

Description

The invention relates to a magnetic-tape apparatus comprising a scanning unit mounted on a frame and comprising

- at least one magnetic head mounted on a rotatable head support,
- a drum-shaped guide means comprising an upper drum and a lower drum which occupy a fixed position on the frame and between which the head support is mounted for rotation, the circumferential outer surfaces of said drums together forming a curved guide surface which is situated near the circular path of the magnetic head and over which a magnetic tape is guided,
- fixing means which interconnect the upper drum and the lower drum, and
- positioning elements which position the upper drum and the lower drum relative to one another.

A magnetic-tape apparatus of the type defined in the opening paragraph is known from United States Patent Specification 3,435,154. In such an apparatus the tape is guided along a helical path over the guide surface formed by the circumferential outer surfaces of stationary upper and lower drums, so that during operation tracks which are inclined relative to the longitudinal axis of the magnetic tape are written onto or read from said tape by the magnetic head.

To interconnect the upper drum and the lower drum the known apparatus employs a bridging member on that side of the upper and lower drums which is remote from the guide surface, which member interconnects the lower and upper drums by means of bolts. In view of the accuracy with which the inclined tracks have to be read or written during operation it is desirable that the connection between the upper drum and the lower drum is such that the two drums are positioned correctly relative to one another. For this purpose the bridging member employs two locating pins which extend in axial directions relative to the axis of rotation of the head support, the upper and lower drums being slid against the locating pins during assembly and being subsequently secured. It is important that the bridging member and the two locating pins which are employed for this purpose are manufactured with a high degree of accuracy. Despite this accuracy the positioning of the upper drum and the lower drum relative to each other may exhibit deviations resulting from at least two causes. The first cause is the occurrence of tolerances in the diameter of the lower and upper drums owing to the diameters of the upper drum and the lower drum not being exactly identical. After assembly of the scanning unit such tolerances may produce a step in the guide surface formed by the circumferential outer surfaces of the drums. The second cause resides in the bridging member which is employed. This is because it is substantially impossible to form the bridging member with bores for the locating pins in such a way that the central axis of each bore extends perfectly perpendicularly to the axial end walls of the upper drum and the lower drum. In practice this generally re-

sults in each locating pin fitted in the bridging member not extending perpendicularly to said axial end walls. During dismantling of the scanning unit, for example, in order to replace the head support, these deviations give rise to the upper and the lower drum being positioned differently after reassembly.

It is an object of the invention to provide a magnetic-tape apparatus of the type defined in the opening paragraph, in which the scanning unit does not employ a bridging member and comprises upper and lower drums whose guide surface is positioned correctly, the correct positioning being also maintained after dismantling and subsequent re-assembly.

To this end the invention is characterized in that:

- near their facing axial end walls the upper and lower drums have wall portions which face one another and each of which is provided with three positioning elements, the positioning elements on one wall portion and those on the other wall portion cooperating with one another in pairs either directly or indirectly through intermediate elements to establish together a statically defined connection between the upper drum and the lower drum, and
- the fixing means keep the positioning elements of each pair pressed against one another or against the associated intermediate element.

In this way the upper and lower drums can be connected to each other without the use of a bridging member. The three-point connection by means of the positioning elements, which is entirely statically defined, results in an accurate positioning of the upper and lower drums relative to one another. Further, the two drums can be dismantled and re-assembled simply, so that the accurate positioning of the two drums is maintained for example after a replacement of the head support and the magnetic head or magnetic heads mounted on this support. The only residual tolerance in the scanning unit resides in the head protrusion of the magnetic head or heads on the head support. The correct positioning of the upper and lower drums relative to each other ensures that the circumferential outer surfaces of the two drums are aligned, so that there is no step in the guide surface formed by these surfaces due to differences in drum diameter, thus guaranteeing constant thickness of the air film formed between the guide surface and the magnetic tape at the location of the upper and lower drums. This enables a very good air-film guidance of the tape at the location of the guide surface of the drums to be obtained, which is advantageous for a correct and uniform tape transport.

It is noted that document DE-A-1.474.433 discloses a magnetic tape apparatus which comprises a scanning unit having an upper and a lower drum, each carrying four elements used in positioning the drums relative to each other.

The elements involved in positioning and fixing are arranged as four pairs. A pair of these elements cooperates with an adjusting screw to position the height of the upper drum relative to the lower drum for obtaining a proper still picture. Height adjustment through use of the adjusting screw pivots the drums about a pivot axis providing a vari-

able positioning of the drums. This document shows four element groupings, rather than three, and teaches away from the use of a fixed repeatable relationship between the two drums based on integral, non-adjustable positioning elements, so that they can be separated from each other and then reassembled while retaining the original alignment.

A preferred embodiment of the invention is characterized in that said wall portions are extensions of the axial end walls of the upper and lower drums. Thus, the positioning elements on the axial end walls are suitable for obtaining a statically defined positioning of the upper and lower drums relative to each other.

United States Patent Specification 3,435,154 further describes a scanning unit in which the guide surface has a circular cylindrical shape with a cylinder axis which at least substantially coincides with the axis of rotation of the head support. A preferred embodiment of the invention in which the guide surface has the shape of part of the surface of an imaginary circular cylinder whose axis coincides at least substantially with the axis of rotation of the head support, is characterized in that, viewed parallel to the axis of rotation, in an area outside the guide surface the drums extend radially beyond the circular path described by the free end of the magnetic head, and the three positioning elements are located on said wall portions in the area outside the circular path. Since said wall portions situated near the facing axial end walls of the drums extend outside the area of the guide surface and also outside the circular path of the magnetic head, the three positioning elements on each of said two wall portions can be arranged outside said circular path, so that after assembly the positioning elements do not obstruct the rotation of the support and the magnetic head on this support.

