion. Upon entering the lead-out portion, the detector 42 is capable of detecting
15 the modified tracking signal and generates a positive control signal by means of the integrator. As the tracking signal is still present in the lead-out portion, the recording of the information signal in the first part of the lead-out remains possible, as the tracking control still functions. Upon the occurrence of the positive control signal, which is the indication of the lead-out portion, the motor transport unit 44 will either stop the transport of the record
20 carrier in order to prevent the record carrier to be withdrawn from the supply reel, or to reverse the transport direction of the record carrier 1. In the latter case, the head 34 will be positioned on another track. As an example, after having recorded the information signal in the track T_a , the head 34 is positioned on the boundary line between the tracks T_2 and T_3 , so that a track T_b comprising the recorded information signal, see figure 7, can be recorded on
25 the record carrier. The record carrier is now transported in the direction from the lead-out portion towards the lead-in portion.

 Upon now entering the lead-in portion, the detector 42 is capable of detecting the modified tracking signal and generates a negative control signal by means of the integrator. As the tracking signal is still present in the lead-in portion, the recording of the
30 information signal in the final part of the lead-in portion remains possible, as the tracking control still functions. Upon the occurrence of the negative control signal, which is the indication of the lead-in portion, the motor transport unit 44 will either stop the transport of the record carrier in order to prevent the record carrier to be withdrawn from the other supply reel, or to reverse the transport direction of the record carrier 1. In the latter case,

the head 34 will be positioned on another track. As an example, after having recorded the information signal in the track T_b , the head 34 is positioned on the boundary line between the tracks T_3 and T_4 , so that a track T_c comprising the recorded information signal, see figure 7, can be recorded on the record carrier.

5 Figure 8 shows an embodiment of an apparatus for reproducing an information signal from the record carrier 1 of figure 1 and 2, which has the tracking signals recorded on it in the tracks T_1 and T_2 and the information signal recorded on it in the tracks T_a and T_b , see figure 7. The apparatus of figure 8 has a reading head 50 which has an output coupled to an input of a deformatter unit 52. An output of the deformatter unit 52 is coupled to an
10 output terminal 54 for supplying the information signal. The deformatter unit 52 converts the formatted information signal which is read out from the tracks T_a and T_b into the original information signal, which is supplied to the terminal 54. The head 50 is further adapted to read the tracking signals recorded in the tracks T_1 and T_2 . The tracking signals are supplied to a filter unit 36, which is the same as the filter unit of figure 6. The apparatus further
15 comprises a generator unit 38, which is identical to the generator unit 38 of figure 6, an actuator unit 40 which is also identical to the actuator unit 40 of figure 6, a detector unit 42, which is identical to the detector unit 42 of figure 6 and a motor transport unit 44, which is identical to the transport unit 44 of figure 6.

When the head 50 is located exactly half way on the tracks T_1 and T_2 , tracking
20 signals of equal amplitude but opposite phase are read from the tracks T_1 and T_2 . As a result, a substantially zero amplitude signal is supplied by the filter 36 to the generator unit 38. The generator unit 38 supplies a control signal to an actuator unit 40 in response to the signal applied by the filter 36. The actuator unit 40 thus positions the head 50 in a direction transverse to the tracks, such that the head is positioned exactly on the track T_a . If the head
25 50 is positioned for a larger part on the track T_1 , the tracking signal read from the track T_1 will have a larger amplitude than the signal read from the track T_2 . This means that a non-zero amplitude signal will be supplied by the filter 36 to the generator unit 38. The generator unit 38 now generates a control signal for the actuator unit 40, such that the head 50 is moved in a specific direction towards a position leading to an decrease in amplitude of the
30 signal applied by the filter 36 to the generator 38, so that the head 50 is exactly above the track T_a .

If the head 50 is positioned for a larger part on the track T_2 , the tracking signal read from the track T_2 will have a larger amplitude than the signal read from the track T_1 . This means that, again, a non-zero amplitude signal will be supplied by the filter 36 to the

generator unit 38. The generator unit 38 now generates a control signal for the actuator unit 40, such that the head 50 is moved in the other direction towards a position leading to an decrease in amplitude of the signal applied by the filter 36 to the generator 38, so that the head 50 is again exactly above the track T_a .

