

SPECIFICATION

Apparatus for magnetically recording and/or reading signals on a magnetic tape

The invention relates to an apparatus for magnetically recording and/or reading signals in interrupted signal tracks on a magnetic tape, which tracks extend obliquely of the tape adjacent each other, the apparatus comprising a rotatable drive spindle having a free end and at least a portion of which extending from the free end is cylindrical, a magnetic head which is rotatable in a circular path about the axis of rotation of the drive spindle for recording and/or reading the oblique signal tracks on the magnetic tape, a head support for the magnetic head, which support is detachably mounted on the cylindrical portion of the drive spindle and is formed with a central bore which receives the drive spindle with some clearance, and means for detachably mounting the head support on the drive spindle which comprise a clamping sleeve having a free end and which concentrically surrounds the drive spindle and comprises an elastically deformable wall portion of the head support, and a clamping ring which surrounds the clamping sleeve and which is deformable between a released position and a clamping position for deforming said clamping sleeve in the clamping position so as to eliminate the clearance between the drive spindle and the clamping sleeve and thereby clamp and also centre the head support on the drive spindle.

Such an apparatus for recording and reading video signals known as a "helical-scan video recorder", is known from Austrian Patent Specification AT-PS 345577. In this known apparatus the head support consists of a cylindrical head drum which constitutes the rotary part of a drum for guiding the magnetic tape in a helical path. In addition to the rotary head drum the drum unit comprises a stationary tape-guide drum which is coaxial with the head drum and which is spaced therefrom by a narrow gap. The stationary drum comprises a guide edge for the magnetic tape, which extends helically around a part of the cylindrical surface of the drum unit. Owing to its rotation the rotary head drum locally produces a film of air between the magnetic tape and the drum unit. As a result of this the friction between the magnetic tape and the drum unit is reduced. On its side which is remote from the stationary drum the head drum is provided with a clamping sleeve having a cylindrical outer surface, which sleeve is integral with the head drum. Around said clamping sleeve there is arranged a split clamping ring, the parts of which on opposite sides of the split in the ring can be moved resiliently towards each other. On the one side of the split a screw is fitted in the clamping ring and extends with clearance through an opening in the clamping ring on the other side of the split. By tightening the screw the clamping ring is deformed between its released position and its clamping position, so that the clamping sleeve of the head drum is also deformed and the head

drum is thereby centred and clamped on the drive spindle.

For a most economic use of the magnetic tape in video recorders the magnetic tape is provided with as dense a pattern of adjacent signal tracks as possible. With modern video recorders slightly overlapping signal tracks are used having a width of approximately 40 microns and having a distance between the centres of the tracks of approximately 30 microns. The track length is approximately 100 mm. Over the entire length the tracks should be positioned within very narrow tolerances, in particular because great value is attached to the possibility of being able to play back on one video recorder video programmes recorded on other video recorders, without a noticeable loss of quality. A really successful interchangeability of cassettes, provided with recorded programmes, and video recorders is obtained only if a video programme recorded on one video recorder can be played back on another video recorder without a perceptible loss of quality of the signal played back by the video recorder. This requirement is referred to as "the compatibility" of video recorders and magnetic tape cassettes, together belonging to a standard system for recording and playing back video signals. As a result of this only very small tolerance ranges are available for the position of the magnetic heads relative to the stationary tape-guide edge. In video recorders which are equipped with a plurality of magnetic heads, such as helical-scan video cassette recorders adapted for domestic use, it is essential that the two heads are also accurately positioned relative to each other in view of the synchronism of the signals which are recorded or read by the two heads. Also in this case only small tolerance ranges are available, because otherwise visible time errors will appear in the reproduced video picture, i.e. instabilities will occur near the edge of the picture.

In view of the stringent accuracy requirements imposed on the position of the magnetic heads, special optical precision instruments are generally used for mounting the magnetic heads on the head support. In the case of head supports for apparatus of the construction described in the preamble of the present specification, the head support is first centred and mounted on a special mounting spindle with the aid of its own clamping device. After mounting and adjustment of the magnetic heads the head support is removed from the mounting spindle by releasing the clamping device, after which the head support may be mounted on the drive spindle of a video recorder. Obviously, it is essential that the adjustments performed with the aid of said mounting spindle are most accurately reproduced when the magnetic head support is mounted on the drive spindle of a video recorder. In this respect a disadvantage of the known apparatus mentioned in the preamble is that owing to the nature of the clamping device used the head support is clamped at two areas on the periphery of the clamping sleeve, which areas are not predetermined. The

