

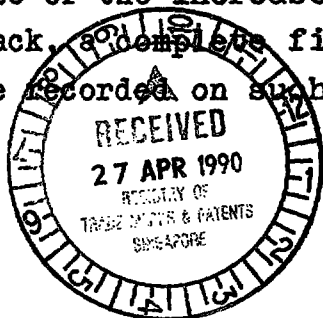
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The invention starts from a method of recording a signal in accordance with the preamble to Claim 1. Such a method is known through IBM TDB, Volume 22, NO. 4, September 1979, pages 1714-1716.

For the recording of broadband signals such as an analogue or digital picture signal, a digital sound signal and other broadband data signals for example, with only one scanning element in contact with the tape at a time, a high scanning speed is needed, that is to say relative speed between the scanning element, for example a magnetic head, and the recording medium, for example a magnetic tape. In the present-day video recorder, this scanning speed is of the order of magnitude of 300 cm per second.

In the so-called transversal recording which is used in particular for professional video recording, the signal is recorded in tracks which extend substantially perpendicular to the edge of a magnetic tape. In this case, the recording and scanning are effected with a rotating head wheel with a plurality of heads, against which head wheel the concavely curved tape is applied. With this solution, only a relatively short signal component of, for example, 16 lines of a television picture can be recorded on one transverse track because of its short geometrical length (equal to the width of the tape), so that repeated switching over between portions of track is necessary during one frame.

In so-called helical recording, the signals are recorded along tracks which extend obliquely to the edge of the tape at a small angle of about 6-7°. Because of the increased geometrical length of a portion of track, a complete field of a television signal can be recorded on such a portion of track extending



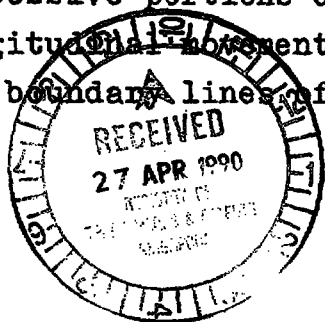
obliquely to the edge of the tape. This solution is used in particular for consumer video recorders.

The known solutions have various disadvantages in the recording of digital signals, particularly of a digital video signal.

Video recorders must, for example, render possible special modes of operation, so-called trick modes, such as picture search, dubbing and the like for example. The realization of such trick modes leads to considerable special problems in the recording of digital signals. On the one hand, a digital picture signal must, in principle, be segmented to a greater extent than an analogue signal during the recording, even in relation to the same track length. On the other hand, the really simple solutions known from the recording of an analogue signal, such as the traversing of the video head over a plurality of tracks during the picture search for example, prove unusable during the recording of a digital signal.

Such special requirements can be better met, particularly in the case of a digital signal, by the known method described at the beginning with a recording pattern in the form of blocks. It is a prerequisite for this that the boundary lines of the blocks should be directed perpendicular or nearly perpendicular to the edge of the medium. This condition is not met without more ado since an offsetting of successive portions of track in the longitudinal direction of the tape occurs because of the continuous movement of the tape in its longitudinal direction.

It is the object of the invention to develop the known method further so that the offsetting of successive portions of track, caused in itself by the longitudinal movement of the tape is compensated, and the boundary lines of the blocks on the tape are



directed approximately perpendicular to the edge of the medium.

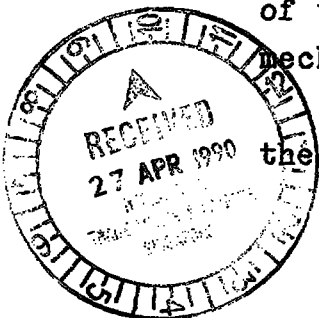
This problem is solved by the invention given in Claim 1. Advantageous further developments of the invention are given in the sub-claims.

A method using a recording in the form of blocks is also known (GB-PS 1 476 819) wherein the tape executes a continuous movement in the longitudinal direction and the rotating head wheel round which the tape is wrapped executes a slow reciprocating movement transversely to the longitudinal direction of the tape. There, however, no steps are taken to compensate the offsetting of adjacent portions of track in the longitudinal direction of the medium caused by the longitudinal movement of the tape. The boundary lines of the blocks therefore lie at an angle obliquely to the edge of the magnetic tape.

Through the solution according to the invention with boundary lines of the blocks formed directed perpendicular or substantially perpendicular to the edge of the medium, the following advantages result which are particularly effective during the recording of a digital picture signal.

A picture search is rendered possible without heavy expenditure being necessary on micromechanics for the tracking. The recording of the sound signal can be effected with optimum utilization of the storage area in such a manner that the sound signal can be recorded, reproduced and erased separately from the picture signal and so dubbing is also possible. The recording and reproduction are possible in both directions of travel of the recording medium. A simple loading mechanism for the recording medium also results.