- 5 The detector unit 42 functions in the same way as described above with reference to figure 6. Thus, upon the occurrence of the positive control signal, which is the indication of the lead-out portion, the motor transport unit 44 will either stop the transport of the record carrier in order to prevent the record carrier to be withdrawn from the supply reel, or to reverse the transport direction of the record carrier 1. In the latter case, the head
10 50 will be positioned on another track. As an example, after having read the information signal from the track T_a , the head 50 is positioned on the boundary line between the tracks T_2 and T_3 , so that a track T_b comprising the recorded information signal, see figure 7, can be read from the record carrier.

- The invention thus relates to the identification of lead-in and lead-out portions
15 of a longitudinal record carrier, using marks in the form of a modification of tracking signals recorded in tracks. This identification is such that the frequencies of the tracking signals remain unchanged in the lead-in and the lead-out portion. Such modification results in the possibility to use the tracking signals in the lead-in and the lead-out portion to record an information signal even in a part of the lead-in and the lead-out portion.

- 20 Whilst the present invention has been described with respect to preferred embodiments thereof, it is to be understood that these are not limitative examples. Thus, various modifications may become apparent to those skilled in the art, without departing from the scope of the invention, as defined in the appended claims.

Related documents

- (D1) USP 4,318,141
- (D2) USP 4,056,832 (PHN 7630)
- 5 (D3) 'Different marks for indicating and detecting the beginning and end of a tape' in
Research Disclosure, October 1991, p. 726

CLAIMS

1. Longitudinal record carrier having a first and a second tracking signal of specific frequencies recorded in respective first and second tracks running in the longitudinal direction of the record carrier, characterized in that a lead-in portion of the record carrier is provided with a lead-in mark indicating a start end of the record carrier, a lead-out portion of the record carrier being provided with a lead-out mark indicating the final end of the record carrier, the lead-in mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, the lead-out mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged.
2. Record carrier as claimed in claim 1, characterized in that the lead-in mark is obtained by modifying the duty cycle of the said at least one of the first and second tracking signals in said lead-in portion and that the lead-out mark is obtained by modifying the duty cycle of the said at least one of the first and second tracking signals in said lead-out portion.
3. Record carrier as claimed in claim 2, characterized in that the duty cycle of the said at least one of the first and second tracking signals in the lead-in mark is different from the duty cycle of the said at least one of the first and second tracking signals in the lead-out mark.
4. Record carrier as claimed in claim 3, characterized in that the duty cycle of the said at least one of the first and second tracking signals in the lead-in mark is x and the duty cycle of the said at least one of the first and second tracking signals in the lead-out mark is $1-x$, where x is a constant smaller than 1.
5. Record carrier as claimed in claim 1, 2, 3 or 4, characterized in that the specific frequencies of the first and second tracking signals are substantially the same and that the first and second tracking signals differ in phase.
6. Record carrier as claimed in claim 5, characterized in that the lead-in mark is obtained by modifying both the first and second tracking signals such that the specific frequency of both the first and second tracking signals remains substantially unchanged and that



the lead-out mark is obtained by modifying both the first and second tracking signals such that the specific frequency of both the first and second tracking signals remains substantially unchanged.

7. Method for producing a prerecorded longitudinal record carrier, the method
- 5 comprising the steps of
- generating first and second tracking signals of specific frequencies,
 - recording the first and second tracking signals in respective first and second tracks running in the longitudinal direction of the record carrier, characterized in that the method further comprises
- 10 - a first step of generating a lead-in mark indicating a start end of the record carrier,
- a second step of generating a lead-out mark indicating the final end of the record carrier, the first generating step generating the lead-in mark by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, the second generating step
- 15 generating the lead-out mark by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged,
- recording the lead-in mark in a lead-in portion of the record carrier and recording the lead-out mark in a lead-out portion of the record carrier.
- 20 8. Apparatus for recording an information signal on a record carrier, the record carrier having a first and a second tracking signal of specific frequencies recorded in respective first and second tracks running in the longitudinal direction of the record carrier, the apparatus being provided with
- means for receiving the information signal,
- 25 - means for writing the information signal in a third track on the record carrier and reading the first and second tracking signals from said first and second tracks,
- generating means for generating a control signal from the first and second tracking signals read from the record carrier, the control signal indicating the position of the writing means relative to the first and second tracks,
- 30 - positioning means for positioning the writing means relative to the first and second tracks so as to enable the writing of the information signal in said third track, characterized in that the apparatus is adapted to record the information signal in a record carrier in which a lead-in portion of the record carrier is provided with a lead-in mark indicating a start end of the record carrier, a lead-out portion of the record carrier being provided with a lead-out mark