location of these areas is not predetermined, which will give rise to an eccentricity of unpredictable magnitude and orientation when the head support is mounted on a drive spindle. These effects are caused by the fact that when the split clamping ring is tightened the clamping sleeve is deformed into an oval shape, until the clearance between the clamping sleeve and the drive spindle is eliminated locally at said areas. In the bore of the clamping sleeve, which has been deformed into an oval shape, the drive spindle is disposed at a location which depends on random factors, such as the initial position of the drive spindle in the bore. Another disadvantage of the known video recorder is that both mounting and removal of the head support in and from a video recorder is complicated by the fact that the screw of the split clamping ring is manipulated in a direction perpendicular to the axis of rotation of the drive spindle.

According to the invention there is provided an apparatus for magnetically recording and/or reading signals in interrupted signal tracks on a magnetic tape, which tracks extend obliquely of the tape adjacent each other, the apparatus comprising a rotatable drive spindle having a free end and at least a portion of which extending from the free end is cylindrical, a magnetic head which is rotatable in a circular path about the axis of rotation of the drive spindle for recording and/or reading the oblique signal tracks on the magnetic tape, a head support for the magnetic head, which support is detachably mounted on the cylindrical portion of the drive spindle and is formed with a central bore which receives the drive spindle with some clearance, and means for detachably mounting the head support on the drive spindle, which means comprise a clamping sleeve having a free end and which concentrically surrounds the drive spindle and comprises an elastically deformable wall portion of the head support, and a clamping ring which surrounds the clamping sleeve and which is deformable between a released position and a clamping position for deforming said clamping sleeve in the clamping position so as to eliminate the clearance between the drive spindle and the clamping sleeve and thereby clamp and also centre the head support on the drive spindle, wherein the clamping ring has an uninterrupted structure in the circumferential direction such that when deformed from its released position to its clamping position it exerts on the clamping sleeve a clamping pressure which produces a symmetrical radial deformation of the sleeve and which is distributed substantially uniformly around the circumference of the sleeve.

As a result of the symmetrical deformation of the clamping sleeve this sleeve retains its circular cross-section and is not distorted into an oval shape when clamped on the drive spindle by the clamping ring. The slight initial clearance between the drive spindle and the clamping sleeve is eliminated completely, so that a satisfactory reproducible alignment of the head support relative to the drive spindle is obtained. The

invention is very suitable for providing embodiments in which the clamping ring can be mounted on and removed from the clamping sleeve in an axial direction.

In one such embodiment the clamping ring has a conical inner surface which coincides with the generated surface of an imaginary cone whose axis coincides with the axis of rotation of the drive spindle, the clamping ring, through cooperation with a part of the outer surface of the clamping sleeve, is radially expanded from the released position to the clamping position by an axial movement of the ring in one direction along the clamping sleeve, and the apical angle of said imaginary cone, measured between the generatrix of the generated surface of the cone and the axis of the cone, is smaller than the friction angle of the materials of the clamping sleeve and the clamping ring, so that the frictional forces exerted between the clamping ring and the clamping sleeve will inhibit movement of the ring along the sleeve in the opposite direction to said one direction under the influence of the axial component of the reaction forces exerted on the ring in the clamping position. The friction angle is defined as the arc tangent of the quotient of the frictional force and the normal force acting on surfaces which are in frictional contact with each other and may be regarded as a constant whose value depends solely on the type and nature of the materials of which the frictional surfaces are made. The clamping sleeve may externally have a conical shape corresponding to the conical shape of the inner surface of the clamping ring. Alternatively, the clamping sleeve may be formed externally with a shoulder for cooperation with the conical inner surface of the clamping ring so that the clamping sleeve is deformed by the clamping ring at a location which is accurately defined by the shoulder. Both embodiments are simple and require few parts, the last mentioned embodiment having the additional advantage that the symmetrical radial deformation of the clamping sleeve always occurs at a part of the clamping sleeve which is well-defined in an axial direction. In the case of a clamping sleeve with a conical outer surface and without a shoulder the axial position of the radial deformation is not defined exactly and depends on the extent to which the clamping ring is deformed. It is evident that the axial position of the mounted clamping ring also determines the magnitude of the clamping pressure between the clamping ring and the clamping sleeve. Furthermore, the thickness of the clamping sleeve at the location of the clamping ring and the elasticity of the clamping sleeve also play a part.