Another preferred embodiment of the invention is characterized in that the positioning elements are integral with the associated upper and lower drum respectively. By forming the positioning elements integrally with the upper and lower drums the positioning elements can be manufactured simultaneously with the drums. This means that the forming of the positioning elements is cheaper and quicker than when these elements are formed in a separate operation after the manufacture of the drums.

With respect to the foregoing another preferred embodiment of the invention is characterized in that the positioning elements are formed as recesses in and protrusions on the wall portions present on the axial end walls of the upper and the lower drum respectively. In this way a three-point connection between the upper and the lower drum which is entirely statically defined can be obtained in a simple manner.

A further preferred embodiment of the invention is characterized in that the fixing means are arranged near the wall portions in said area outside said circular path. In this way the wall portions can be connected to each other without the fixing means obstructing the rotation of the head support and the magnetic head carried by this support.

In this respect still another preferred embodiment

of the invention is characterized in that the fixing means secure the upper drum and the lower drum relative to each other by means of only one bolt connection, which bolt connection, viewed parallel to the axis of rotation, extends at least substantially diametrically relative to the centre of the guide surface and within a triangle whose vertices are defined by the positioning elements. This provides the possibility of interconnecting the upper and the lower drum by means of only one bolt connection, which because it is situated within said triangle also ensures that the positioning elements correctly engage with each other and the upper drum and the lower drum are accurately positioned relative to one another.

The invention also relates to a method of manufacturing the scanning unit of a magnetic-tape apparatus in accordance with the invention. This method is characterized by the following sequence of operations:

- the upper drum and the lower drum are manufactured separately, the respective positioning elements being formed at the same time,
- the upper drum and the lower drum are assembled, positioned relative to each other by means of the positioning elements, and clamped in a lathe,
- the assembled upper and lower drums are together machined at their circumferential surfaces at least locally, to form the guide surface,
- the upper drum and lower drums are separated from each other and the head support and the associated drive means are mounted, and
- the upper drum and lower drums are re-assembled, and positioned relative to each other by means of the positioning elements, and are interconnected by means of the fixing means.

Thus, after their manufacture the lower drum and the upper drum may initially have different radii with a comparatively large tolerance. After assembly the circumferential surfaces of the two drums together are machined at least locally, suitably by turning on a lathe, so that the resulting guide surface has a radius which is exactly the same for the upper drum and the lower drum. The presence of the positioning elements ensures that after separation of the two drums, mounting of the head support and the associated drive means, re-assembly of the two drums and interconnection with the aid of the fixing means the parts of the guide surface situated on the upper drum and the lower drum are positioned very accurately relative to each other. Furthermore, it is advantageous in the manufacture of the lower and the upper drum that the positioning elements themselves need not comply with specific accuracy requirements. It is important only that in the assembled condition of the lower drum and the upper drum a uniquely defined scanning unit assembly is obtained. Thus, the present method enables a scanning unit to be manufactured cheaply and rapidly with an accurate positioning of the guide surfaces on both drums.

In this respect a further method is characterized in that during the combined machining of the upper and the lower drum the tool used for this purpose is controlled in both the radial and the axial direction.

The use of a tool, preferably a cutting tool which is controlled in both the radial and the axial direction during turning, has the advantage that other parts on the drums can also be formed when the drums are being turned. In this respect it is important in that the cutting tool is controlled in such a way that the wall portions carrying the positioning elements and the fixing means on the facing axial end walls of the upper and lower drums are effectively avoided by the cutting tool at the location of the positioning elements and the fixing means. Thus in the area where said elements and means are situated these wall portions retain their original shape as obtained after their manufacture.

With respect to the foregoing another method is characterized in that during its controlled movement in the axial direction the tool forms a guide face on one of the drums for guiding an edge of the magnetic tape. Such a guide face supports one edge of the magnetic tape in a direction perpendicular to the longitudinal axis of the tape during the movement of the tape over the guide surface. In this way this guide face can also be formed accurately on the scanning unit, so that the height position of the magnetic tape on the scanning unit during the movement over the guide surface is defined accurately.

With respect to the foregoing another method is characterized in that by the controlled movement in the axial and the radial direction at least one tape guide is formed at the same time. By simultaneously forming the tape guide this tape guide need not be formed separately and is positioned accurately relative to both drums. Thus, all the guide means for the magnetic tape in the apparatus which should be positioned accurately are integrated in the scanning unit. If, relative to the tape-transport direction over the guide surface, further tape guides are arranged near both ends of the guide surface, the tape can leave the scanning unit at a level relative to a reference face, such as the upper side of the deck plate, which at least substantially corresponds to the level at which the tape enters the scanning unit. This is a significant advantage because it enables the other tape guides of the magnetic-tape apparatus to be arranged with their portions which guide the lower tape edge situated at the same level relative to said reference face, so that these other tape guides can be mounted in a simple manner. Thus, in a situation in which the magnetic tape is wound on reels which are spaced equidistantly from said reference face, the transport of the tape out of the cassette accommodating the reels can be effected simply in the magnetic-tape apparatus in accordance with the invention.

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings, which show embodiments of a magnetic-tape apparatus comprising a scanning unit in accordance with the invention. In the drawings:

Fig 1 is a perspective view of a magnetic-tape apparatus in accordance with the invention;

Fig. 2 is a side view, drawn to a different scale, of the scanning unit of the magnetic-tape apparatus shown in Fig. 1,

Fig 3 is a plan view of the scanning unit looking in the direction of the arrow III in Fig.2;

Fig. 4 is an exploded perspective view of the lower and upper drums and the positioning elements arranged thereon;

Fig. 5 is a plan view similar to Fig. 3, of the scanning unit of a magnetic-tape apparatus in a second embodiment in accordance with the invention, the scanning unit being provided with two tape guides, and

Fig. 6 is an exploded view similar to Fig. 4, of the scanning unit of a magnetic-tape apparatus in a third embodiment.

