

"TAPE GUIDE FOR A RECORD CARRIER IN THE FORM OF A TAPE".

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The invention relates to a tape guide for a record carrier in the form of a tape, the guide having a guide surface over which the record carrier passes when in motion. Such tape guides are used in tape cassettes. They are known in a wide variety of versions. The guide surface of such a tape guide may be circular-cylindrical or conical, or it may have a differently curved shape. Such tape guides may be formed by stationary parts or by rotatable rollers. Examples of these are described in German Auslegeschrift 23 25 069 and Austrian Patent Specification 290,159. Such tape guides may be arranged in a cassette which accommodates the record carrier, or they may be mounted on a recording and/or playback apparatus in the path of the record carrier outside the cassette, as is described in the said AT-PS 290,159. As is known, such tape guides should comply with special requirement, i.e. they should guarantee a very uniform movement of the record carrier over the guide surface, without the occurrence of abrupt irregularities, which may occur if the record carrier momentarily sticks to the guide surface. It is equally important that the path of the record carrier over the tape guide is not disturbed with respect to its direction, in order to ensure that the record carrier, as it leaves the tape guide, is correctly fed to the next component with which it is to cooperate after the tape guide; such a component may, for example, be a magnetic head, a winding hub or a tape reel or another tape guide. When a tape guide is arranged inside the cassette it is of special importance that said requirements are met. This is particularly so with respect to the uniform supply and take-up of the record carrier to and from the winding hubs in the cassette, in order to prevent the edges of the record carrier contacting the walls of the cassette, which may occur if the tape is not wound accurately onto the tape reels. It is primarily the friction between the record carrier and the guide surface of the tape guide which is of importance for a satisfactory guidance of the tape.

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According to the present invention there is provided a tape guide for a record carrier in the form of a tape, the guide having a guide surface over which the record carrier passes when in motion, wherein the guide surface is formed with a multiplicity of recesses each having a closed boundary and which are arranged in a recurrent pattern such that the lands left between the recesses form a coherent network of intersecting ridges.

With a tape guide of this construction, the area of the guide surface which contributes to the friction between the record carrier and the guide surface is substantially reduced, because the record carrier is in contact only with the ridges, so that a lower friction and thus a more uniform motion of the record carrier can be obtained. Since the ridges form a coherent network, it is ensured that the record carrier, as it moves over the guide surface, and despite the presence of the recesses is continuously supported in a uniform manner, which has a very favourable effect on the uniformity of its motion.

In this respect it is to be noted that tape-guides arranged outside a cassette are known in which the friction during cooperation with the record carrier is improved by a special design of the guide surfaces.

This concerns tape guide drums of comparatively large diameter for use in magnetic video tape equipment. For example, in accordance with German Auslegeschrift DE-AS 19 35 524 a corrugation is formed in the guide surface of the tape guide drum, whilst in accordance with German Auslegeschrift DE-AS 19 08 508 inclined grooves are formed in the guide surface. The recesses thus formed in both cases are continuous channels which extend outside the area of the guide surface in which the record carrier contacts this surface. Although in this case the area of the guide surface which produces the friction with the record carrier is reduced, the reduction in friction is achieved mainly by the entry of air into the open-ended channels so that underneath the record carrier air cushions are formed which support the record carrier. As can be seen, such recesses differ in form, and in principle also in effect, from the recesses in the guide surface of a tape guide in accordance with the invention, which recesses have closed boundaries and are separated from each other by ridges constituting a coherent

network, so that a uniform and continuous guidance and support for the record carrier is obtained, as opposed to the interrupted guidance and support provided by the corrugated or grooved guide surface of a tape guide of the above known types.

5 It is found to be particularly advantageous if the intersecting ridges of a tape guide in accordance with the invention form a diamond pattern. In this way a very uniform structure of the guide surface is obtained which is found to yield a very uniform motion of the record carrier. In this respect it is further found to be advantageous if each
10 of the ridges makes an angle smaller than 45° with the normal to the direction of movement of the record carrier over the guide surface. This ensures that the ridges are disposed substantially transversely of the direction of movement of the record-carrier, so that the record carrier is supported by the ridges in a particularly favourable
15 manner.

Practical tests have revealed that very favourable results are obtained with an embodiment in which the recesses each have a depth of the order of 10 to 50 μm , the ridges each have a width of the order of 150 to 250 μm and the distance between adjacent ridges extending in
20 the same direction is of the order of 250 to 350 μm .