In view of the precision with which apparatus of the construction described in the preamble is manufactured, the drive spindle and the magnetic-head support should be handled with the greatest care during assembly and dismantling operations. In order to avoid exerting axial or radial forces on the drive spindle when mounting the clamping ring on the clamping sleeve, the head support may be provided with a collar which is coaxial with the

clamping sleeve for taking up reaction forces exerted on the head support by a tool used for tightening the clamping ring on the clamping sleeve. Thus, the head support is adapted to

- 5 cooperate with an assembly tool. The forces required for pressing home the clamping ring act directly on the head support itself, so that no external forces are exerted on the drive spindle.
- 10 In an alternative embodiment the head support is provided with a bush which concentrically surrounds the clamping sleeve and is spaced therefrom to leave an annular space in which the clamping ring is accommodated, and which is
- 15 internally screw-threaded for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in one direction to deform the ring radially into its clamping position, and the clamping ring is
- 20 provided with an extra external screw-thread for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in the opposite direction to release the clamping ring. Even when simple hand-operated tools are used, this embodiment prevents external
- 25 axial forces and to some extent external radial forces being exerted on the drive spindle during mounting and removal of the clamping ring. The head support should be retained, for example by hand, to prevent it rotating when the mounting or
- 30 removal tool is being turned.

- In another embodiment the clamping ring consists of a material such that the ring is radially deformable under axial pressure, a pressure bush concentrically surrounds the clamping sleeve and
- 35 is spaced therefrom to leave an annular space in which the clamping ring is accommodated, an axially movable pressure member is provided for applying axial pressure to the clamping ring at one end thereof, the head support is provided with a
- 40 stop for the clamping ring at the other end thereof, and means are provided for axially moving the pressure member towards the clamping ring so as axially to compress the clamping ring in the space bounded by the clamping sleeve, the bush, the
- 45 clamping ring stop and the pressure member, so that the clamping ring is radially deformed from its released position to its clamping position to exert on the clamping sleeve a clamping pressure which is uniformly distributed over the circumference of
- 50 the clamping sleeve. In this embodiment the clamping ring may be made of, for example, a plastics material consisting of 85% polyvinylchloride and 15% plasticizer; alternatively, the clamping ring may be made of
- 55 polytetrafluoroethylene. The last-mentioned material has the advantage of a low coefficient of friction. Such materials in themselves are not suitable for exerting a pressure of an accurately defined magnitude, i.e. with a low temperature-dependence, because the coefficient of cubical expansion is comparatively high, for example 220×10^{-6} per $^{\circ}\text{C}$ for the first-mentioned material. However, this does not necessarily make the
- 60 material unsuitable for use in the present invention. For further information on techniques
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employing a plastics body for the transmission of pressure reference is made to the relevant literature. For example reference is made to the article "Werkstuckspanner mit plastischer Masse als Druckübertragungsmittel", Teil 2, "Zeitschrift für praktische Metallarbeit", Jahrgang 63, 31 Juni 1969, Heft 12, pp. 662 through 666, (Dipl.-Ing. Heinrich Matuszewski) (therewith incorporated by reference).

- 70 In the last-mentioned embodiment the means for axially moving the pressure member may comprise an annular member which concentrically surrounds said bush and an annular surface of which bears on a member connected to the pressure member, and a bush which is fixed on the head support and which concentrically surrounds and is spaced from the clamping sleeve and which has an internal screw-thread for cooperation with an external screw-thread on said annular member.

- 85 Some embodiments of the invention will now be described in more detail with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a helical-scan video cassette recorder,

- 90 Fig. 2 is a perspective view to a larger scale of part of the video recorder of Fig. 1, showing an embodiment of the invention in the recorder,

Fig. 3 is a side view, partly in cross-section and to an even larger scale, of a drum unit, comprising a rotatable head drum and a stationary tape-guide drum, of the video recorder of Figs. 1 and 2,

- 95 Fig. 4 is a perspective view of a clamping ring as used in Fig. 3 for centring and clamping the head drum on the drive spindle of the video recorder,

Figs 5 and 6 are perspective view showing the parts of a tool for mounting the clamping ring of Fig. 4 on the clamping sleeve of the head drum of Fig. 3,

- 100 Fig. 7 is a partially exploded perspective view of a tool for removing the clamping ring of Fig. 4 from the clamping sleeve of the head drum of Fig. 3,

Fig. 8 is a view similar to Fig. 3 showing a second embodiment of the invention,

- 110 Figs. 9 and 10 are sectional views of tools for respectively mounting and removing the clamping ring of Fig. 8 on and from the clamping sleeve, and

Fig. 11 is a view similar to Figs. 3 and 8

- 115 showing a third embodiment of the invention.