The magnetic-tape apparatus shown in Fig. 1 comprises a scanning unit 1 mounted on a frame 2 comprising a flat deck plate. The scanning unit 1 is shown to an enlarged scale in Figs. 2 to 4. The scanning unit comprises a drum-shaped guide means comprising two stationary drums 3 and 4, the drum 3 being mounted on the frame 2, thus constituting the lower drum, and the upper drum 4 being mounted on the lower drum 3 in a manner to be described hereinafter. A head support 5 carrying a plurality of magnetic heads 6, for example four heads, is mounted for rotation between the lower drum and the upper drum. Together the lower drum and the upper drum form a curved guide surface 7 having the shape of part of the surface of an imaginary circular cylinder whose axis coincides at least substantially with the axis of rotation 5a of the head support 5. During operation of the apparatus the surface 7 guides a magnetic tape 8 which, as is shown schematically in Fig. 1 is wound on tape reels 8a and 8b and which during normal operation is transported from the reel 8a to the reel 8b in the direction indicated by the arrow A. For this purpose the apparatus comprises winding spindles 9 and 10 which are driven, in a manner not shown, from the underside of the frame to provide the tape transport. Driving is effected by means of an electric motor 11 which, viewed in Fig. 1, is situated to the right of the scanning unit 1. The head support 5 is driven by means of an electric motor 12 which is situated to the left of the scanning unit. However, it is to be noted that alternatively, in a manner not shown, the drive of the head support 5 may be integrated in the scanning unit 1, in which case the drive is situated near the underside of the lower drum 3. On the upper side of the frame 2 a sliding plate 13 is arranged to be rectilinearly slidable in a direction perpendicular to a line interconnecting the axes of rotation of the winding spindles 9 and 10. Further, a pressure-roller lever 14 is arranged on the upper side of the frame 2 so as to be pivotable about a spindle 14a. The pressure-roller lever carries a pressure roller 15 which, in the operating position shown in Fig.1, is positioned against the capstan 16 as a result of the pivotal movement of the pressure-roller lever 14. The capstan also is driven by the electric motor 11 in a manner not shown. In the operating position the capstan 16 in cooperation with the pressure roller 15 ensures that the magnetic tape 8 is moved over the guide surface 7 with a constant velocity.

The sliding plate 13 controls two levers 17 and 18

which carry guide pins 19 and 20 respectively. The magnetic tape is guided round these pins from the reel 8a to the reel 8b. The sliding plate 13 further carries two pairs of tape guides 21, 22 and 23, 24 respectively. Each pair of tape guides may be formed as an integral unit from one piece of a material, for example a plastics. The tape guides 21 and 22 extend perpendicularly to the frame 2 and the tape guides 22 and 24 are inclined. Since the axis of rotation 5a is inclined relative to the frame 2 and the tape guides 22 and 24 are also inclined, the tape can be guided along a helical path over the guide surface 7 of the drum during operation, the tape being guided over the larger part of its width by the upper drum 4 at the side of the tape guide 22 and the tape being guided over the larger part of its width by the lower drum 3 at the side of the tape guide 24. In order to ensure a correct guidance of the tape in the direction of its width the lower drum 3 further comprises a guide face 25 in the form of a ledge on the circumferential outer surface of the drum 3. Thus, during its travel over the guide surface 7 the tape performs an accurately predetermined movement so that during rotation the head 6 writes or reads tracks on the magnetic tape 8 which are inclined relative to the longitudinal axis of tapes. For a further description of the parts of the apparatus such as the sliding plate 13, and the movement of this plate to the various operating positions, reference is made to the Applicant's non pre-published NL-A- 85 01 027 of 3.1 1.86, filed on the 9th of April 1985 (herewith incorporated by reference).

It is important that the lower drum 3 and the upper drum 4 are positioned correctly relative to one another after assembly of the scanning unit 1. For this purpose the facing axial end walls of the lower drum and the upper drum comprise arcuate or crescent-shaped extensions which constitute wall portions 3a and 4a respectively, each of which carries three positioning elements, namely the positioning elements 26, 27 and 28 on the wall portion 3a and the positioning elements 28, 30 and 31 on the wall portion 4a. In the assembled condition of the scanning unit 1 the positioning elements 26 and 29, 27 and 30, and 28 and 31 engage one another in pairs. The positioning elements 29, 30 and 31 are semispherical and the positioning element 27 is formed with a wall which extends in a plane perpendicular to the axis of rotation 5a. The positioning element 26 takes the form of a recess with three walls such that the recess has the form of a tetrahedron. The positioning element 28 has two walls arranged in the form of a V. Together the three pairs of positioning elements 26 and 29, 28 and 31, and 27 and 30, which interengage upon assembly of the lower and upper drums ensure that the drums are in entirely statically defined positions relative to one another. Preferably, the positioning elements are formed integrally with the associated lower or upper drum. As can be seen in Fig.3, the positioning elements and the wall portions 3a and 4a are situated outside the path 6a described by the heads 6. For this purpose the facing axial end walls of the drums extend from the area where they adjoin the guide surface 7 to a point outside the circular path 6a described by the free ends of the magnetic

heads 6. The lower drum and the upper drum are interconnected by fixing means comprising only one bolt 32 which extends through a plain box in the drum 4 and screws into a threaded box in the lower drums 3, the boxes having a common axis which extends parallel to the axis of rotation 5a. A spring 34 is arranged between the upper axial end wall of the upper drum 4 and the head of the bolt 32 and when the bolt 32 is tightened, the spring exerts a pressure on the lower drum and the upper drum at the location of the positioning elements. In this respect it is advantageous that, viewed parallel to the axis of rotation 5a, the bolt 32 is situated substantially on a line (not shown) which bisects the guide surface 7 and within a triangle whose vertices are defined by the positioning elements. In this way a correct and uniform pressure is exerted on the pairs of positioning elements.