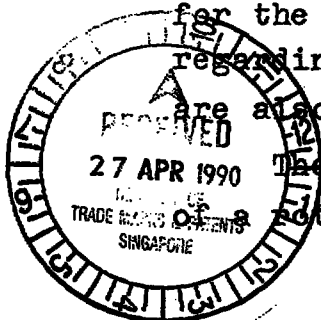
With the solution according to the invention, the blocks, each consisting of a plurality of portions



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of track, occupy substantially rectangular areas on the medium, which areas are bounded by lines which are substantially parallel and substantially perpendicular to the edge of the support. These blocks occupying substantially rectangular areas are thus arranged on the magnetic tape following one another in a matrix-like manner in the longitudinal direction. At the same time preferably no gap is provided between successive blocks or between tracks lying parallel and adjacent to one another, thus portions of track lying one behind the other in the longitudinal direction of the medium merge into one another without a gap or overlap one another. The portions of track are preferably each marked by a beginning pulse and an end pulse. Nevertheless, the portions of track lying parallel side by side transversely to the longitudinal direction of the medium can be separated from one another because of different azimuth angles.

The recording and reproduction is preferably effected with a cylindrical head drum over the circumference of which a plurality of heads are distributed. The head drum is wrapped round by the magnetic tape at an angle of 180° for example, in such a manner that the longitudinal direction of the magnetic tape extends substantially transversely to the axis of the cylinder, thus, in contrast to helical recording, it is not inclined in relation to this. Thus the two edges of the magnetic tape always lie on one plane. This solution has the advantage that, in contrast to helical recording, the magnetic tape always remains in one plane and parallel to the winding axis, and that the expenditure for the guiding of the tape and the requirements regarding the accuracy of the guiding of the tape are also reduced.



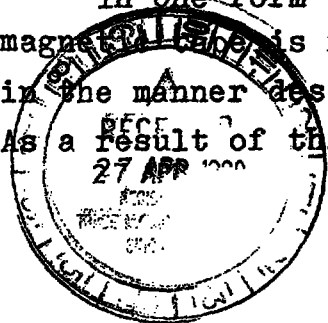
The heads can be arranged at the circumference of a rotating head drum. It is also possible to

arrange the heads on a rotating head wheel disc which is between two fixed cylinders coaxial with one another and with the head wheel disc. With this solution, the friction between the head wheel and the magnetic tape, and the inert mass of the rotating parts are reduced in comparison with the case where the whole head drum rotates.

In order that the tracks may be recorded side by side transversely to the direction of the tape, the head wheel is continuously adjusted in the direction of its axis, that is to say transversely to the longitudinal direction of the magnetic tape during the scanning operation. As a result, the portions of track are in a slightly inclined position relative to the edge of the tape.

As a result of the matrix-like arrangement, it is possible, during the scanning, to scan only certain regions of each block by appropriate alteration of the range of vertical adjustment of the head wheel transversely to the direction of the tape. Individual regions of a block, which follow one another transversely to the direction of the tape, may therefore contain different signals which are independent of one another, such as a picture signal, various sound signals and control signals for example. As a result of the fact that the portions of track lie substantially parallel to the edge of the tape, various recorded signals can be geometrically separated and be reproduced separately from one another, in contrast to helical recording. This also applies to tape speeds which differ from the normal speed, for example for search.

In one form of embodiment of the invention, the magnetic tape is recorded on over only half its width in the manner described and is scanned accordingly. As a result of this solution, a so-called reversible



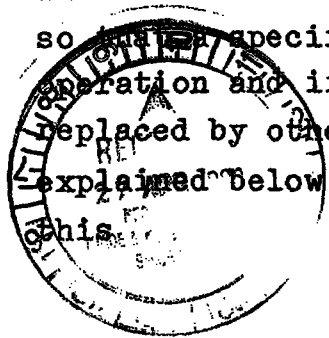
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cassette is rendered possible with which, during one scanning operation, only half the width of the magnetic tape and, after reversal of the cassette, the other half is recorded or scanned each time. The magnetic tape may, however, also be recorded quasi compatibly with signals at a relatively high data rate, such as a high-definition television signal (HDTV) for example, using both half-tracks of the tape with two scanning systems working in parallel for example.

During the recording of a television signal, one portion of track contains about 1/50th of a frame, that is to say about 16 images per block. The number of heads disposed on the head drum is preferably an even number, for example 4. The number of portions of track per block is preferably also an even number and is in the order of magnitude of some 100s to 1,000. In order to reduce the crosstalk between adjacent portions of track, the recording in adjacent portions of track is preferably effected with differently inclined azimuth angles, for example $+6^\circ$ and -6° . In this case, portions of track situated one behind the other in the longitudinal direction of the tape have the same azimuth angle.

According to a further development of the invention, a device for automatic track following, a so-called DTF (Dynamic Track Following), may additionally be provided whereby the head is always adjusted precisely to the portion of track, particularly at the end of a portion of track.

The individual blocks are preferably provided with an addressing, that is to say a continuous numbering, so that a specific block can be reached in search operation and if necessary be erased, corrected or replaced by other signal contents. The invention is explained below with reference to the drawing. In



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Figure 1 shows the arrangement of the portions of track on half the width of a magnetic tape,

Figure 2 shows an enlarged illustration of the portions of track according to Figure 1,

Figure 3 shows the coordination of the magnetic tape with a head drum carrying the heads,

Figure 4 shows the course of the recording in time with reference to an example with 4 heads and four portions of track per block, for the case where the tape feed and the direction of rotation of the head are in the same direction,

Figure 5 shows the course in time according to Figure 4 for the case where the direction of the tape feed and the direction of the head movement are oppositely directed,