Fig. 1 shows a helical-scan video recorder of a conventional type and suitable for magnetically recording and reading video signals in interrupted signal tracks on a magnetic tape, which tracks extend obliquely of the tape adjacent each other in known manner. A cassette holder 2 is pivotably journaled on the housing 1 of the video recorder. A magnetic tape cassette 3 may be inserted into the cassette holder in the direction of the arrow 4.

- 120 When the cassette has been inserted completely the cassette holder can be swung down to bring the cassette into its operating position in which a loop of the magnetic tape can be extracted from the cassette with the aid of means provided for this purpose in the video recorder, and laid
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helically around part of the surface of a drum unit containing the magnetic heads of the video recorder. The usual controls, such as, for example, a number of control buttons 5, are located on the housing 1. Figure 2 shows a part of the video recorder of Fig. 1 with the cassette holder removed, so that a part of the interior of the video recorder is visible. The video recorder comprises a drive spindle 7 with a free upper end 10 (Fig. 3) and at least a portion of which extending from this free end is cylindrical. The drive spindle is rotatable about an axis 5 in the direction of the arrow 6. Two diametrically opposed magnetic heads 8, one of which is shown in Fig. 2, rotate about the axis of rotation 5 of the drive spindle 7. These magnetic heads serve for recording and/or reading the oblique signal tracks on the magnetic tape in the magnetic-tape cassette 3. The magnetic tape is omitted from the drawings for sake of simplicity. On the drive spindle 7, adjacent the free end 10 thereof, a magnetic-head support in the form of a rotary head drum 9 is detachably mounted, which drum carries the two magnetic heads 8. The manner in which the head drum 9 is secured to the drive spindle 7 is shown in Fig. 3. The head drum 9 is formed with a central axial through-bore 11 which receives the drive spindle with some clearance. For detachably mounting the head drum 9 on the drive spindle 7 there are provided means comprising a clamping sleeve 12 which has a free end 13 and concentrically surrounds the drive spindle 7 and which comprises an elastically deformable inner wall portion of the head drum 9 having an outer surface 14. There is further provided a clamping ring 15 which fits on the outside of the clamping sleeve 12 and which is radially deformable between a released position and a clamping position. In the clamping position the ring 15 deforms the clamping sleeve 12 and thus eliminates the clearance between the drive spindle 7 and the clamping sleeve 12 so that the head drum 9 is both centred and clamped on the drive spindle 7.

45 The clamping ring 15 (also see Fig. 4) has an uninterrupted structure in the circumferential direction, and through a symmetrical radial deformation locally exerts a clamping pressure on the clamping sleeve 12, which pressure is substantially uniformly distributed around the circumference of the sleeve. In order to obtain a sufficiently high clamping pressure and for a sufficiently accurate centring it is of importance that the clearance between the drive spindle 7 and the clamping sleeve 12 when the clamping ring is in its released position is not greater than substantially 15 microns, preferably even smaller. In the case of a drive spindle diameter of 6 mm, for example, a fit may be used which is designated h5/H6 in the ISO system of fits. In accordance with this fit the drive spindle may be undersized to a maximum of 5 μ m and the bore in the head drum may be oversized to a maximum of 8 μ m.

Fig. 2 shows a number of parts of the mechanism of the video recorder 1 which are not

of interest for the invention as such. It shows a stationary tape-guide drum 16, which is coaxial with the rotary head drum 9. Around this stationary drum there is concentrically disposed a rotatable ring 17 which forms part of a tape-threading mechanism which lays the magnetic tape in a helical path around part of the cylindrical surface of the drum unit comprising the stationary tape-guide drum 16 and the rotary head drum 9.