The entirely statically defined positioning of the lower drum and the upper drum relative to one another by means of three pairs of positioning elements in accordance with the invention enables the scanning unit to be manufactured accurately yet easily. First of all, the lower drum 3 and the upper drum 4 are manufactured separately, the positioning elements 26 to 28 and 29 to 31 being formed at the same time on the wall portions 3a and 4a respectively. Subsequently, the lower drum and the upper drum are assembled by interengagement of the positioning elements on the drums, after which the lower and upper drum assembly is clamped in a lathe, which is preferably of a numerically controlled hydrostatic type. During machining with such a lathe, preferably turning with a cutting tool, it is possible to control this tool in both the radial and the axial direction relative to the axis of rotation 5a. During the controlled movement of the cutting tool, which results in the side of the guide surface 7, being turned off both this surface and the guide face 25 are formed. After removal from the lathe the upper drum and the lower drum are separated and the head support 5 provided with the heads 6 is mounted between the lower and the upper drum. Assembly of the scanning unit 1 is completed after re-assembly of the lower and the upper drum, positioning by means of the positioning elements, and securing by means of the bolt 32.

As a result of the location of the positioning elements outside the circular path 6a described by the heads 6 the angle through which the guide surface 7 can guide the tape 8 is limited to approximately 200°. In the present embodiment the scanning unit 1 is intended for reading or writing tracks with digitally encoded audio signals, the angle through which the magnetic tape 8 is wrapped around the guide surface 7 being at least substantially 90°. Therefore the construction of the magnetic-tape apparatus comprising the scanning unit in accordance with the invention is particularly suitable for use in such a magnetic-tape apparatus, but from the foregoing it will be evident that this construction can also be employed in the case of wrapping angles larger than 90°.

Thus, for the manufacture of the scanning unit 1, drums 3 and 4 may be used which initially need not

be manufactured very accurately, because after turning in a lathe and mounting the head support 5 the drums 3 and 4 are positioned in an unambiguously defined relationship to each other, in such a way that no or substantially no tolerance exists between the radii of the lower and the upper drum at the location of the guide surface 7. The only residual tolerance is caused by a difference in the radial protrusion of the heads 6 on the head disc 5. During rotation of the drums an air film is formed between the magnetic tape 8 and the guide surface 7. An advantage of the construction in accordance with the invention is that reckoned in the direction of width of the tape the air film has a uniform thickness at the lower drum and the upper drum. This results in a very effective air-film guidance of the tape at the location of the guide surface, which is also advantageous for a correct and uniform tape transport. Since this air film is uniform in the direction of width of the tape the tolerances in the radial distances of the individual heads 6 from the axis of rotation 5a may be slightly larger in comparison with conventional constructions without giving rise to problems. Further, it is possible by optimising the shape of the guide surface 7 to arrange the magnetic heads 6 near that part of the guide surface where the tape 8 meets this surface, in such a way that the radial protrusion relative to the guide surface is slightly larger than at the location where the tape leaves the guide surface. At the location where the guide surface begins the thickness of the air film is generally larger than at the end of the guide surface.

The correct positioning of the drums in the construction in accordance with the invention enables the tolerance in the distance between the facing axial end walls of the drums 3 and 4 and the height of the gap between these walls in which the head support 5 rotates to be reduced. This results in a very small interruption in the guide surface 7 at the location of said gap. A further advantage is that in the case of future replacement of the head support 5, for example owing to wear of the heads 6, dismantling and subsequent re-assembly can be effected simply. This simplifies and speeds up such a replacement, which is advantageous with respect to servicing.

The use of a lathe, in which the cutting tool can be controlled in both the axial and the radial direction during turning of the assembled drums 3 and 4, also enables the guide face 25 at the lower side of the guide surface 7 to be formed accurately. It is advantageous that the circumferential surface of the drum need be turned by the cutting tool only at the location of the guide surface 7. This is effected by radial control of the cutting tool, so that machining is effected only at the location of the guide surface 7 and the cutting tool moves freely past the remainder of the circumferential surface of the drums.

As is shown in Fig. 5, the construction in accordance with the invention enables a tape guide 35 and 36 to be formed simultaneously with the manufacture of the lower and upper drum respectively. These tape guides replace the inclined tape guides 22 and 24 in Fig. 1. Forming such a tape guide on the circumferential ends of the guide surface 7 is possible

owing to the method of controlling the cutting tool in the axial and radial directions during turning.

When such a tape guide is used the tape can leave the scanning unit after the guide 36 at the same level relative to the frame 2 at which the tape enters the scanning unit at the location of the tape guide 35. In this way all the guide means which must be positioned accurately are concentrated in the scanning unit 1. All the other tape guides of the magnetic-tape apparatus can be arranged in such a way that their lower end surfaces are situated at the same level relative to the frame 2, which results in a simple mounting of these tape guides.

The drums 3 and 4 may be made of a metal, the positioning elements 26-31 being secured on the end walls of the drums. Alternatively, the drums can be manufactured advantageously from a plastics, the positioning elements 26 to 31 being formed at the same time by injection-moulding. In this way it is also possible to achieve an accurate mutual positioning of those parts of the drums 3 and 4 which cooperate with the tape. Alternatively, the drums may be die-cast from aluminium.