With respect to the shape of the recesses there are several possibilities within the scope of the invention, allowance being made for the influence on the pattern and the shape of the ridges. In one embodiment of the invention the cross-section of each recess
25 transversely of the direction of depth of the recess has the shape of a parallelogram. The recesses can then each have a comparatively large area, whilst nevertheless a dense network of uniformly wide ridges is obtained, so that on the one hand an effective reduction of the area of the guide surface which determines the friction with the record
30 carrier is obtained and on the other hand the network of ridges ensures a correct guidance and support for the record carrier without the occurrence of sticking effects.

Embodiments of the invention will now be described in more detail with reference to the accompanying drawings, in which:

35 Figure 1 is a plan view of a cassette containing a record carrier in the form of a tape which passes round two cylindrical tape guides inside the cassette;

Figure 2 is a sectional view taken on the line II-II in Figure 1 but drawn to a larger scale, showing lozenge-shaped recesses in the guide surface of one of the tape guides;

Figures 3, 4 and 5 are views showing portions of guide surfaces formed with recesses of rectangular, circular and triangular shape respectively;

Figure 6 is a plane view of a part of a cassette provided internally with a cylindrical tape guide of reniform cross-section; and

Figure 7 is an elevation of a tape guide which is not located inside a cassette but is mounted directly on a recording and/or playback apparatus and round which a record carrier passes along a helical path.

Figure 1 shows a cassette 1 which accommodates a record carrier 2 in the form of a tape, for example, a magnetic tape, which extends between two reels 3 and 4, one of which serves as a supply reel and the other as a take-up reel. The cassette 1 furthermore comprises two circular-cylindrical tape guides 5 and 6 round which the record carrier passes between the two reels 3 and 4, so that it travels along one narrow side of the cassette, in which side an opening 7 is formed. This opening 7 may serve, for example, to permit the withdrawal of the record carrier from the cassette, when the latter is placed on a recording and/or playback apparatus, for cooperation with parts of the apparatus such as magnetic heads, drive means or further tape guides. Alternatively, parts of the apparatus may be inserted into the cassette through such an opening 7 to be brought into contact with the record carrier.

Figure 2 shows the tape guide 5 (the tape guide 6 is of the same construction) in more detail. It comprises a circular-cylindrical guide portion 8, whose surface constitutes the guide surface for the record carrier 2. For the lateral guidance of the record carrier, at the ends of the guide portion 8 there are provided two flanges 9 and 10. Adjoining these flanges are cylindrical stubs 11 and 12 respectively which fit rotatably in coaxial circular holes 13 and 14 formed in the two major walls 15 and 16 of the cassette. In this way the position of the tape guide inside the cassette is defined. The tape guide 5 may function as a rotatable roller, which moves with the record carrier 2,

or it may function as a stationary tape guide, in which case when the cassette is placed onto a recording and/or playback apparatus, a pin on said apparatus engages in an axial bore 17 formed in the guide portion 8 thereby preventing the tape guide from being rotated during transport of the record carrier 2.

The guide surface of the guide portion 8 of the tape guide 5 is formed with a multiplicity of recesses each of which has a closed boundary and which are arranged in a recurrent pattern such that the lands left between the recesses form a coherent network of

intersecting ridges. Such a pattern of recesses can be seen within the circle 18 in Figure 2, which within the circle shows a portion of the cylindrical tape guide surface developed onto a flat plane, and in which the recesses are designated 19. The entire surface of the guide portion 8 of the tape guide has the construction shown within the circle 18. As can be seen from Figure 2, the recesses 19 are arranged in parallel rows extending in two directions, the rows which extend in one direction intersecting the rows which extend in the other direction. Thus, the ridges formed by the lands between the rows of recesses extending in one direction and the ridges formed by the lands between the rows of recesses extending in the other direction intersect one another in these two directions, which are represented by the broken lines 20 and 21 in Figure 2 and each of which in the embodiment shown forms an angle of 30° with the normal 22 to the direction of movement of the record carrier 2 over the guide surface of the tape guide 5. In the embodiment shown in Figure 2 the closed boundary of each recess 19 has the shape of a parallelogram, in the present case a rhombic or lozenge shape. Since the ridge portions surrounding each recess follow this shape, and since the lands forming the ridges are continuous, that is to say, there is no interruption between the individual ridge portions surrounding each recess or between the ridge portions surrounding adjacent recesses, the guide surface for the record carrier can be seen to consist of a coherent network composed of such ridge portions.