indicating the final end of the record carrier, the lead-in mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, the lead-out mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, that the writing and reading means are further adapted to read the first and second tracking signals, where modified, from the lead-in portion and the lead-out portion of the record carrier, the generating means being further adapted to generate said control signal from said first and second tracking signals, where modified, the positioning means being further adapted to position the writing means relative to the first and second tracks so as to enable the writing of the information signal in said third track in at least part of the lead-in portion of the record carrier and at least part of the lead-out portion of the record carrier.

9. Apparatus as claimed in claim 8, characterized in that it is provided with detection means for detecting the modification in the said at least one of the first and second tracking signals in the lead-in portion and the lead-out portion of the record carrier and for generating a second control signal in response to a detection of a modification, the apparatus being further adapted to change the transport velocity of the record carrier in response to the occurrence of the second control signal.

10. Apparatus as claimed in claim 9, characterized in that the detection means are adapted to detect a change in the duty cycle in said at least one of the first and second tracking signals and to generate said second control signal in response thereto.

11. Apparatus for reading an information signal from a track on a longitudinal record carrier, the record carrier having a first and a second tracking signal of specific frequencies recorded in respective first and second tracks running in the longitudinal direction of the record carrier, and the information signal being recorded in a third track in the longitudinal direction of the record carrier, the apparatus being provided with

- means for reading the information signal from said third track on the record carrier and reading the first and second tracking signals from said first and second tracks,
- generating means for generating a control signal from the first and second tracking signals read from the record carrier, the control signal indicating the position of the reading means relative to the first and second tracks,
- positioning means for positioning the reading means relative to the first and second tracks so as to enable the reading of the information signal in said third track,



- means for supplying the read out information signal, characterized in that the apparatus is adapted to read the information signal from a record carrier in which a lead-in portion of the record carrier is provided with a lead-in mark indicating a start end of the record carrier, a lead-out portion of the record carrier being provided with a lead-out mark indicating the final end of the record carrier, the lead-in mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, the lead-out mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, that the reading means are further adapted to read the first and second tracking signals, where modified, from the lead-in portion and the lead-out portion of the record carrier, the generating means being further adapted to generate said control signal from said first and second tracking signals, where modified, the positioning means being further adapted to position the reading means relative to the first and second tracks so as to enable the reading of the information signal in said third track in at least part of the lead-in portion of the record carrier and at least part of the lead-out portion of the record carrier.

12. Apparatus as claimed in claim 11, characterized in that it is provided with detection means for detecting the modification in the said at least one of the first and second tracking signals in the lead-in portion and the lead-out portion of the record carrier and for generating a second control signal in response to a detection of a modification, the apparatus being further adapted to change the transport velocity of the record carrier in response to the occurrence of the second control signal.

13. Apparatus as claimed in claim 12, characterized in that the detection means are adapted to detect a change in the duty cycle in said at least one of the first and second tracking signals and to generate said second control signal in response thereto.