As is shown in Fig. 6, the lower drum 3 and the upper drum 4 may also be positioned by means of an intermediate member constituted by an arcuate plate 37 which in the assembled condition is situated between the wall portions 3a and 4a of the drums and outside the circular path 6a described by the magnetic heads 6. In the wall portions 3a and 4a positioning elements are formed comprising prismatic recesses 38a, 38b, 38c and 39a, 39b, 39c respectively, the longitudinal axes of the recesses 38a, 38c and 39a, 39c being coincident and the longitudinal axes of the recesses 38b and 39b extending perpendicularly to the longitudinal axes of the recesses 38a, 38c and 39a, 39c respectively. The plate 37 carries three positioning elements constituted by balls 40a, 40b, 40c which are fixed in holes in the plate 37 and which project from the lower and upper wall portions of the plate 37. In the assembled condition the bolt 32 urges the balls 40a, 40b, 40c against the walls of the recesses in the wall portions 3a and 4a. This also results in an entirely statically defined three-point connection of the two drums. An additional advantage of the use of the intermediate member 37 is that the height of the gap between the drums 3 and 4 in which the heads 6 rotate is adjustable by a suitable choice of the diameters of the balls 40.

Claims

1. A magnetic-tape apparatus comprising a scanning unit (1) mounted on a frame and comprising
 - at least one magnetic head (6) mounted on a rotatable head support (5),
 - a drum-shaped guide means comprising an upper drum (4) and a lower drum (3) which occupy a fixed position on the frame and between which the head support (5) is mounted for rotation, the circumferential outer surfaces of said drums together forming a curved guide surface (7) which is situated near the circular path (6a) of the mag-

be manufactured very accurately, because after turning in a lathe and mounting the head support 5 the drums 3 and 4 are positioned in an unambiguously defined relationship to each other, in such a way that no or substantially no tolerance exists between the radii of the lower and the upper drum at the location of the guide surface 7. The only residual tolerance is caused by a difference in the radial protrusion of the heads 6 on the head disc 5. During rotation of the drums an air film is formed between the magnetic tape 8 and the guide surface 7. An advantage of the construction in accordance with the invention is that reckoned in the direction of width of the tape the air film has a uniform thickness at the lower drum and the upper drum. This results in a very effective air-film guidance of the tape at the location of the guide surface, which is also advantageous for a correct and uniform tape transport. Since this air film is uniform in the direction of width of the tape the tolerances in the radial distances of the individual heads 6 from the axis of rotation 5a may be slightly larger in comparison with conventional constructions without giving rise to problems. Further, it is possible by optimising the shape of the guide surface 7 to arrange the magnetic heads 6 near that part of the guide surface where the tape 8 meets this surface, in such a way that the radial protrusion relative to the guide surface is slightly larger than at the location where the tape leaves the guide surface. At the location where the guide surface begins the thickness of the air film is generally larger than at the end of the guide surface.

The correct positioning of the drums in the construction in accordance with the invention enables the tolerance in the distance between the facing axial end walls of the drums 3 and 4 and the height of the gap between these walls in which the head support 5 rotates to be reduced. This results in a very small interruption in the guide surface 7 at the location of said gap. A further advantage is that in the case of future replacement of the head support 5, for example owing to wear of the heads 6, dismantling and subsequent re-assembly can be effected simply. This simplifies and speeds up such a replacement, which is advantageous with respect to servicing.

The use of a lathe, in which the cutting tool can be controlled in both the axial and the radial direction during turning of the assembled drums 3 and 4, also enables the guide face 25 at the lower side of the guide surface 7 to be formed accurately. It is advantageous that the circumferential surface of the drum need be turned by the cutting tool only at the location of the guide surface 7. This is effected by radial control of the cutting tool, so that machining is effected only at the location of the guide surface 7 and the cutting tool moves freely past the remainder of the circumferential surface of the drums.

As is shown in Fig. 5, the construction in accordance with the invention enables a tape guide 35 and 36 to be formed simultaneously with the manufacture of the lower and upper drum respectively. These tape guides replace the inclined tape guides 22 and 24 in Fig. 1. Forming such a tape guide on the circumferential ends of the guide surface 7 is possi-

ble owing to the method of controlling the cutting tool in the axial and radial directions during turning.

When such a tape guide is used the tape can leave the scanning unit after the guide 36 at the same level relative to the frame 2 at which the tape enters the scanning unit at the location of the tape guide 35. In this way all the guide means which must be positioned accurately are concentrated in the scanning unit 1. All the other tape guides of the magnetic-tape apparatus can be arranged in such a way that their lower end surfaces are situated at the same level relative to the frame 2, which results in a simple mounting of these tape guides.

The drums 3 and 4 may be made of a metal, the positioning elements 26-31 being secured on the end walls of the drums. Alternatively, the drums can be manufactured advantageously from a plastics, the positioning elements 26 to 31 being formed at the same time by injection-moulding. In this way it is also possible to achieve an accurate mutual positioning of those parts of the drums 3 and 4 which cooperate with the tape. Alternatively, the drums may be die-cast from aluminium.