By the provision of the recesses 19 the area which determines the friction between the record carrier 2 and the guide surface of the tape

guide 5 is considerably reduced in comparison with an imperforate guide surface, whilst the coherent network of intersecting ridges ensures that the record carrier 2 is uniformly and continuously supported and guided over the entire guide surface. In this way a tape guide is obtained which guarantees a very uniform motion of the record carrier without the occurrence of undesirable sticking or snatching effects and consequent non-uniform motion of the record carrier. Since the obliquely intersecting ridges 20, 21 form a diamond pattern and since they each form an angle smaller than 45° with the normal 22 to the direction of movement of the record carrier 2, i.e., they each extend substantially transversely of the direction of movement of the record carrier 2, particularly favourable guiding properties of the tape guide are obtained, because the record carrier is very uniformly supported with a low friction. Of course, the diamond pattern of the ridges 20, 21 may be rotated through 90° or through a smaller angle so that the ridges extend substantially in the direction of movement of the record carrier, i.e., they each form an angle of less than 45° with this direction. In practice it is found to be advantageous if the recesses each have a depth of the order of 10 to $50\mu\text{m}$ and the ridges each have a width of the order of 150 to $250\mu\text{m}$, whilst the distance between adjacent parallel ridges is of the order of 250 to $350\mu\text{m}$, so that especially in the case of a magnetic tape the tape guide provides a satisfactory guidance.

Forming the recesses in the guide surface of the tape guide can be effected in various ways and is comparatively simple. If the tape guide is made of a plastics, for example, which is generally effected by means of an injection-moulding process, the recesses can be formed directly when manufacturing the tape guide. If desired, such a plastics tape guide may be provided with a metal surface layer by electro-deposition. If the tape guide is a metal part, the recesses in the surface of the tape guide may be formed by etching, for example. It is found to be very simple to form the recesses in the guide surface by means of a suitably shaped embossing tool, the tape guide being rolled over the tool or the tool over the tape guide.

Although a rhombic shape of the recesses is found to be very favourable, there are several other possibilities with respect to the

shape of the recesses. Figures 3, 4 and 5 show three examples of this, each figure again showing within a circle 118, 218 to 318 respectively a portion of a cylindrical tape guide surface developed onto a flat plane. In Figure 3 the guide surface is formed with recesses 119 of rectangular shape arranged in intersecting rows such that the lands between the rows form two intersecting sets of ridges constituting a coherent network, the directions of the two sets of ridges again being represented by broken lines 120 and 121 outside the circle 118.

In this embodiment the orientation of the ridges 120, 121 is selected so that one set of ridges 120 extends at right angles to the direction of movement of the record carrier and the other set of ridges 121 extends exactly in this direction. Obviously, the orientation of the two sets of ridges may differ from that shown in Figure 3; for example, the directions of the two sets of ridges may each form a specific angle, for example, an angle of 45° , with the direction of movement of the record carrier.

In the embodiment of Figure 4 the tape guide surface is formed with recesses 219 each having a closed boundary of circular shape, giving the recesses a circular cross-section transversely of the direction of their depth. The recesses may have cylindrical walls or they may simply be formed as concavities or depressions in the tape guide surface. The recesses 219 are arranged in intersecting rows extending in three directions, so that the lands between the rows of recesses form a coherent network of intersecting ridges extending in three directions, as represented by the broken lines 220, 221 and 223. The two sets of ridges extending in the directions 220 and 221 form a diamond pattern and extend substantially transversely of the direction of movement of the record carrier, whilst the third set of ridges, whose direction is designated 223, extends exactly in the direction of movement of the record carrier. This results in a very good performance of the tape guide. Moreover, the recesses 219 of each row of recesses in Figure 4 is staggered in relation to the recesses in the adjacent parallel rows, so that the ridges are not exactly rectilinear but have a slightly serpentine shape.

The recesses 319 shown in Figure 5 are of triangular cross-section transversely of the direction of their depth, that is to say, they each have a closed boundary in the form of a triangle, suitably an isosceles triangle, so that the recesses 319 can again be arranged in

5 intersecting rows extending in three directions to produce three intersecting sets of ridges extending in three directions, which are designated 320, 321 and 323. The three sets of ridges extend at angles of 60° and 120° respectively relative to one another, so that again a very good performance of the tape guide is obtained, because

10 it supports the record carrier in a highly uniform manner.