75 For this purpose tape-guide pins 18 and 19 and guide rollers 20 and 21 are provided on the ring 17. Also shown are a stationarily mounted magnetic erase head 22 and an audio head 23, as well as a capstan 24 and a pressure roller 25. In the embodiment of the invention shown in Figs. 2 to 4 the clamping ring 15 has a conical inner surface 26 which coincides with the generated surface of an imaginary cone, whose axis in Fig. 3 coincides with the axis of rotation 5 of the drive spindle 7, and which has a certain apical angle α . In Fig. 3 this angle is shown as the angle between the generatrix 27 of the generated surface of the imaginary cone and a line 28 extending parallel to the axis of rotation 5. By an axial movement of the clamping ring 15 down the clamping sleeve 12, the clamping ring, through cooperation with a part of the outer surface of the clamping sleeve is radially expanded from a released position, when it is situated nearer the end 13 of the clamping sleeve, to a clamping position, when it occupies the position shown in Fig. 3. The angle α is smaller than the friction angle (as defined earlier herein) for the materials used for the clamping sleeve and the clamping ring. Thus the frictional forces exerted between the clamping sleeve 12 and the clamping ring 15 prevent the clamping ring moving up the sleeve under the influence of the axial component of the reaction forces exerted on the ring in the clamping position. When an aluminium head drum 9 and a brass clamping ring 15 are used, the angle α may, for example be 1°30'.

The clamping sleeve 12 is formed externally with a shoulder 29 for cooperation with the conical inner surface 26 of the clamping ring 15 so that the clamping sleeve is deformed by the clamping ring 15 at a location which is accurately defined by the shoulder 29.

Mounting and removing the clamping ring 15 on and from the clamping sleeve 12 may be effected with fairly simple hand-operated tools. Figs. 5 and 6 show a tool for mounting the clamping ring and Fig. 7 a tool for removing it. The head drum 9 is provided with a collar 30, which is coaxial with the clamping sleeve 12, for taking up reaction forces exerted on the head support by the mounting tool. As shown in Fig. 5, this tool comprises a sleeve 31 to which two radially extending pins 32 are secured on two diametrically opposed sides thereof and in an end wall of which, at a central location, a screw 33 can be screwed in and out in an axial direction. At its lower end the sleeve comprises a flange 34 which bounds a substantially U-shaped opening 45. This opening is proportional so that the sleeve 31 can be slid laterally around the collar 30 of the head

drum, the flange 34 engaging underneath the collar in a circumferential groove 36. Before the sleeve 31 is slid onto the drum the clamping ring 15 is fitted on the clamping sleeve 12 and a thrust member 37 (Fig. 6) is placed on the clamping ring 15. The thrust member 37 comprises a disc-shaped body 39 with three axially extending limbs 38 which bear on the upper surface of the clamping ring 15 around the clamping sleeve 12. In the upper surface of the body 39 of the thrust member 37 a conical recess 40 is formed for receiving the conical tip 41 of the thrust screw 33. The clamping ring 15 is pressed down onto the clamping sleeve 12 by tightening the screw 33. The two pins 32 on the sleeve 31 can be manually held to prevent the sleeve 31 from turning as the screw 33 is tightened. The axial reaction forces of the mounting tool are transmitted to the collar 30 of the head drum 9 by the flange 34. For removing the clamping ring the extractor tool of Fig. 7 may be used. This tool comprises a screw 42 with a conical tip 43, a ring 44 with a flange 45, three pivotable claws 46 and a resilient wire ring 47. The claws 46 each comprise an arcuate body portion 50 which fits on the flanged ring 44, and a limb 48 which extends from the body portion 50 in a mainly axial direction and is inwardly hooked at its distal end 49. The body portions 50 of the three claws together present on their outer sides a cylindrical surface in which is formed a groove 51 for the wire ring 47, which urges the body portions 50 against the outside of the ring 44. The body portions 50 are slightly movable on the ring 44 so that the limbs 48 of the claws can be pivoted slightly outwards, i.e. at least so far that the hooked ends 49 of the claws can be positioned beneath the clamping ring 15. The conical tip 43 of the screw 42 is fitted into a conical recess 52 in the free end 10 of the drive spindle 7. When the screw 42 is tightened, the hooked ends 49 of the claw limbs 48 are moved upwards until they are positioned against the underside of the clamping ring 15. When the screw 42 is further tightened the clamping ring is drawn off the clamping sleeve 12. The axial reaction force of this tool is transmitted directly to the drive spindle 7.