Figure 6 shows a more detailed explanation of the angles occurring in Figures 4, 5 for the practical case with a plurality of portions of track per block,

Figure 7 shows a practical design of the head wheel,

Figure 8 shows a section through Figure 7,

Figure 9 shows a further development of the head wheel,

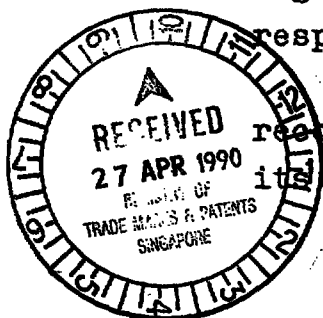
Figure 10 shows a section through Figure 9,

Figure 11 shows the cooperation between a cassette containing the magnetic tape and the head drum according to Figures 9, 10,

Figure 12 shows an arrangement of tracks on the magnetic tape with distinguishing signals for automatic track finding, and

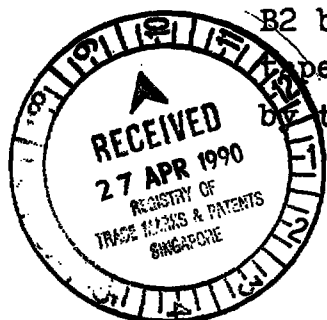
Figure 13 shows the arrangement of the distinguishing signals in time windows at the beginnings and ends respectively of tracks.

Figure 1 shows a magnetic tape 1 which, during the recording and during the reproduction, is conveyed in its longitudinal direction 2 at a constant speed, for



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example in the order of magnitude of 10 - 30 mm/s. The portions of track S with the width b and the length l, recorded on the magnetic tape 1, extend substantially parallel to the edge 3 of the tape, being inclined at a small angle $\varphi \approx \arctan b/l$, for example $\arctan 10 \mu\text{m}/15 \text{ mm}$. Except during the transition from one block to another, portions of track S following one another in time lie side by side in the transverse direction of the tape 1 and thus form a block B1 of portions of track. The boundary lines 4, 5 of the block B1, that is to say the line of the beginning points and end points of the portions of track S, lie perpendicular to the edge 3 of the tape. The block B1 extends over only half the width of the tape 1. The purpose of this is that another independent signal can be recorded on the other half (reversible cassette). The slightly oblique position of the portions of track S in relation to the edge 3 of the tape is due to the fact that, during the scanning, the head scanning the portions of track S simultaneously executes a continuous movement in the transverse direction 6 so that, on the change-over from one head to another, the latter can record the next portions of track S, lying parallel underneath, with the necessary offsetting. In this manner, the blocks B1, B2, B3, B4 etc. are recorded in succession and each occupy a substantially rectangular area on the tape 1, which area is bounded perpendicular to the edge 3 of the tape in the direction of the tape. When the last portion of track S has been recorded at the lower edge of the block B1, the next active head begins the corresponding recording of the next block B2 but now starting from the middle of the magnetic tape 1 as far as the edge 3 of the tape, as illustrated by the arrows. Since the head now moves from the



middle of the tape 1 to the edge 3 of the tape, that is to say upwards, the inclined position of the portions of track in the block B2 is also directed oppositely in comparison with that in block B1.

Figure 2 shows, in an enlarged illustration, four successive portions of track S1 - S4 for the block B2. The portions of track S are each marked by a beginning pulse 7 and an end pulse 8 so that the portions of track S can be recognized again during the reproduction.

In Figure 3, the tape 1 is guided by guide rollers 9, 10 over an angle of about 180° round a cylindrical head drum 11. In the course of this, the tape extends perpendicular to the axis 12 of the head drum 11, that is to say it is not inclined at an angle thereto as in so-called helical recording. Thus the tape 1 does not suffer from any twisting out of the plane of the winding axes. The head wheel 11 carries heads K1, K2, K3, K4 which successively record or reproduce the portions of track S1, S2, S3, S4 on the tape 1. In the course of this, the head drum 11 moves in the direction of the axis 12, and does so in alternate directions for the successive blocks B1, B2, B3, B4 as illustrated by the arrows in Figure 1.

When a head K is recording a portion of track S, the tape 1 moves during this time by a certain amount in the longitudinal direction 2. If the next head were now to record the following portion of track S, for example S2, under the same conditions, the second portion of track would be offset by this amount counter to the direction 2 in relation to the preceding one. Thus the individual blocks B shown in Figures 1, 2 would not lie perpendicular to the edge 3 of the tape but obliquely to the edge 3 of the tape. Then the tape would not be fully utilized or an overlapping of individual blocks B would occur.

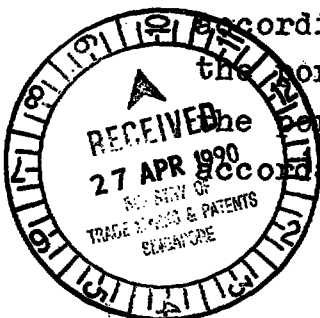


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Figure 4 shows a control of the heads in a simplified example with 4 heads and 4 successive portions of track S per block, wherein the position of the portions of track as shown in Figures 1, 2 is reached.

