

In the so-called matrix type recording in accordance with DE-OS 35 09 584, blocks are written onto a magnetic tape in tracks which extend approximately parallel to the edge of the tape and which are short relative to the length of the tape, with a rotating head wheel that carries out a sweeping motion in the axial direction. This type of recording, with matrix type blocks succeeding each other in the direction of the tape length, is suitable in particular for the recording of digital picture and sound signals and enables a better segmentation of the signals for special functions.

In this connection, it is known to write upon the magnetic tape, using two scanning systems working in parallel, with two signals each effective over half the width e.g. a high definition television signal (HDTV). With this method then, two synchronously operative rotating heads or groups of heads are necessary.

The object of the invention is to produce a head drum for the described matrix type recording with which both tracks, even with unavoidable tolerances, can be correctly and synchronously read.

This object is achieved by the invention defined in claim 1. Further advantageous developments of the invention are defined in the appendant claims.

The invention is based on the following findings and considerations. During the reading operation of already written tracks, it can be ensured that the heads of the head wheel exactly follow the tracks written on the tape, by the adjustment of the sweeping motion of the rotating head wheel using a signal obtained from the tracking control signal. However, due to mechanical tolerances such as e.g. in the temperature, the tape tension and the stretching of the tape, it is not thereby ensured, that the heads of the second group of heads are then simultaneously following the tracks of the other tracking path. Consequently, in accordance with the invention, the heads of the second group of heads are dynamically adjusted by the actuator in the axial direction of the head drum such that these heads too, exactly follow the written tracks of the second tracking path. For this, the adjustment is effected by a voltage which is obtained from a sampled tracking control signal. The position of the second group of heads in the axial direction of the head drum, thus matches itself dynamically to the position of the first group of heads so that the heads of the first group read the tracks of the first tracking path correctly and

simultaneously, the heads of the second group correctly read the tracks of the second tracking path on the magnetic tape.

In one embodiment of the invention, this control of the heads of the second group is effected by an amount, which is smaller or equal to the width of half a track, such that the heads exactly follow a respective track without taking into account whether the heads of the first group and the heads of the second group are scanning tracks of the same ordinal number in the two tracking paths and thus whether the time correlation of the sampled signals is correct. A time divergence remaining during the reproduction between the signals obtained, can be overcome, preferably for a plurality of tracks, by stores during the reproduction. Such types of stores are required in any case for the processing of digital signals during the reproduction. With this method, it is sensible and sufficient to design the actuator with a sweep range of $\pm$ half a track width.

In another embodiment, the adjustment of the heads of the second group is effected over such a sweep range that, during the reproduction, tracks of the same ordinal number are always scanned in both the tracking paths and the two sampled signals from the two tracking paths are in synchronism.

The simultaneous synchronous and correlated reading of the two tracking paths achieved by the invention, enables a greater variety in the type of the recording of the signals. In each case, two signals can be simultaneously written and read which, during the reproduction, must co-incide in their relative timing. If necessary, each tracking path can thus also be read alone. The recorder may also serve therefore to record signals on the two tracking paths which are not correlated with each other and to read these timewise one after the other. The recorder is particularly suitable for recording an additional signal or a replacement signal with the signal written on the first tracking path which e.g. provides an improvement of the signal of the first tracking path e.g. for the recording of an additional signal for a television reproduction with higher resolution (HDTV). If the mode "high definition" is then selected, both tracking paths are simultaneously used in parallel whereby a particular cassette then has only half the playing time. In the mode "normal resolution", one of the tracking paths would only be used in the forward direction and the other tracking path in the reverse direction whereby the mode "normal resolution" would provide double the playing time. A compatible choice between resolution and playing time is therefore provided. The signal format in both the paths can be identical and thus completely compatible.

The invention will be explained hereinafter by an embodiment with the help of the drawing. Therein

Fig. 1 depicts in principle the co-operation of the head drum with the magnetic tape and

Fig. 2 a constructional form of the head drum and its drive.

In Fig. 1, the magnetic tape 15 is fed in the direction 33 past the rotating head drum 8 such that it enfolds the latter over an angle of about 180° . The head drum 8 is set in rotation by the drive motor 32 and is simultaneously moved periodically in the direction of the axis 31 by means of a control voltage U_s in the sense of a sweeping motion 30 over half of the tape width $H_1 = H_2$. In this way, the first group of heads K_1 write to or read from the magnetic tape 15, successive blocks $B_1, B_2...$ with tracks S running roughly parallel to the edge of the tape. In so doing during the reading operation, the sweeping motion 30 is additionally controlled by a voltage U_1 obtained from a tracking control signal such that the heads exactly follow the written tracks.