As is shown in Fig. 6, the lower drum 3 and the upper drum 4 may also be positioned by means of an intermediate member constituted by an arcuate plate 37 which in the assembled condition is situated between the wall portions 3a and 4a of the drums and outside the circular path 6a described by the magnetic heads 6. In the wall portions 3a and 4a positioning elements are formed comprising prismatic recesses 38a, 38b, 38c and 39a, 39b, 39c respectively, the longitudinal axes of the recesses 38a, 38c and 39a, 39c being coincident and the longitudinal axes of the recesses 38b and 39b extending perpendicularly to the longitudinal axes of the recesses 38a, 38c and 39a, 39c respectively. The plate 37 carries three positioning elements constituted by balls 40a, 40b, 40c which are fixed in holes in the plate 37 and which project from the lower and upper wall portions of the plate 37. In the assembled condition the bolt 32 urges the balls 40a, 40b, 40c against the walls of the recesses in the wall portions 3a and 4a. This also results in an entirely statically defined three-point connection of the two drums. An additional advantage of the use of the intermediate member 37 is that the height of the gap between the drums 3 and 4 in which the heads 6 rotate is adjustable by a suitable choice of the diameters of the balls 40.

Claims

1. A magnetic-tape apparatus comprising a scanning unit (1) mounted on a frame and comprising
 - at least one magnetic head (6) mounted on a rotatable head support (5),
 - a drum-shaped guide means comprising an upper drum (4) and a lower drum (3) which occupy a fixed position on the frame and between which the head support (5) is mounted for rotation, the circumferential outer surfaces of said drums together forming a curved guide surface (7) which is situated near the circular path (6a) of the mag-



netic head (6) and over which a magnetic tape (8) is guided,

— fixing means (32) which interconnect the upper drum (4) and the lower drum (3), and

— positioning elements (26-31) which position the upper drum (4) and the lower drum (3) relative to one another, characterized in that

— near their facing axial end walls the upper and lower drums have wall portions (4a, 3a) which face one another and each of which is provided with three positioning elements (26-31), the positioning elements on one wall portion (3a) and those on the other wall portion (4a) cooperating with one another in pairs either directly or indirectly through intermediate elements (40a, 40b, 40c) to establish together a statically defined connection between the upper drum (4) and the lower drum (3), and

— the fixing means (32) keep the positioning elements (26-31) of each pair pressed against one another or against the associated intermediate element (37).

2. A magnetic-tape apparatus as claimed in Claim 1, characterized in that said wall portions (4a, 3a) are extensions of the axial end walls of the upper and lower drums (4, 3).

3. A magnetic-tape apparatus as claimed in Claim 2, characterized in that there are provided two further wall portions on an intermediate (37) situated between said axial end walls and carrying said intermediate elements (40a, 40b, 40c).

4. A magnetic-tape apparatus as claimed in Claim 2, the guide surface (7) having the shape of part of the surface of an imaginary circular cylinder whose axis coincides at least substantially with the axis (5a) of rotation of the head support (6), characterized in that, viewed parallel to the axis of rotation, in an area outside the guide surface (7) the drums extend radially beyond the circular path (6a) described by the free end of the magnetic head, and the positioning elements (26-31) are located on said wall portions (4a, 3a) in the area outside the circular path (6a).

5. A magnetic-tape apparatus as claimed in Claim 4, characterized in that the positioning elements (26-31) are integral with the associated upper and lower drum (4, 3) respectively.

6. A magnetic-tape apparatus as claimed in Claim 5, characterized in that the positioning elements (26-31) are formed as recesses in and protrusions on the axial end walls of the upper drum (4) and the lower drum (3) respectively.

7. A magnetic-tape apparatus as claimed in Claim 4, characterized in that the fixing means (32) are arranged near the wall portions (4a, 3a) in said area outside said circular path (6a).

8. A magnetic-tape apparatus as claimed in Claim 7, characterized in that the fixing means secure the upper and the lower drum (4, 3) relative to each other by means of only one bolt (32) connection, which bolt connection, viewed parallel to the axis (5a) of rotation, is situated substantially on a line which bisects the guide surface and within a triangle whose vertices are defined by the positioning elements (26-31).

9. A method of manufacturing the scanning unit of a magnetic-tape apparatus as claimed in Claim 1, characterized by the following sequence of operations:

- 5 — the upper and the lower drum (4, 3) are manufactured separately, the respective positioning elements (26-31) being formed at the same time,
- 10 — the upper drum (4) and the lower drum (3) are assembled, positioned relative to each other by means of the positioning elements (26-31), and clamped in a lathe,
- 15 — the assembled upper and lower drums (4, 3) are together machined at their circumferential surfaces at least locally to form the guide surface (7),
- 20 — the upper and lower drums (4, 3) are separated from each other and the head support (5) and the associated drive are mounted, and
- 25 — the upper and the lower drums (4, 3) are re-assembled, are positioned relative to each other by means of the positioning elements (26-31), and are interconnected by means of the fixing means (32).

10. A method as claimed in Claim 9, characterized in that during the contained machining of the upper and the lower drum (4, 3) the tool used for this purpose is controlled in both the radial and the axial direction.

11. A method as claimed in Claim 10, characterized in that during its controlled movement in the axial direction the tool forms a guide face (25) on one of the drums (3) for guiding an edge of the magnetic tape (8).

12. A method as claimed in Claim 9, characterized in that by the controlled movement in the axial and radial directions at least one tape guide (35, 36) is formed at the same time.