14. Apparatus for reading an information signal from a track on a longitudinal record carrier, the record carrier having a first and a second tracking signal of specific frequencies recorded in respective first and second tracks running in the longitudinal direction of the record carrier, and the information signal being recorded in a third track in the longitudinal direction of the record carrier, the apparatus being provided with

- means for reading the information signal from said third track on the record carrier and reading the first and second tracking signals from said first and second tracks,
- generating means for generating a control signal from the first and second tracking signals read from the record carrier, the control signal indicating the position of the reading means



relative to the first and second tracks,

- positioning means for positioning the reading means relative to the first and second tracks so as to enable the reading of the information signal in said third track,

- means for supplying the read out information signal, characterized in that the apparatus is

- 5 adapted to read the information signal from a record carrier in which a lead-in portion of the record carrier is provided with a lead-in mark indicating a start end of the record carrier, a lead-out portion of the record carrier being provided with a lead-out mark indicating the final end of the record carrier, the lead-in mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of
- 10 the first and second tracking signals remains substantially unchanged, the lead-out mark being obtained by modifying at least one of the first and second tracking signals such that the specific frequency of the said at least one of the first and second tracking signals remains substantially unchanged, that the apparatus is provided with detection means for detecting the modification in the said at least one of the first and second tracking signals in the lead-in
- 15 portion and the lead-out portion of the record carrier and for generating a control signal in response to a detection of a modification, the apparatus being further adapted to change the transport velocity of the record carrier in response to the occurrence of the control signal.



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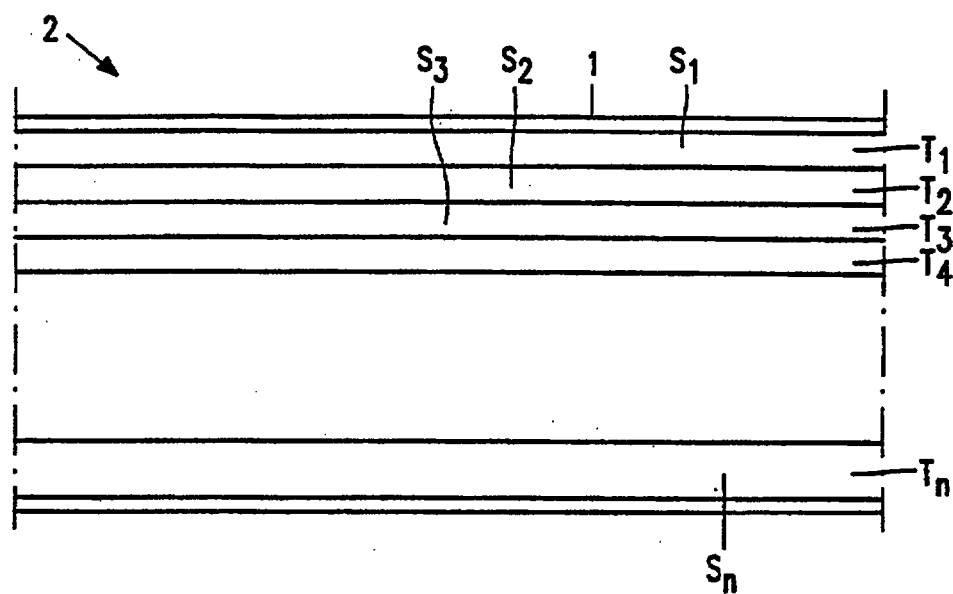