In the embodiment of the invention shown in Fig. 8 a head drum 53 is secured on a drive spindle 54 by means of a clamping ring 55. For detachably mounting the head drum on the drive spindle the head drum is provided with a clamping sleeve 59 and with a bush 56 which concentrically surrounds the clamping sleeve 59. Between the bush 56 and the clamping sleeve 59 is an annular space which accommodates the clamping ring 55 and into which an externally screw-threaded mounting tool (Fig. 9) can be inserted to cooperate with an internal screw-thread 57 on the bush 56 for axially moving the clamping ring 55 down the clamping sleeve 59 to deform the ring radially into its clamping position. The clamping ring is provided with an external screw-thread 58, onto which an internally screw-threaded extractor tool (Fig. 10) can be screwed for axially moving the clamping ring up the clamping sleeve to release the

ring. The clamping sleeve 59 has a conical outer surface 60, whose shape corresponds to the conical inner surface of the clamping ring 55.

The mounting tool 61 shown in Fig. 9 for mounting the clamping ring 55 comprises an externally screw-threaded bush 62 formed at one end with a flange 63. The screw-thread 64 on the bush 62 is adapted to cooperate with the screw-thread 57 in the threaded bush 56 of the head drum 53. When the bush 62 is screwed down into the bush 56, the lower end 65 of the bush 62 engages a flange 66 at the bottom of the clamping ring 55 and presses this ring downwards onto the clamping sleeve 59. The bore 67 of the threaded bush 62 has a diameter such that the clamping ring 55 can be accommodated in this bore. In the flange 63, whose outer diameter corresponds to the outer diameter of the threaded bush 56 of the head drum 53, two cylindrical holes 68 are formed. These holes serve for receiving the pins of a pin spanner for tightening the threaded bush 62. Fig. 10 shows an extractor tool 69 for removing the clamping sleeve 55. This tool comprises a bush 69 which is provided with an internal screw-thread 70. This screw-thread is adapted to cooperate with the screw-thread 58 on the outside of the clamping sleeve 55. The threaded bush 69 is formed with a flange 71, which has an outer diameter equal to that of the threaded bush 56 of the head drum 53. In the flange 71 holes 72 are formed for the pins of a pin spanner. To extract the clamping ring 55 the bush 69 is screwed down the clamping ring until the flange 71 bears on the upper surface 73 of the threaded bush 56 of the head drum 53. Continued rotation of the bush 69 then moves the clamping ring up the clamping sleeve. If desired, a plastics ring may be inserted between the flange 71 and the surface 73 to reduce friction.

In the embodiment shown in Fig. 11 a head drum 74 is secured to a drive spindle 77 by means of a clamping ring 75 which consists of a material such that the ring is radially deformable under axial pressure, for example, a material such as polytetrafluoroethylene. A clamping sleeve 76 of cylindrical shape which is fixed to the head drum 74 by screws 88 serves for the centring and mounting of the drum on a drive spindle 77. Concentrically surrounding the clamping sleeve 76 is a bush 78. Between the bush 78 and the sleeve 76 is an annular space in which the clamping ring 75 is accommodated. For applying axial pressure to the clamping ring 75 there is provided an axially movable pressure member which is formed by an inwardly directed flange 80 on the upper end of the bush 78. The flange 80 surrounds a central opening 81 for the passage of the free end 82 of the clamping sleeve 76. At some axial distance from its free end 82 the clamping sleeve 76 has an external shoulder 83 which forms a stop on the head drum for the clamping ring 75. By axially moving the pressure member 80 towards the clamping ring stop 83, the clamping ring 75 is axially compressed in the annular space bounded by the clamping sleeve 76,

the bush 78, the clamping ring stop 83 and the pressure member 80. As a result of this axial compression the clamping ring 75 is radially deformed from a released position to a clamping position in which it exerts on the clamping sleeve 76 a clamping pressure which is uniformly distributed around the circumference of the clamping sleeve 76. For the axial movement of the pressure member 80 there are provided means comprising an externally screw-threaded annular member 85 which concentrically surrounds the bush 78 and an annular surface 84 of which bears on an outwardly directed flange 79 on the lower end of the bush 78, and a bush 86 on the head drum 74, which bush concentrically surrounds and is spaced from the clamping sleeve 76 and has an internal screw-thread 87 with which the external screw-thread of the annular member 85 cooperates. The member 85 has two holes 89 for the pins of a pin spanner by means of which the member 85 can be tightened or slackened. When the member 85 is slackened the clamping ring 75 returns from the clamping position to the released position under the influence of its own elasticity. In this respect it is of advantage if the friction occurring between the inner surface of the clamping ring and the outer surface of the clamping sleeve presents a minimal resistance to the clamping ring during its axial expansion, due to the fact that the clamping ring is made of polytetrafluorethylene.