In Figure 4a, it is assumed that, with the drum in the initial phase of 0° , the head K1 records the portion of track S1 on the tape 1 by rotation of the head drum 11 over an angle of 112.5° in the direction illustrated, and at the same time moves continuously in the direction of the axis 12. During this time, however, the position of the tape 1 in relation to the head drum 11 has not remained unaltered. Instead, the tape 11 has moved in the direction 2 by the longitudinal advance of the tape. Thus the length of the portion of track recorded on the tape corresponds to a quarter of the circumference of the head drum. Thus at the end of the recording operation, the beginning of the portion of track S1 recorded is no longer at the point designated by K1 in Figure 4a but is offset by 22.5° in the direction 2. Therefore, the recording operation with the head K2 is started with an initial phase of 22.5° for the following portion of track S2. As a result, the effect is achieved that the portion of track S2 lies immediately beside the portion of track S1, without any offsetting, as illustrated in Figure 2.

Since, after the recording of the portion of track S2, the magnetic tape 1 has again moved by the same amount in the longitudinal direction 2, the beginning of the track S2 recorded now lies at the point indicated by K3 in Figure 4c. Therefore, the recording operation with the head K3 for the portion of track S3 accordingly begins with an initial phase of 45° so that the portion of track S3 again lies immediately beside the portion of track S2 without any offsetting, in accordance with Figure 2. Accordingly, the recording



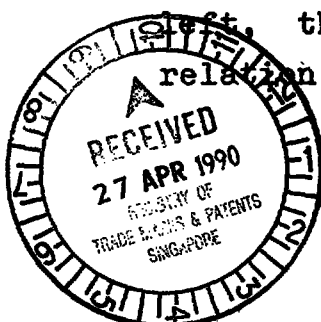
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operation with the head K4 for the portion of track S4 begins with an initial phase of 67.5° in accordance with Figure 4d so that the portion of track S4 also lies immediately beside the other portions of track S1 - S3 without any offsetting. Figure 4e shows the starting position for the recording of the first track of the next block B3 with the head K2.

The offsetting of the beginning and end points of the tracks in relation to the fixed preset entry and exit of each head into and from the angular region wrapped round by the tape, which offsetting compensates for the tape speed within a block, is realized by suitable electronic switches, that is to say:

- During the recording operation, the head signal is applied only for the respective angular range.
- During the reproduction operation, the respective period of time is blanked out of the reproduced signal.

Figure 5 shows the scanning of the magnetic tape 1 according to Figure 4 but for the case where the transport direction 2 of the magnetic tape 1 is directed counter to the direction of rotation of the head drum 11. Since the magnetic tape 1 now runs counter to the heads K at the circumference of the head drum 11, the geometrical length of the recorded portion of track is increased. Since the length of a portion of track should again correspond to the circumference over 90° of the head drum 11, the angle during which a head K carries out the recording operation or reproduction operation is reduced by 22.5° . In Figure 5a, the scanning begins with the head K1 at 112.5° and ends at 180° , that is to say it amounts to $90^\circ - 22.5^\circ$. Since, during this scanning, the magnetic tape 1 has moved towards the left, that is to say in counter-clockwise direction in relation to the head drum 11, the recorded portion of



track according to Figure 5b is at 90° , so that according to Figure 5b, the next portion of track is then again recorded over an angle of $90^\circ - 22.5^\circ$, beginning at 90° . According to Figures 5c and d, the beginning of the scanning operation of a head K is now displaced by 22.5° counter to the direction of rotation of the head drum 11, from one portion of track to the next.

In Figure 5e, the scanning of a portion of track of the next block begins, again with an initial phase of 112.5° . It can be seen that this scanning is now effected with the head K4. The heads must be fed with the signals accordingly.

Figure 6 shows various phases of the recording of portions of track within a block for the generalized case of many tracks per block. In an application which is logical in practice, the starting point here is a magnetic tape with a width of 8 mm, a track width $b = 10 \mu\text{m}$ and a head wheel with four magnetic heads. Instead of the number of 400 portions of track per block which would be calculated theoretically, taking into consideration inevitable centre and marginal fields on the magnetic tape, only 360 portions of track per block are assumed. Thus the dynamic shortening or lengthening of the angle of rotation of the head, necessary for the recording or reproduction, which was assumed to be 22.5° by way of simplification in Figures 4 and 5, is calculated as

$$\delta \varphi = 90^\circ / 360^\circ = 0.25^\circ$$

Figure 6a now shows the recording of the first of 360 portions of track per block with the magnetic head K1 with movement of head and tape in opposite directions. The head K1 begins the recording operation with an initial phase

$$90^\circ + \Delta \varphi = 90.25^\circ$$



and records over an angle of rotation of $90^\circ - \Delta \varphi$. The next magnetic head K2 takes over the recording operation (see Figure 6b) with an initial phase

$$\psi_2 = \psi_1 - \delta \varphi = 90^\circ$$

and in turn again records over an angle of rotation of $90^\circ - \delta \varphi$.

Figure 6c shows the general case of recording the portion of track No. n (between 1 and 360). The initial phase resulting from calculation is

$$\psi_n = \psi_1 - (n - 1) \cdot \delta \varphi,$$

while the angle of rotation used for the recording operation remains constant at $90^\circ - \delta \varphi$.