Patentansprüche

- 40 1. Magnetbandgerät mit einer auf einem Gestell angeordneten Abtasteinheit (1) mit:
 - 45 — wenigstens einem auf einem drehbaren Kopfträger (5) angeordneten Magnetkopf (6)
 - einem trommelförmigen Führungsmittel mit einer Obertrommel (4) und einer Untertrommel (3), die auf dem Gestell eine feste Lage einnehmen und zwischen denen der Kopfträger (5) drehbar angeordnet ist, wobei die Manteloberflächen der genannten Trommeln zusammen eine in der Nähe der Kreisbahn (6a) des Magnetkopfes (6) liegende gekrümmte Führungsfläche (7) bilden, über die ein Magnetband (8) geführt wird,
 - 50 — Befestigungsmitteln (32), welche die Obertrommel (4) und die Untertrommel (3) miteinander verbinden und
 - 55 — Positionierungselementen (26-31), welche die Obertrommel (4) und die Untertrommel (3) gegenüber einander positionieren, dadurch gekennzeichnet, daß
 - 60 — in der Nähe der einander zugewandten axialen Endwände die Ober- und Untertrommel Wandteile (4a, 3a) aufweisen, die einander zugewandt sind und die mit je drei Positionierungselementen (26-31) versehen sind, wobei die Positionierungsele-
 - 65



mente auf dem einen Wandteil (3a) und die auf dem anderen Wandteil (4a) paarweise miteinander zusammenarbeiten entweder unmittelbar oder mittelbar mittels Zwischenelemente (40a, 40b, 40c), um zusammen eine statisch bestimmte Verbindung zwischen der Obertrommel (4) und der Untertrommel (3) zu erzielen, und

- die Befestigungsmittel (32) die Positionierungselemente (26-31) jedes Paares gegeneinander oder gegen das zugeordnete Zwischenelement (37) gedrückt halten.

2. Magnetbandgerät nach Anspruch 1, dadurch gekennzeichnet, daß die genannten Wandteile (4a, 3a) Fortsetzungen der axialen Endwände der Ober- und der Untertrommel (4, 3) sind.

3. Magnetbandgerät nach Anspruch 2, dadurch gekennzeichnet, daß zwei weitere die genannten Zwischenelemente (40a, 40b, 40c) tragende Wandteile auf einem Zwischenelement (37) zwischen den genannten axialen Endwänden vorgesehen sind.

4. Magnetbandgerät nach Anspruch 2, wobei die Führungsfläche (7) die Form eines Teils der Oberfläche eines imaginär kreisförmigen Zylinders hat, dessen Achse wenigstens im wesentlichen mit der Drehungsachse (15a) des Kopfträgers (6) zusammenfällt, dadurch gekennzeichnet, daß, gesehen in einer Richtung parallel zu der Drehungsachse in einem Gebiet außerhalb der Führungsfläche (7), die Trommeln sich radial bis außerhalb der durch das freie Ende des Magnetkopfes beschriebenen kreisförmigen Bahn (6a) erstreckt, und die Positionierungselemente (26-31) auf den genannten Wandteilen (4a, 3a) in dem Gebiet außerhalb der kreisförmigen Strecke (6a) vorgesehen sind.

5. Magnetbandgerät nach Anspruch 4, dadurch gekennzeichnet, daß die Positionierungselemente (26-31) eine integrierte Einheit mit der zugeordneten Ober- und Untertrommel (4, 3) bilden.

6. Magnetbandgerät nach Anspruch 5, dadurch gekennzeichnet, daß die Positionierungselemente (26-31) als Vertiefungen in bzw. Vorsprünge auf den axialen Endwänden der Obertrommel (4) bzw. der Untertrommel (3) bilden.

7. Magnetbandgerät nach Anspruch 4, dadurch gekennzeichnet, daß die Befestigungsmittel (32) in der Nähe der Wandteile (4a, 3a) in dem genannten Gebiet außerhalb der genannten kreisförmigen Bahn (6a) vorgesehen sind.

8. Magnetbandgerät nach Anspruch 7, dadurch gekennzeichnet, daß die Befestigungsmittel mittels nur einer Bolzenverbindung (32) die Ober- und die Untertrommel (4, 3) gegenüber einander verbinden, wobei diese Bolzenverbindung, gesehen parallel zu der Drehungsachse (5a), im wesentlichen auf einer die Führungsfläche halbierenden Linie und innerhalb eines Dreieck liegt, dessen Eckpunkte durch die Positionierungselemente (26-31) gebildet werden.

9. Verfahren zum Herstellen einer Abtasteinheit eines Magnetbandgeräts nach Anspruch 1, gekennzeichnet, durch die folgenden Verfahrensschritte:

- die Ober- und Untertrommel (4, 3) werden einzeln hergestellt, wobei gleichzeitig die betreffenden Positionierungselemente (26-31) gebildet werden,
- die Obertrommel (4) und die Untertrommel (3)

werden mittels der Positionierungselemente (26-31) zusammengebaut und gegenüber einander positioniert und eingespannt,

- die zusammengefügte Ober- und Untertrommel (4, 3) werden zum Bilden der Führungsfläche (7) an ihren Umfangsflächen wenigstens örtlich gemeinsam bearbeitet,

- die Ober- und Untertrommel (4, 3) werden voneinander getrennt und der Kopfträger (5) sowie die zugeordnete Antriebsvorrichtung angeordnet, und

- die Ober- und Untertrommel (4, 3) werden wieder zusammengefügt mittels Positionierungselemente (26-31) gegenüber einander positioniert und mittels Befestigungselemente (32) miteinander verbunden.

10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß während der gemeinsamen Bearbeitung der Ober- und Untertrommel (4, 3) das dazu verwendete Werkzeug in der radialen sowie axialen Richtung gesteuert wird.

11. Verfahren nach Anspruch 10, gekennzeichnet, daß während der gesteuerten Bewegung in der axialen Richtung mit dem Werkzeug eine Führungsfläche (25) an einer der Trommeln (3) gebildet wird zum Führen eines Randes des Magnetbandes (8).

12. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß durch die gesteuerte Bewegung in der axialen und radialen Richtung gleichzeitig wenigstens eine Bandführung (35, 36) gebildet wird.