FIG. 1

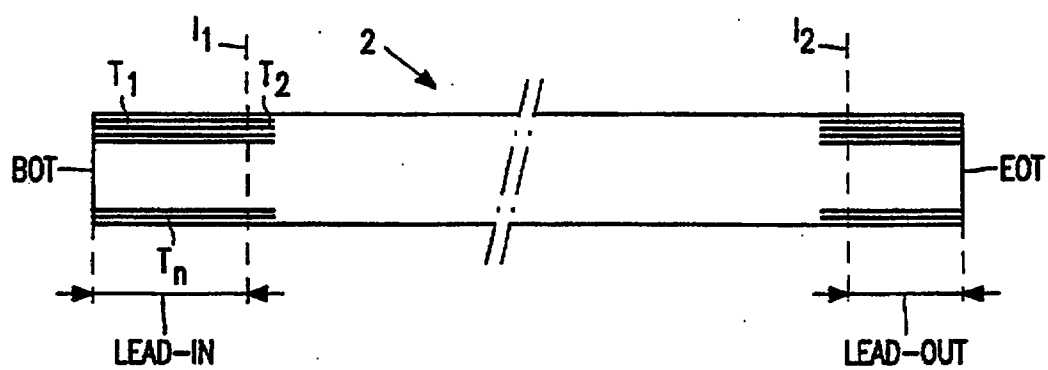


FIG. 2

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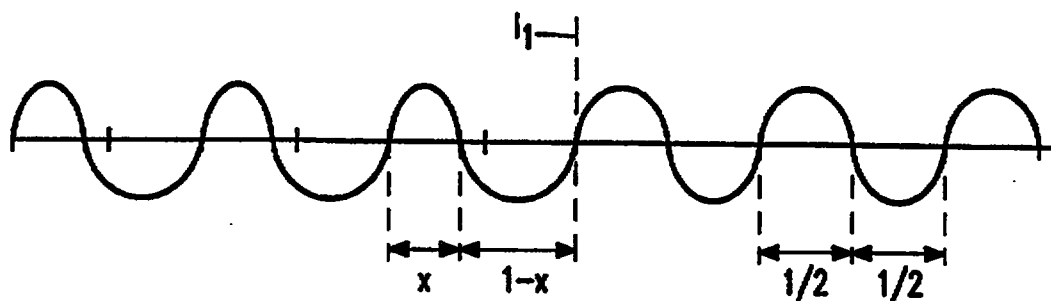