Figure 6d shows the angular relationships during the recording of the last track of the block under consideration, with the head K4. The initial phase has been reduced to

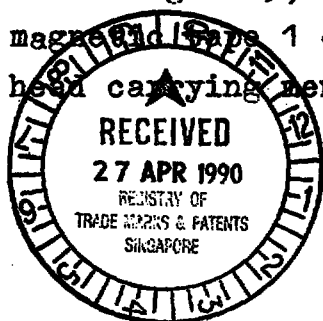
$$\psi_{360} = 2 \cdot \delta \varphi.$$

On the transition to the first portion of track of the next block (see Figure 6d), the head K4 remains switched on and records - practically continuously - from the initial phase

$$\psi_1 = 90^\circ + \delta \varphi.$$

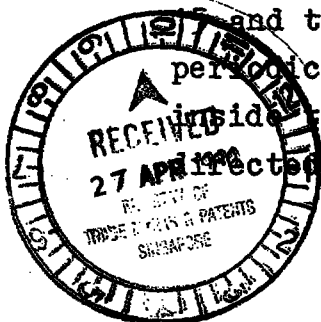
As a result of this jump of the initial phase by the phase angle $90^\circ - \delta \varphi$ used for the recording of each track, the intended uninterrupted sequence of blocks with boundary lines perpendicular to the edge of the tape is achieved in the longitudinal direction of the tape.

Figure 7 shows a practical embodiment of the head drum 11 illustrated in Figures 3 and 4. The shaft 13, to which the cylinder 14 is secured, is mounted in the bearing 52 for rotation but not for axial displacement. As in Figure 3, the cylinder 14 is wrapped round by the magnetic tape 1 over an angle of about 180° . The head carrying member 15 is mounted in the cylinder 14



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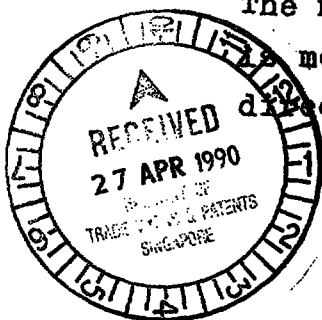
for axial displacement relative to this but non-rotatably. This head carrying member contains four web-like members 6 which are distributed over the circumference and slide in grooves 17 extending axially in the cylinder 14. The members 16 close the grooves 17 practically completely apart from a small gap of about 1/10th mm. Their surface is mainly adapted to the surface of the cylinder 14 so that the surface of the cylinder 14 is practically not interrupted by the grooves 17 in the region of the position of the magnetic tape 1. The members 16 carry the magnetic heads K1 - K4 which thus come into contact with the magnetic tape 1 and can effect the recording described. The head carrying member 15 and the motor 14 are driven jointly by the motor 24 via the transmitter 18 and the shaft 19 so that the scanning of the magnetic tape 1 is effected by the four magnetic heads K1 - K4 in accordance with Figure 4. The transmitter 18 serves to supply the signals to the heads K1 - K4 and to take off the signals during the reproduction. Thus the upper part of the transmitter 18 rotates together with the shaft 19, the head carrying member 15, the cylinder 14 and the shaft 13 while the lower part remains stationary and serves for the supply and offtake of the signals for the heads or from the heads. Disposed at the lower end of the motor 24 is a non-rotating shaft 19 which penetrates into a plunger coil 20 which serves as an actuator and is in turn secured fixed to the chassis 21. A delta voltage 22 is applied to the plunger coil 20. Through the plunger coil 20, the shaft 19, the motor 24, the transmitter 18, the shaft 19, the head carrying member and the members 16, this voltage 22 causes the periodic axial displacement of the heads K1 - K4 inside the grooves 17, which is indicated by the arrows effected alternately upwards and downwards in Figure 1.



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Figure 8 shows a section through the arrangement according to Figure 7, in a plane perpendicular to the axis and substantially in the middle of the magnetic tape 1. The four heads K1 - K4 are arranged distributed uniformly over the circumference as in Figure 3. The web-shaped members 16, together with the heads K1 to K4, form a mainly tight closure of the grooves 17 so that the magnetic tape does not experience any appreciable deformation in the region of the heads K1 - K4. The gaps of the heads K1 - K4 project somewhat beyond the surface line of the cylinder 14 so that a reliable contact is ensured between the heads and the magnetic tape 1. The rotating cylinder 14 is non-displaceable in the direction of the axis 23 while the head carrying member 15 together with the heads K1 - K4 is continuously and periodically adjusted relative to the cylinder 14, in the direction of the axis 23 as shown in Figure 7.

Figures 9 and 10 show a further construction of the head drum 11. Between the arm 25 secured to the chassis 21 and the chassis 21, the cylinder 14 carrying the heads K is mounted on the stationary shaft 26 for rotation by means of radial bearings 27, 28. The cylinder 14 is driven by the motor 24 via the driving belt 29. The axial movement of the cylinder 14, described in more detail, is compensated by a crowned construction of the belt pulley 30. Mounted for rotation on the frame 21 is a gearwheel 31 with external teeth and an internal tap, in which gearwheel the pinion 32 of the motor 33 engages. The motor 33 causes the adjustment in height of the cylinder 14 in the direction of the axis 23 in the following manner. The motor 33 turns the gearwheel 31. The member 34 is mounted in the gearwheel 31 for adjustment in the direction of the axis 23 by a pin 35 and a groove 36