Obviously the boundaries of the recesses are not limited to geometrical shapes; shapes may be chosen which will produce intersecting ridges that do not extend along straight lines but will nevertheless form a coherent network. For example, the boundaries of the

15 recesses may be drop-shaped or reniform.

Guide surfaces formed with recesses in accordance with the invention are suitable for a wide variety of tape guides. Such tape guides need not necessarily be of circular-cylindrical form; they may have the shape of other cylinders, which may be right or oblique cylinders, of any

20 arbitrary cross-section. Such a tape guide is shown in Figure 6. Again it is a tape guide which is arranged in a cassette 401, only part of the cassette being shown. The cylindrical tape guide 424 shown is of reniform cross-section, the guide surface for the record carrier 402 being constituted by the convex surface of the tape guide. Again this guide

25 surface may be formed with a pattern of recesses of any of the shapes described above.

Although it is found that the invention is very beneficial for tape guides in a cassette, because especially for such tape guides it is important that the friction between the tape guide and the record

30 carrier is minimized and the motion of the record carrier is as uniform and smooth as possible, it is also advantageous to apply the invention to tape guides which are arranged directly on a recording and/or playback apparatus and which serve for guiding the record carrier on said apparatus. Figure 7 shows an example of such application. On a

35 chassis 525 an inclined circular-cylindrical tape guide 26 is arranged,

whose circumferential surface serves as a guide surface for a record carrier 526 which travels around the guide along a helical path. Such a tape guide may serve, for example, as a tape-diverting element or as a tape guide drum, in the vicinity of which rotatable magnetic heads are provided for cooperation with the record carrier. As can be seen from the portion of the guide surface illustrated schematically in the circle 518, the guide surface of this tape guide is formed with recesses each having a closed boundary and which are arranged in a recurrent pattern such that the lands between the recesses form a coherent network of intersecting ridges.

CLAIMS:

1. A tape guide for a record carrier in the form of a tape, the guide having a guide surface over which the record carrier passes when in motion, wherein the guide surface is formed with a multiplicity of recesses each having a closed boundary and which are arranged in a recurrent pattern such that the lands left between the recesses form a coherent network of intersecting ridges.

2. A tape guide as claimed in Claim 1, wherein the intersecting ridges form a diamond pattern.

3. A tape guide as claimed in Claim 2, wherein each of the ridges forms an angle smaller than 45° with the normal to the direction of movement of the record carrier over the guide surface.

4. A tape guide as claimed in Claim 2 or 3, wherein the recesses each have a depth of the order of 10 to 50 μm , the ridges each have a width of the order of 150 to 250 μm , and the distance between adjacent ridges extending in the same direction is of the order of 250 to 350 μm .

5. A tape guide as claimed in any of the preceding Claims, wherein the cross-section of each recess transversely of the direction of depth of the recess has the shape of a parallelogram.

6. A tape guide substantially as herein described with reference to any of Figures 2 to 7 of the accompanying drawings.



whose circumferential surface serves as a guide surface for a record carrier 526 which travels around the guide along a helical path. Such a tape guide may serve, for example, as a tape-diverting element or as a tape guide drum, in the vicinity of which rotatable magnetic heads are provided for cooperation with the record carrier. As can be seen from the portion of the guide surface illustrated schematically in the circle 518, the guide surface of this tape guide is formed with recesses each having a closed boundary and which are arranged in a recurrent pattern such that the lands between the recesses form a coherent network of intersecting ridges.

CLAIMS:

1. A tape guide for a record carrier in the form of a tape, the guide having a guide surface over which the record carrier passes when in motion, wherein the guide surface is formed with a multiplicity of recesses each having a closed boundary and which are arranged in a recurrent pattern such that the lands left between the recesses form a coherent network of intersecting ridges.
2. A tape guide as claimed in Claim 1, wherein the intersecting ridges form a diamond pattern.
3. A tape guide as claimed in Claim 2, wherein each of the ridges forms an angle smaller than 45° with the normal to the direction of movement of the record carrier over the guide surface.
4. A tape guide as claimed in Claim 2 or 3, wherein the recesses each have a depth of the order of 10 to 50 μm , the ridges each have a width of the order of 150 to 250 μm , and the distance between adjacent ridges extending in the same direction is of the order of 250 to 350 μm .
5. A tape guide as claimed in any of the preceding Claims, wherein the cross-section of each recess transversely of the direction of depth of the recess has the shape of a parallelogram.
6. A tape guide substantially as herein described with reference to any of Figures 2 to 7 of the accompanying drawings.