At the same time, the group of heads K_2 write or read the corresponding blocks $B_n, B_{n+1}...$ etc on the lower half H_2 of the tape. During the writing operation, there are still no tracks on the tape 15 so that the exact position of the heads of the group K_2 does not need to be adjusted. So as to allow tapes to be replaced however, the distance between the two groups must be set so that it is very accurately reproducible. During the reading operation, the heads of the group K_1 are guided by the voltage U_1 exactly along the tracks S in the upper half H_1 of the tape. Without additional measures, the heads of the group K_2 would not run exactly along the tracks on the lower half H_2 of the tape due to the tolerances of the tape as regards its lateral dimensions. In the ideal case, such an "offset" of the heads of the group K_2 would be fairly constant since both groups of heads are guided by the tracking control signal of the heads K_1 . Therefore, the group of heads K_2 is arranged on a symbolically indicated actuator A which permits a minute adjustment of the group K_2 in the direction 34. Preferably, the actuator is a piezo electric actuator as is known for the control of the heads in video recorders. Such types of actuators are also referred to as "bimorphs" or as "thickness vibrators". The actuator A is controlled by a voltage U_2 which is derived from a tracking control signal on the tape- half H_2 . Thus, the group K_1 is controlled for correct track following in the tape- half H_1 by control of the sweeping motion 30 by the voltage U_1 and additionally, the group K_2 is controlled for correct track

following in the tape- half H2 with the actuator A. Preferably, by means of a common actuator A, all of the heads of the group K2 receive the same adjustment of the distance from the plane of the group K1 by the voltage U2. The individual heads of the group K2 may also be arranged on separate actuators A which are then controlled by the same voltage U2. The voltage U2 is transferred as a low frequency alternating voltage signal via the windings of the rotary transformer which also carry the head signals. The decoupling of the actuator signal U2 may be effected by a simple low pass filtering on the head drum 8.

Fig. 2 shows a constructional form of the head drum 8 and of the drive 32 for the rotation and the sweeping motion 30 in Fig. 1. The shaft 4 carrying the screw 6 is rotatably but axially immovably mounted in the stationary frame 1 by means of the bearings 2, 3. The upper end of the shaft 4 is coupled to the rotor 5 of the motor M2 whose stator 7 is firmly attached to the frame 1. The head wheel 8, which contains the head disc 12, the first group of heads K1 and the drum 14, is rotatably mounted on the shaft 4 by the plain bearings 9, 10. In this way, the screw 6 engages the nut 11 firmly fixed to the drum 14. The magnetic tape 15 is fed around the head wheel 8, e.g. through an angle of 180°. In addition to the group of heads K1, the head drum 8 contains the group of heads K2 which are mounted on the head drum 8 via the actuator A. The voltage U2 is supplied to the actuator A for the displacement in the direction 34 as in Fig. 1. The signals are supplied to the recording or reproducing amplifiers from the two groups of heads K1, K2 via rotatory transformer 23 and flexible conductors 17. Separate transformers may also be provided for the groups K1, K2. Preferably, these are then arranged on the head drum 8 relatively displaced, radially, axially or both radially and axially. Moreover, the rotor 16 of the motor M1 is attached to the drum 14. The stator 19 of the motor M1 is mounted via bearings 28, 29 on the drum 14, rotatably relative thereto, and contains the stator winding 20. The stator 19 is coupled via the pin 21 and the bearing 22 to the frame 1 in such a way that the pin 21 is moveable in the slit 13 of the frame 1 in an axial direction 31 but a rotation of the stator 19 is prevented.

The parts 9, 10, 11, 12, K1, K2, 14, 16 form the part of the head wheel arrangement rotating around the axis 31. the parts 19, 20, 21, 30 form the part of the head wheel arrangement which cannot rotate but is displaceable in the direction of the axis 31 corresponding to the sweeping motion.