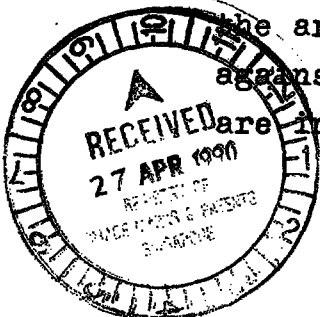


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but is non-rotatable. On rotation of the gearwheel 31, as a result of the thread between gearwheel 31 and member 34, the member 34 is displaced in the direction of the axis 23 and acts, via a piezo-electric transducer 37, on the cylinder 14 so that this is adjusted in the direction of the axis 23. The piezo-electric transducer 37 causes a fine adjustment of the cylinder 14 in the direction of the axis 23 for the automatic track following. The supply and offtake of the signal to and from the heads K is effected by the rotating transmitter of which the lower, fixed part is connected to the member 34 and the upper, rotating part to the cylinder 14. The cable 38 leads to the transmitter 18, the motor 33 and the phase detector 38 which serves to detect the current angular position of the cylinder 14.

In the region where the magnetic tape, not illustrated, wraps round the cylinder 14, the tape guide 39 is provided which surrounds the cylinder 14 over an angle of somewhat less than 180° . The tape guide 39 has angled edges at the top and bottom, which cause a vertical guiding of the tape. Provided at both ends of the tape guide 39 are receivers 40 with trapezoidal incisions which serve to receive the pins which bring the magnetic tape out of a cassette. Thus the magnetic tape wraps round the cylinder 14 between the two receivers 40, of which only the front one is illustrated in Figure 9. A corresponding receiver 40 with trapezoidal notches 41 is provided at the other side, that is to say behind the cylinder 14.

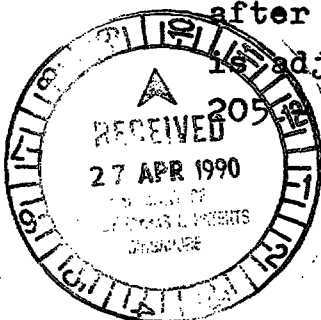
Figure 11 shows how the magnetic tape 1 from the cassette 44 is applied against the cylinder 14. The magnetic tape 1, which is at first in the cassette 44, is pulled out of the cassette 44 in the direction of the arrows illustrated by two pins 42, 43 and applied against the cylinder 14. During this, the pins 42, 43 are inserted in the trapezoidal notches 41 in the



second head is switched to reading and it is ascertained in an evaluation circuit whether the signal supplied to the first head appears at the output of the second head. If this is not the case, there is not yet any head/tape contact. If the signal supplied to the first head is detected at the output of the second head, the head/tape contact is sure to be present because otherwise the second head would not be able to read this signal. In order to be certain, the presence of the signal is preferably detected repeatedly, that is to say during a plurality of revolutions of the head drum 11 before switching over to the particular function recording or reproduction. In this manner, it is possible to ascertain, independently of an evaluation of the angle of rotation of the head wheel, whether the head is already in contact with the tape and so the recording operation or reproduction operation can be initiated. As a result, a better utilization of the magnetic tape may possibly be achieved.

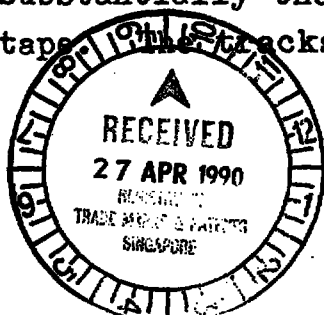
With reference to Figures 12, 13, a further development of the method is described which serves for determining, for finding and/or for recording tracks, that is to say it renders possible an automatic correct tracking or track finding.

Figure 12 shows a magnetic tape 201 with blocks 202 - 204 in which tracks 205 - 216 are arranged. The tracks 205 - 208 are arranged one below the other and the tracks 205, 209, 213 side by side. The height lines 55 - 57 extend parallel to the edge 58 of the tape. The tracks 205 - 216 are divided into track portions 217 - 252. While a magnetic head 60, 61 is running through the track portion 241 - 252, hereinafter called run-in 241 - 252, the head wheel disc 59 is adjusted. In the trailer 217 - 228 of a track 205 - 216, hereinafter called the run-out, a magnetic



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head 60,61 must detect the precise position of a track 205 - 216. Disposed in front of the run-outs 217 - 228 are synchronizing regions 229 - 240. The intelligence and/or the information of a track 205 - 216, hereinafter called the useful signal, lies between the run-in 241 and the synchronizing region 229, the run-in 242 and the synchronizing region 230, the run-in 243 and the synchronizing region 231 etc. The block circuit diagram 59 shows part of a head wheel disc with magnetic heads 60, 61. Recorded signals and/or signals to be recorded are transferred from and/or to the head wheel disc to and/or from the circuit construction in the chassis of a video recorder via a control 63 and one or more transformers 64. The block circuit diagram 59 shows the edge 62 of the head wheel disc in the developed state. Only a slight curvature of the edge 62 of the head wheel disc indicates that the head wheel disc is round. In practice, four magnetic heads 60, 61 are accommodated on a head wheel disc with a spacing of 90°. During the recording of signals in the block 203, the magnetic head 60 reads the run-out 219 of the track 207 in the block 202. At the same time, the magnetic head 61 records the run-out 222 of the track 210 in the following block 203. The blocks 202 and 204 are recorded track by track from the bottom upwards; the block 203 is recorded track by track from the top downwards. In the region 247, because of the information from the run-out 219 which the head 60 has read, the head wheel disc is re-adjusted before the head 60 begins to record a useful signal on the track 211. The broken height lines 56 and 57 indicate that the run-out 219 is substantially parallel to the run-in 247 and that the run-out 219 and the run-in 247 are at substantially the same distance from the edge 58 of the tape. The tracks 205 - 208, 213 - 216 of the blocks