FIG. 3

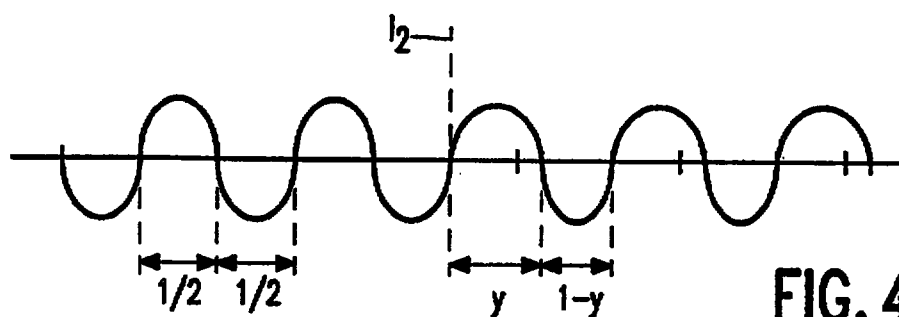


FIG. 4

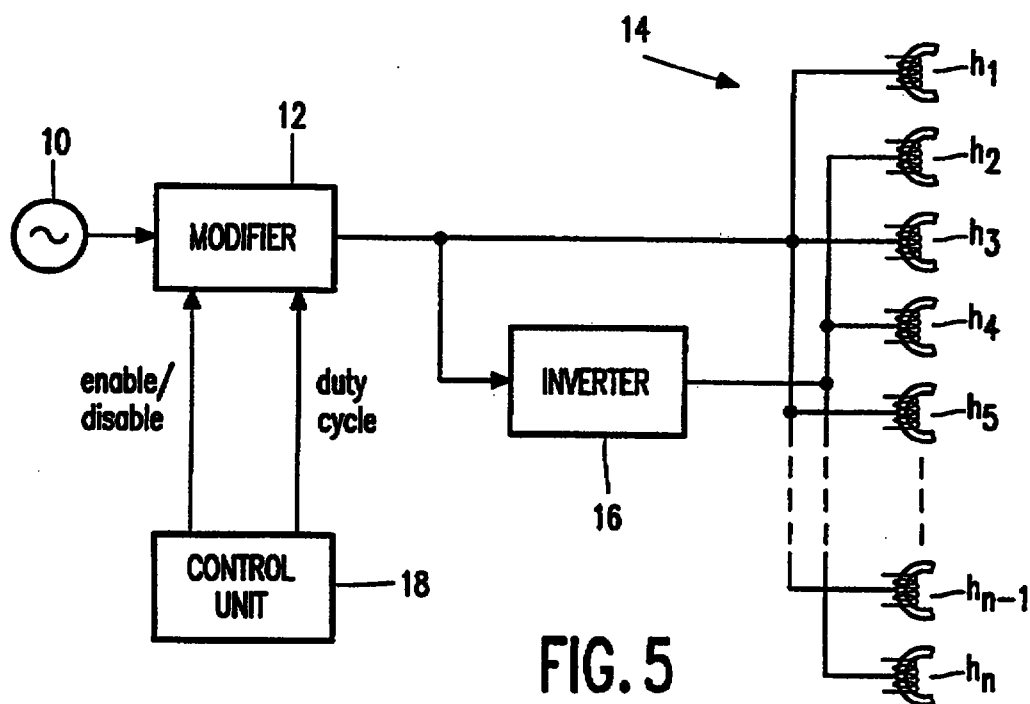


FIG. 5

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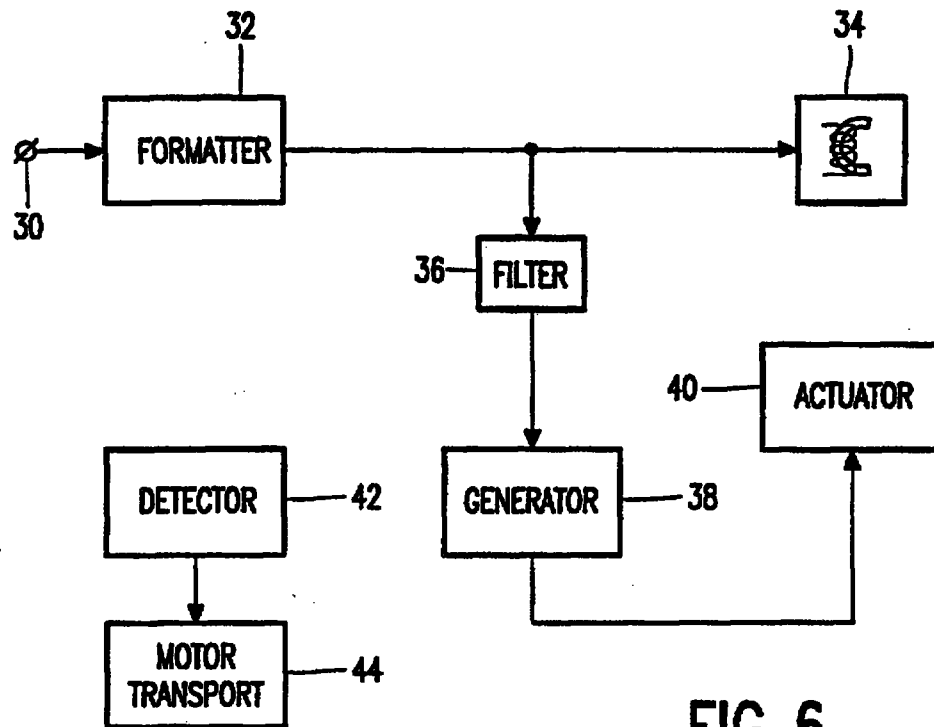