The manner of operation is as follows: The motor M1 is driven at a speed of about 6000 rpm so that the head wheel 8 rotates with this speed about the axis 31. The shaft 4 with the screw 6 is driven by the motor M2 at the same rotational speed and in the same direction as the head wheel 8. Because of the equal rotational speeds, there is no relative movement between the screw 6 and the nut 11 so that the head wheel 8 rotates but is not moved in the direction of the axis 31. This state is indicated in Fig. 2 before t_1 . At time point t_1 , the control voltage U_s applied via the terminals 18 to the winding 35 is increased so that the motor M2 runs faster e.g. at 6010 rpm. Because of this, the screw 6 slowly turns into the nut 11 so that the head wheel 8 effects a sweeping motion downwardly in the desired manner. At the time point t_2 , the control voltage U_s and thereby correspondingly the speed of the screw 6 are decreased so that the screw 6 withdraws from the nut 11 and the head wheel 8 is moved in an upwardly sweeping direction 30. The jump in amplitude of the voltage U_s at t_1 , t_2 , t_3 thus determines the speed of the sweeping motion 30 and the duration $t_1 - t_2$ or $t_2 - t_3$, the amplitude of the sweeping motion 30.

A non ferrous, electronically commutated so-called solenoid motor is used for the motor M1 and an electronically commutated side armature type for the motor M2. However, mechanically commutated motors, armature motors and the like may also be used.

The actuator A dynamically controls the position of the group of heads K2 as in Fig. 1 in such a way that for correct following of the tracks of the first group K1 on the tape- half H1, the group K2 exactly follows the tracks on the tape- half H2. During recording, the actuator A is actuated currentlessly i.e. the voltage U_2 then has a constant value which results in the desired actual distance between the two groups K1, K2 in the axial direction. This distance is approximately equal to half the width of the tape, i.e. $= H1 = H2$. During reproduction, in the ideal case, the actuator A is set once after the start, namely at a deflection such that the two simultaneously active magnetic heads each run optimally over a respective track on the two halves of the tape H1, H2. After this adjustment, the track guidance could be effected in common in the theoretically ideal case, whereby the reference would be obtained from the tracks in only one half of the tape.



Claims

1. Recorder for a matrix type recording in which blocks (B) are written on a magnetic tape (15) in tracks (S) that are approximately parallel to the edge of the tape and that are short relative to the length of the tape, with a rotating head drum (8) that effects a sweeping motion (30) in the axial direction, wherein a first (K1) and a second (K2) group of heads, displaced in the axial direction (31), is provided on the head drum (8), characterised in that, the two groups are mounted on the head drum (8), displaceable relative to each other in the axial direction (31) by means of an electromechanical actuator (A).
2. Recorder in accordance with Claim 1, characterised in that, the actuator (A) and/or the sweeping motion (30) is controlled by an adjusting value (U2, U1) which is obtained from a tracking control signal sampled from the tape (15).
3. Recorder in accordance with Claim 1, characterised in that, the sweeping motion (30) is controlled such that the first group (K1) of heads follows the tracks (S) written on a first half (H1) of the tape (15).
4. Recorder in accordance with Claim 3, characterised in that, simultaneously with the control of the first group of heads by the tracking control signal, the actuator (A) is controlled such that the second group (K2) of heads follows the tracks written on the second half (H2) of the tape (15) without regard to their ordinal number relative to the ordinal number of the tracks read from the first half (H1) of the tape by the first group (K1) of heads.
5. Recorder in accordance with Claim 3, characterised in that, the actuator (A) is controlled such that both groups (K1, K2) of heads always read tracks (S) of similar ordinal number on the two halves (H1, H2) of the tape (15).
6. Recorder in accordance with Claim 4, characterised in that, during the reproduction, differences in the temporal ordinal number of the signals read at the same time by the two groups (K1, K2) of heads are balanced out by stores.
7. Recorder in accordance with Claim 1, characterised in that, the heads of the second group (K2) are arranged on separate actuators (A) or on a common actuator (A).



8. Recorder in accordance with Claim 7, characterised in that, the separate actuators (A) are identical and are controlled by the same signal (U2).

9. Recorder in accordance with Claim 1, characterised in that, the distance between the two groups (K1, K2) of heads in the axial direction (31) of the head drum (8) is approximately equal to half the geometrical width (H1, H2) of the tape (15).

10. Recorder in accordance with Claim 1, characterised in that, during recording, the control of the actuator (A) is turned-off.