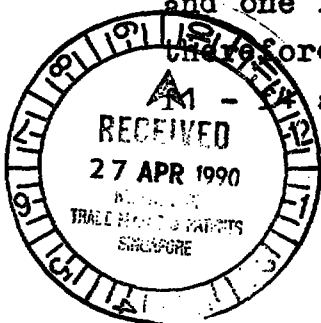


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202 and 204 intersect the height line 55 at angle 53 and the tracks 209 - 212 of the block 203 at an angle 54. The angles 53 and 54 are substantially equally large in value but assume different signs with respect to the height line 55. In practice, these deviations are so slight that they are negligible in the track finding. While the head 60 is reading the run-out 219, any vertical correction of the head wheel disc which may be necessary is carried out with reference to a crosstalk of the adjacent run-outs 218 and 220. After the track 210 has been recorded in block 203, the track 211 is recorded in block 203. The recording is so effected that the tracks 209 - 212 are first recorded one below the other in the block 203 before there is a transition to the following block 204. During the recording of the track 211, the run-out 219 of the track 207 is scanned. Crosstalk from the run-outs 218 and 220 to the tracks 206 and 208 are evaluated and adjust the head wheel disc at the correct height.

The simultaneous reading and writing of two magnetic heads can advantageously be used when overwriting a block 203. Also, if the block 203 contains disturbances, the block 203 can be completely replaced. During the adjustment of the head 60 to a correct height h on the tape 201, it is not the immediately preceding tracks 209 - 212 of the block 203 which are used for the adjustment but the block 202 is used for the adjustment.

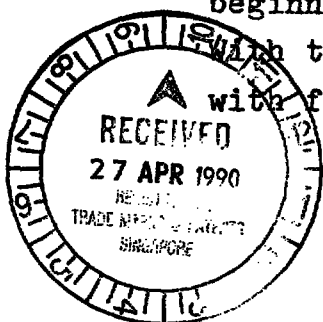
During the reading of the run-out 219, which is decisive for an adjustment of the head wheel disc at a height h in relation to the tape 201, two magnetic heads 60 and 61 are active simultaneously, one is reading and one is writing. For a track sequence system, therefore, a total of four difference frequencies are needed. Figure 13A shows the run-outs



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of tracks situated one below the other. Each run-out 217 - 228 has a distinguishing signal characterizing it, hereinafter called a sine-wave signal, with a different frequency $f_1 - f_4$. During the reading, one magnetic head 60 reads a sine-wave signal with the frequency f_2 in the run-out 218, and at the same time crosstalk components from the run-outs 217 and 219 with frequency components from the frequencies f_1 and f_3 . The precise position of the fresh track 211 to be recorded is determined from the crosstalk components. While the head 60 is reading three frequencies f_1-f_3 , the head 61 is writing a fresh run-out 221 with the frequency f_4 . Since all the sine-wave signals are transferred simultaneously, via a transformer 64, from a circuit arrangement in the chassis to the head wheel disc and/or from the head wheel disc to a circuit arrangement in the chassis, four different frequencies are used because a clear distinction between frequencies, crosstalk components of frequencies and combination frequencies has to be made both by the control 63 and by the circuit arrangement in the chassis.

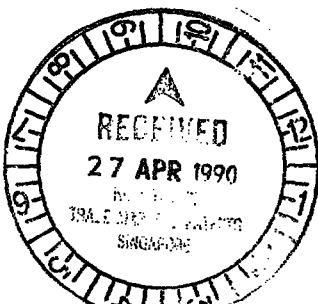
Figure 13B shows the division of the distinguishing signals in the run-outs 217 - 224 into a plurality of time windows. In this case, the run-out 217 contains two time windows 65, 66, the run-out 218 two time windows 67, 68, the run-out 219 two time windows 69, 70, the run-out 220 two time windows 71, 72 and the logical continuation shows a following track with two time windows 73, 74. The run-out 221 comprises two time windows 77, 78, the run-out 222 two time windows 79, 80, the run-out 223 two time windows 81, 82 and the run-out 224 two time windows 83, 84, the logical beginning is distinguished by two time windows 75, 76. With two time windows, two different sine-wave signals with frequencies f_1 and f_2 are used. No signal, that



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means noise during the scanning, is recorded in the time windows 66, 68, 70, 72, 74, 76, 78, 80, 82 and 84. The arrangement of the time windows 69, 70, 79, 80 with frequencies f_1 and f_2 is selected so that the frequency f_1 which is written in the time window 79 in the run-out 222 by the head 61 is different from the frequency f_2 which the head 60 is reading. While the head 60 is reading crosstalk components of the frequencies f_1 and f_2 from the adjacent run-outs 218 and 220 out of the time windows 67 and 71 in the time window 70, and combination frequencies of the frequencies f_1 and f_2 are resulting in the transformer 64, the head 61 is writing no sine-wave signal, that is to say noise, in the time window 80. Thus a distinction between frequencies is made both by the head wheel control 63 and by the circuit arrangement in the video recorder.