FIG. 6

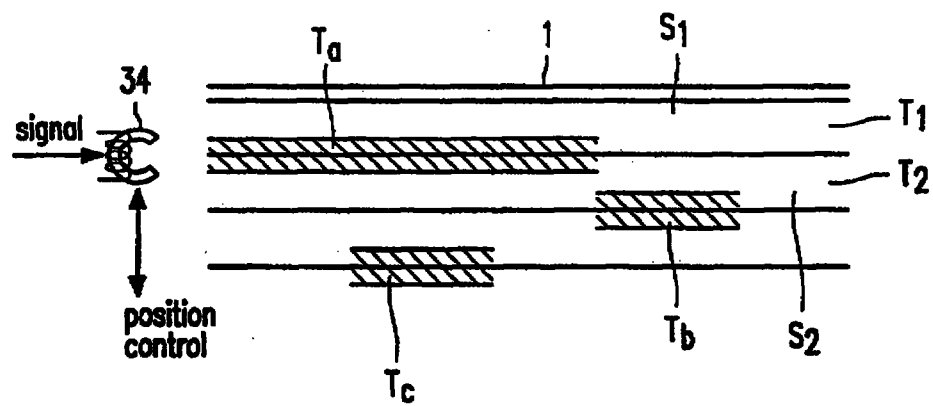


FIG. 7

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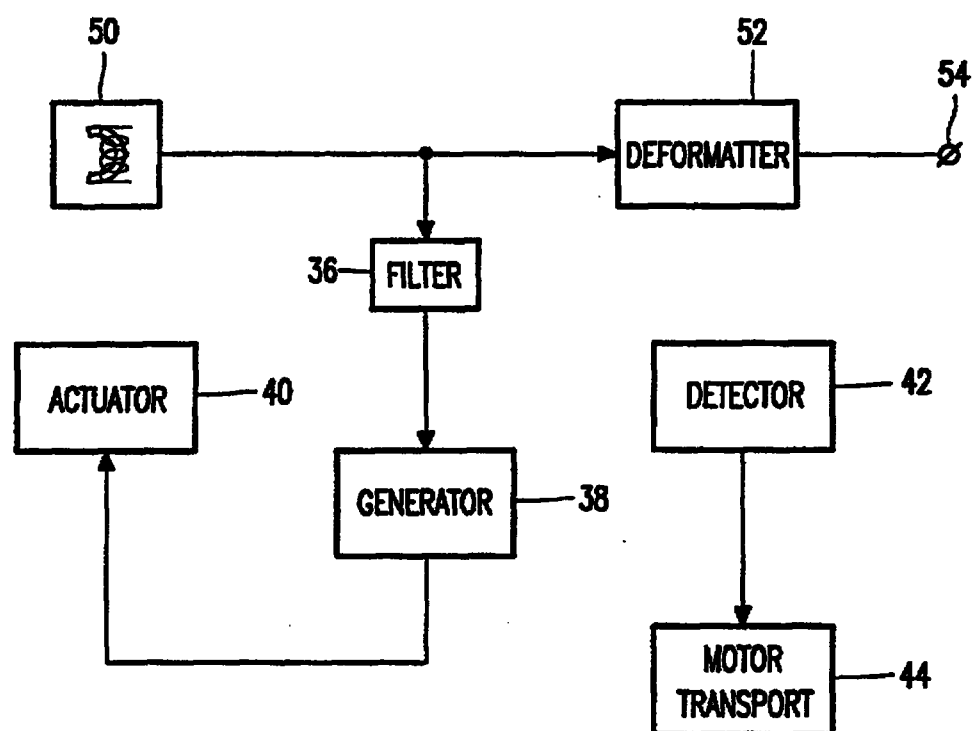


FIG. 8

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(21) International Application Number: ☒ PCT/IB96/01149 (22) International Filing Date: ☒ 25 October 1996 (25.10.96) (30) Priority Data: ☒ 95203028.6 ☒ 8 November 1995 (08.11.95) EP (34) Countries for which the regional or international application was filed: NL et al. (71) Applicant: PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL). (71) Applicant (for SE only): PHILIPS NORDEN AB [SE/SE]; Kottbygatan 7, Kista, S-164 85 Stockholm (SE). (72) Inventors: HOOGENDOORN, Abraham; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). KALFS, Johannes, Jozef, Wilhelmus; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). (74) Agent: VAN DER KRUK, Willem, L.; Internationaal Octrooibureau B.V., P.O. Box 220, NL-5600 AE Eindhoven (NL).	(81) Designated States: CN, JP, KR, NO, SG, TR, VN, European patent (AT, BE, CH, DE, DK, ES, FL, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. } plz refer to assignment (PF24) of 14 May 97	
(54) Title: RECORDING AND REPRODUCING AN INFORMATION SIGNAL ON/FROM A LONGITUDINAL RECORD CARRIER PROVIDED WITH TRACKING SIGNALS		
(57) Abstract The invention thus relates to the identification of lead-in and lead-out portions of a longitudinal record carrier (2), using marks in the form of a modification of tracking signals (s_1, s_2) recorded in tracks (T_1, T_2). This identification is such that the frequencies of the tracking signals remain unchanged in the lead-in and the lead-out portion. Such modification results in the possibility to use the tracking signals in the lead-in and the lead-out portion to record an information signal even in a part of the lead-in and the lead-out portion. The modification may be realized by changing the duty cycle of the tracking signals.		