CLAIMS

1. Apparatus for magnetically recording and/or reading signals in interrupted signal tracks on a magnetic tape, which tracks extend obliquely of the tape adjacent each other, the apparatus comprising a rotatable drive spindle having a free end and at least a portion of which extending from the free end is cylindrical, a magnetic head which is rotatable in a circular path about the axis of rotation of the drive spindle for recording and/or reading the oblique signal tracks on the magnetic tape, a head support for the magnetic head, which support is detachably mounted on the cylindrical portion of the drive spindle and is formed with a central bore which receives the drive spindle with some clearance, and means for detachably mounting the head support on the drive spindle, which means comprise a clamping sleeve having a free end and which concentrically surrounds the drive spindle and comprises an elastically deformable wall portion of the head support and a clamping ring which surrounds the clamping sleeve and which is deformable between a released position and a clamping position for deforming said clamping sleeve in the clamping position so as to eliminate the clearance between the drive spindle and the clamping sleeve and thereby clamp and also centre the head support on the drive spindle, wherein the clamping ring has an uninterrupted structure in the circumferential direction such that when deformed from its released position to its clamping position it exerts on the clamping sleeve a clamping pressure which produces a

65 symmetrical radial deformation of the sleeve and which is distributed substantially uniformly around the circumference of the sleeve.

2. An apparatus as claimed in Claim 1, wherein the clamping ring has a conical inner surface which coincides with the generated surface of an imaginary cone axis coincides with the axis of rotation of the drive spindle, wherein the clamping ring, through cooperation with a part of the outer surface of the clamping sleeve, is radially expanded from the released position to the clamping position by an axial movement of the ring in one direction along the clamping sleeve, and wherein the apical angle of said imaginary cone, measured between the generatrix of the generated surface of the cone and the axis of the cone, is smaller than the friction angle of the materials of the clamping sleeve and the clamping ring, so that the frictional forces exerted between the clamping ring and the clamping sleeve will inhibit movement of the ring along the sleeve in the opposite direction to said one direction under the influence of the axial component of the reaction forces exerted on the ring in the clamping position.

3. An apparatus as claimed in Claim 2, wherein the clamping sleeve is formed externally with a shoulder for cooperation with the conical inner surface of the clamping ring so that the clamping sleeve is deformed by the clamping ring at a location which is accurately defined by the shoulder.

4. An apparatus as claimed in Claim 2 or 3, wherein the head support is provided with a collar which is coaxial with the clamping sleeve for taking up reaction forces exerted on the head support by a tool used for tightening the clamping ring on the clamping sleeve.

5. An apparatus as claimed in Claim 1 or 2, wherein the head support is provided with a bush which concentrically surrounds the clamping sleeve and is spaced therefrom to leave an annular space in which the clamping ring is accommodated, and which is internally screw-threaded for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in one direction to deform the ring radially into its clamping position, and wherein the clamping ring is provided with an external screw-thread for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in the opposite direction to release the clamping ring.

6. An apparatus as claimed in Claim 1, wherein the clamping ring consists of a material such that the ring is radially deformable under axial pressure, wherein a bush concentrically surrounds the clamping sleeve and is spaced therefrom to leave an annular space in which the clamping ring is accommodated, wherein an axially movably pressure member is provided for applying axial pressure to the clamping ring at one end thereof, wherein the head support is provided with a stop for the clamping ring at the other end thereof, and wherein means are provided for axially moving the



(22)

the bush 78, the clamping ring stop 83 and the pressure member 80. As a result of this axial compression the clamping ring 75 is radially deformed from a released position to a clamping position in which it exerts on the clamping sleeve 76 a clamping pressure which is uniformly distributed around the circumference of the clamping sleeve 76. For the axial movement of the pressure member 80 there are provided means comprising an externally screw-threaded annular member 85 which concentrically surrounds the bush 78 and an annular surface 84 of which bears on an outwardly directed flange 79 on the lower end of the bush 78, and a bush 86 on the head drum 74, which bush concentrically surrounds and is spaced from the clamping sleeve 76 and has an internal screw-thread 87 with which the external screw-thread of the annular member 85 cooperates. The member 85 has two holes 89 for the pins of a pin spanner by means of which the member 85 can be tightened or slackened. When the member 85 is slackened the clamping ring 75 returns from the clamping position to the released position under the influence of its own elasticity. In this respect it is of advantage if the friction occurring between the inner surface of the clamping ring and the outer surface of the clamping sleeve presents a minimal resistance to the clamping ring during its axial expansion, due to the fact that the clamping ring is made of polytetrafluorethylene.