Figure 13C shows the division of the distinguishing signals in the run-outs 217 - 224 into a plurality of time windows. The run-out 217 contains four time windows 85-88, the run-out 218 four time windows 89-92, the run-out 219 four time windows 93-96, the run-out 220 four time windows 101-104. The run-out 221 comprises four time windows 109-112, the run-out 222 four time windows 113-116, the run-out 223 four time windows 117-120, the run-out 224 four time windows 121-124 and a run-out above the track 209 would have four time windows 105-108. No signal, that is to say only noise, is recorded in the time windows 86-89, 91-94, 96, 98-100, 102-106, 108, 110-112, 114-117, 119-122, 124. The arrangement of the time windows 85-124 with a frequency f_1 is so selected that the frequency f_1 can be allocated by the control 63 and/or by a circuit arrangement in the chassis of a video recorder. When the head 61 is writing the frequency f_1



during the time window 113, the head 60 does not receive any sine-wave signal from the run-out 219 and the adjacent run-outs 218 and 220 with the time windows 89, 93 and 100. During the time windows 114-116, no signal is transferred via the transformer 64 for the head 61. During these time windows 114-116, the head 60 reads the crosstalk components out of the run-outs 218 and 220 during the time windows 90 and 97 and the frequency f1 during the time window 95. After that, the head wheel disc can be re-adjusted during the run-in 247 and after that the head 60 records the fresh track 211.

A correcting variable, which indicates the current deviation of the head 60, 61 from a track 205 - 216, is obtained from the distinguishing signals f1-f2. Through an electro-mechanical transducer, for example through a piezo-ceramic, this correcting variable adjusts the position of the head 60, 61 of a head wheel disc and/or the head wheel disc transversely to a track 205 - 216 in such a manner that the head 60, 61 adheres to the previously recorded track 205 - 216.

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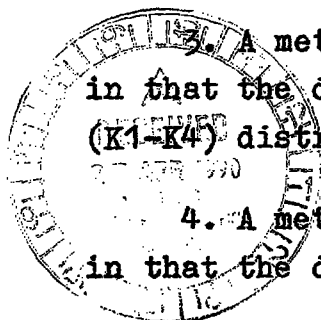
Claims

1. A method of recording a signal on a recording medium in the form of tape, particularly for a digital signal on a magnetic tape (1), wherein portions of track (S), which are short in comparison with the length of the medium (1) and succeed one another in time, lie side by side on the medium (1) and the portions of track (S1 - S4) extend substantially parallel to the edge of the medium and lie side by side in the direction (6) transverse to the edge (3) of the medium in such a manner that the boundary lines (4, 5) of the blocks (B) of portions of track (S1-S4) formed are aligned perpendicular or substantially perpendicular to the edge (3) of the medium, the scanning elements effecting the recording and/or reproduction being disposed at the circumference of a cylindrical rotating drum round which the medium is wrapped, characterised in that the angle of rotation of the heads (K) during which the recording operation of a portion of track (S) is effected, is offset from one portion of track to another within a block by such an amount that the offsetting of successive portions of track (S) in their longitudinal direction resulting in itself from the longitudinal feed of the medium (1) is compensated and these portions of track lie substantially side by side on the medium (1) without offsetting in the longitudinal direction of the medium.

2. A method according to Claim 1, characterised in that the drum (11) is wrapped round by the medium (1) only over a portion (180°) of its circumference.

3. A method according to Claim 1, characterised in that the drum (11) contains a plurality of heads (K1-K4) distributed over the circumference.

4. A method according to Claim 1, characterised in that the drum (11) or the head wheel is adjusted



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in the direction of its axis (12) relative to the medium (1) during the scanning of the portions of track.(S).

5. A method according to Claim 4, characterised in that the range over which the adjustment is effected is variable so that only the portions of track over a selected portion of the width of the medium (1) are scanned.

6. A method according to Claim 1, characterised in that provided one behind the other in the direction of the portion of track (S) are two scanning elements of which the first is fed with a signal for a recording operation and the second acts as a reproduction element, and the presence of the signal at the output of the second scanning element serves as a criterion for the existence of contact between scanning element and medium.

7. A method according to Claim 1, characterised in that the recording is effected with different azimuth angles from one portion of track to the next.

8. A method according to Claim 1, characterised in that a track readjustment is provided which ensures a precise position of the scanning element in relation to the portion of track at the end of each portion of track (S).

9. A method according to Claim 4, characterised in that a lifting magnet (20) is provided for the axial adjustment of the head carrier member (15).

10. A method according to Claim 1, characterised in that only about half the angle of the wrap-round angle is used for the recording and/or reproduction of a portion of track (S).



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11. A method according to Claim 1, characterised in that, during the recording of portions of track (S), the beginning and the end of a portion of track (S) are determined not by the temporal beginning and the temporal end of the contact between medium and scanning element but by electronic switches in the signal path to the scanning element.