Revendications

1. Appareil à bande magnétique comportant une unité de balayage (1) montée sur un châssis et comprenant :

- au moins une tête magnétique (6) montée sur un porte-têtes tournant (5),

- un dispositif de guidage en forme de tambour comprenant un tambour supérieur (4) et un tambour inférieur (3) qui occupent une position fixe sur le châssis et entre lesquels le porte-têtes (5) est monté à rotation, les surfaces extérieures circonférentielles des tambours formant ensemble une surface de guidage courbe (7) qui est située à proximité du trajet circulaire (6a) de la tête magnétique (6) et sur laquelle une bande magnétique (8) est guidée,

- des moyens de fixation (32) qui relient le tambour supérieur (4) et le tambour inférieur (3), et

- des éléments positionneurs (26-31) qui positionnent le tambour supérieur (4) et le tambour inférieur (3) l'un par rapport à l'autre, caractérisé en ce que :

- à proximité de leurs parois d'extrémité axiale qui se font face, les tambours supérieur et inférieur comportent des parties de paroi (4a, 3a) qui se font face et qui sont pourvues chacune de trois éléments positionneurs (26-31), les éléments positionneurs prévus sur une partie de paroi (3a) et ceux prévus sur l'autre partie de paroi (4a) co-opérant mutuellement par paires, soit directement, soit indirectement par des éléments intermédiaires (40a, 40b, 40c), pour établir ensemble une liaison définie statiquement entre le tambour



supérieur (4) et le tambour inférieur (3), et
- les moyens de fixation (32) maintiennent les éléments positionneurs (26-31) de chaque paire pressés l'un contre l'autre ou contre l'élément intermédiaire (37) associé.

2. Appareil à bande magnétique suivant la revendication 1, caractérisé en ce que les parties de paroi (4a, 3a) sont des prolongements des parois d'extrémité axiale des tambours supérieur et inférieur (4, 3).

3. Appareil à bande magnétique suivant la revendication 2, caractérisé en ce que deux autres parties de paroi sont prévues sur un organe intermédiaire (37) situé entre les parois d'extrémité axiale et portant les éléments intermédiaires (40a, 40b, 40c).

4. Appareil à bande magnétique suivant la revendication 2, dans lequel la surface de guidage 7 a la forme d'une partie de la surface d'un cylindre circulaire imaginaire dont l'axe coïncide au moins en substance avec l'axe de rotation (5a) du porte-têtes (5), caractérisé en ce que, vu parallèlement à l'axe de rotation, dans une zone située en dehors de la surface de guidage (7), les tambours s'étendent radialement au-delà du trajet circulaire (6a) décrit par l'extrémité libre de la tête magnétique, et les éléments positionneurs (26-31) sont placés sur lesdites parties de paroi (4a, 3a) dans la zone située en dehors du trajet circulaire (6a).

5. Appareil à bande magnétique suivant la revendication 4, caractérisé en ce que les éléments positionneurs (26-31) sont respectivement d'une pièce avec le tambour supérieur et le tambour inférieur (4, 3) associé.

6. Appareil à bande magnétique suivant la revendication 5, caractérisé en ce que les éléments positionneurs (26-31) ont la forme d'évidements ménagés dans et de saillies prévues respectivement sur les parois d'extrémité axiale du tambour supérieur (4) et du tambour inférieur (3).

7. Appareil à bande magnétique suivant la revendication 4, caractérisé en ce que les moyens de fixation (32) sont disposés à proximité des parties de paroi (4a, 3a) dans la zone située en dehors du trajet circulaire (6a).

8. Appareil à bande magnétique suivant la revendication 7, caractérisé en ce que les moyens de fixation fixent le tambour supérieur et le tambour inférieur (4, 3) l'un par rapport à l'autre à l'aide d'une seule liaison par vis (32), cette liaison par vis, vu parallèlement à l'axe de rotation (5a), étant située en substance sur une ligne qui bissecte la surface de guidage et dans un triangle dont les sommets sont définis par les éléments positionneurs (26-31).

9. Procédé de fabrication de l'unité de balayage d'un appareil à bande magnétique suivant la revendication 1, caractérisé par la séquence d'opérations suivante :

- le tambour supérieur et le tambour inférieur (4, 3) sont fabriqués séparément, les éléments positionneurs respectifs (36-31) étant façonnés en même temps,

- le tambour supérieur (4) et le tambour inférieur (3) sont assemblés, positionnés l'un par rapport à l'autre à l'aide des éléments positionneurs (26-31) et serrés dans un tour,

- les tambours supérieur et inférieur (4, 3) assemblés sont usinés ensemble au niveau de leurs surfaces circonférentielles, au moins localement, pour former la surface de guidage (7),

- le tambour supérieur et le tambour inférieur (4, 3) sont séparés l'un de l'autre et le porte-têtes (5) ainsi que le dispositif d'entraînement associé sont montés en place, et

- le tambour supérieur et le tambour inférieur (4, 3) sont remontés et positionnés l'un par rapport à l'autre à l'aide des éléments positionneurs (26-31) et sont reliés à l'aide du moyen de fixation (32).

10. Procédé suivant la revendication 9, caractérisé en ce que, pendant l'usinage combiné du tambour supérieur et du tambour inférieur (4, 3), l'outil utilisé à cet effet est commandé dans le sens radial et dans le sens axial.

11. Procédé suivant la revendication 10, caractérisé en ce que, pendant son déplacement commandé dans le sens axial, l'outil forme une face de guidage (25) sur un (3) des tambours pour guider un bord de la bande magnétique (8).

12. Procédé suivant la revendication 9, caractérisé en ce que, par le déplacement commandé dans le sens axial et dans le sens axial, au moins un guide de bande (35, 36) est formé en même temps.