CLAIMS

1. Apparatus for magnetically recording and/or reading signals in interrupted signal tracks on a magnetic tape, which tracks extend obliquely of the tape adjacent each other, the apparatus comprising a rotatable drive spindle having a free end and at least a portion of which extending from the free end is cylindrical, a magnetic head which is rotatable in a circular path about the axis of rotation of the drive spindle for recording and/or reading the oblique signal tracks on the magnetic tape, a head support for the magnetic head, which support is detachably mounted on the cylindrical portion of the drive spindle and is formed with a central bore which receives the drive spindle with some clearance, and means for detachably mounting the head support on the drive spindle, which means comprise a clamping sleeve having a free end and which concentrically surrounds the drive spindle and comprises an elastically deformable wall portion of the head support and a clamping ring which surrounds the clamping sleeve and which is deformable between a released position and a clamping position for deforming said clamping sleeve in the clamping position so as to eliminate the clearance between the drive spindle and the clamping sleeve and thereby clamp and also centre the head support on the drive spindle, wherein the clamping ring has an uninterrupted structure in the circumferential direction such that when deformed from its released position to its clamping position it exerts on the clamping sleeve a clamping pressure which produces a

65 symmetrical radial deformation of the sleeve and which is distributed substantially uniformly around the circumference of the sleeve.

2. An apparatus as claimed in Claim 1, wherein the clamping ring has a conical inner surface which coincides with the generated surface of an imaginary cone axis coincides with the axis of rotation of the drive spindle, wherein the clamping ring, through cooperation with a part of the outer surface of the clamping sleeve, is radially expanded from the released position to the clamping position by an axial movement of the ring in one direction along the clamping sleeve, and wherein the apical angle of said imaginary cone, measured between the generatrix of the generated surface of the cone and the axis of the cone, is smaller than the friction angle of the materials of the clamping sleeve and the clamping ring, so that the frictional forces exerted between the clamping ring and the clamping sleeve will inhibit movement of the ring along the sleeve in the opposite direction to said one direction under the influence of the axial component of the reaction forces exerted on the ring in the clamping position.

3. An apparatus as claimed in Claim 2, wherein the clamping sleeve is formed externally with a shoulder for cooperation with the conical inner surface of the clamping ring so that the clamping sleeve is deformed by the clamping ring at a location which is accurately defined by the shoulder.

4. An apparatus as claimed in Claim 2 or 3, wherein the head support is provided with a collar which is coaxial with the clamping sleeve for taking up reaction forces exerted on the head support by a tool used for tightening the clamping ring on the clamping sleeve.

5. An apparatus as claimed in Claim 1 or 2, wherein the head support is provided with a bush which concentrically surrounds the clamping sleeve and is spaced therefrom to leave an annular space in which the clamping ring is accommodated, and which is internally screw-threaded for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in one direction to deform the ring radially into its clamping position, and wherein the clamping ring is provided with an external screw-thread for cooperation with a screw-threaded tool for axially moving the clamping ring along the clamping sleeve in the opposite direction to release the clamping ring.

6. An apparatus as claimed in Claim 1, wherein the clamping ring consists of a material such that the ring is radially deformable under axial pressure, wherein a bush concentrically surrounds the clamping sleeve and is spaced therefrom to leave an annular space in which the clamping ring is accommodated, wherein an axially movably pressure member is provided for applying axial pressure to the clamping ring at one end thereof, wherein the head support is provided with a stop for the clamping ring at the other end thereof, and wherein means are provided for axially moving the



- pressure member towards the clamping ring stop so as axially to compress the clamping ring in the space bounded by the clamping sleeve the bush, the clamping ring stop and the pressure member,
- 5 so that the clamping ring is radially deformed from its released position to its clamping position to exert on the clamping sleeve a clamping pressure which is distributed uniformly around the circumference of the clamping sleeve.
- 10 7. An apparatus as claimed in Claim 6, wherein the means for axially moving the pressure
- surrounds said bush and an annular surface of which bears on a member connected to the
- 15 pressure member, and a bush which is fixed on the head support and which concentrically surrounds and is spaced from the clamping sleeve and which has an internal screw-thread for cooperation with an external screw-thread on said annular member.
- 20 8. Apparatus for magnetically recording and/or reading signals in interrupted signal tracks on a magnetic tape, substantially as herein described with reference to Figures 1 to 4 or Figure 8 or 11 of the accompanying drawings.