



Drum-shaped scanning apparatus.

The invention relates to a drum-shaped scanning device for a recording and/or reproducing apparatus for a magnetizable record carrier in the form of a tape, which record carrier can be wrapped at least partly around the circumferential surface of the scanning device, which
5 device comprises at least one rotatable one-piece head mount for at least one magnetic head for scanning the record carrier wrapped around the circumferential surface, said at least one head being arranged substantially symme-
10 trically relative to a radial line through the axis of rotation of the head mount, which head mount comprises a planar mounting portion for mounting on the scanning device and a planar carrier portion for carrying the magnetic head, which carrier portion is connected to the mounting
15 portion by at least one strip-shaped connecting member which functions as an integral hinge, which extends substantially in the same direction as said radial line and which is deformable for adjustment of the carrier portion relative to the mounting portion, the planes of the mount-
20 ing portion and the carrier portion extending substantially perpendicularly to the axis of rotation, and an adjusting device, which bears against an abutment, acting on the carrier portion for adjusting the carrier portion relative to the mounting portion in the axial direction.

25 Such a scanning device is known from, for example, US-PS 4,117,522. This known scanning device comprises a disc-shaped head mount having one mounting portion and four carrier portions, one for each magnetic head, as well as connecting members which integrally interconnect the mount-
30 ing portion and the carrier portions. The mounting portion, the connecting members and the carrier portions are disposed in one plane, so that the head mount requires a comparatively large amount of space. However, this is unfavourable

(11)

for the construction of scanning devices of small diameter, as are required for equipment having small dimensions and a high storage capacity. In this known scanning device each carrier portion is integrally connected to the mounting
5 portion by three strip-shaped connecting members. One of the connecting members extends in the direction of the radial line and each carrier portion is adjustable relative to the mounting portion via this connecting member by means of two set-screws for adjusting the azimuth position of the
10 magnetic head which is secured to the carrier portion. The other two connecting members extend perpendicularly to the direction of the relevant radial line and each carrier portion is adjustable relative to the mounting portion via these two connecting members by means of a set-screw for
15 adjusting the axial position, in the direction of the axis of rotation, of the magnetic head which is secured to the carrier portion. However, it is then essential that the normal distance between the magnetic head and the connecting members which extend perpendicularly to the radial line is
20 as large as possible in order to ensure that the adjusting movement of the carrier portion during adjustment of the axial position of the magnetic head does not adversely affect the inclined position of the magnetic head, which, as is known, should be such that the magnetic head co-
25 operates with a record carrier scanned by said head with its entire head face. As in this known scanning device the mounting portion, the connecting members and the carrier portion of the head mount are disposed in one plane, said normal distance can only be comparatively small.

30 It is the object of the invention to provide a simple and economic solution to the said problem and to provide a drum-shaped scanning device of the type defined in the opening paragraph, which device has a small diameter, which comprises a particularly simple head mount, and which
35 in particular provides a large range of adjustment of the axial position of the magnetic head without adversely affecting the inclined position of the magnetic head by said adjustment. To this end the invention is characterized

(12)

in that the connecting member is bent into a U-shape about a bending axis which extends parallel to the planes of the mounting portion and the carrier portion and substantially perpendicularly to said radial line, said connecting member interconnecting the mounting portion and the carrier portion at their edges which are remote from the circumferential surface of the scanning device and keeping them resiliently biassed relative to each other in the axial direction with their major surfaces situated above one another in the axial direction.

The U-shape of the connecting member ensures that the planes of the mounting portion and the carrier portion of the head mount are disposed above one another in the direction of the axis of rotation, which yields several advantages with respect to the construction and adjustment. For example, the dimensions of the head mount are reduced, which enables the overall diameter of the drum-shaped scanning device to be reduced. Since the U-shaped connecting member, which functions as an integral hinge, interconnects the mounting portion and the carrier portion at their edges which are remote from the circumferential surface of the scanning device, a maximal normal distance is obtained between the connecting member and the magnetic head, which is arranged on the carrier portion near the circumferential surface of the scanning device, so that the adjusting movement of the magnetic head for its axial adjustment in the direction of the axis of rotation hardly influences the inclined position of the magnetic head. Since the connecting member elastically biasses the mounting portion and the carrier portion relative to each other, the carrier portion can simply be adjusted either away from or towards the mounting portion by actuating the adjusting device accordingly, permitting a repeated adjustment in opposite directions. Such an U-shaped construction of the connecting member also permits a simple azimuth adjustment of a magnetic head arranged on the carrier portion when an adjusting device is provided which acts on the carrier portion asymmetrically relative to the relevant radial line.

(2)

For the adjusting device which acts on the carrier portion a separate abutment may be arranged on the mounting portion, for example, by means of screws or rivets, on which abutment the adjusting device is adjustably arranged. This is for example also the case with the known scanning device, which comprises a carrying arm for set-screws on the mounting portion, the free end of said arm extending up to the carrier portion. Securing the separate abutment to the mounting portion demands an additional operation during which the mounting portion may become misaligned and deformed, which adversely affects the accuracy, dimensional stability and dimensional accuracy of the head mount. Therefore, it is found to be particularly advantageous if the mounting portion directly constitutes the abutment for the adjusting device which acts on the carrier portion. As the U-shaped connecting member ensures that the mounting portion and the carrier portion of the head mount remain disposed above one another, the mounting portion may simply be used as abutment for the adjusting device which acts on the carrier portion, so that it is no longer necessary to provide a separate abutment and to mount it on the mounting portion. The mounting portion itself may, for example, be formed with a threaded bore into which can be fitted a set-screw which serves as the adjusting device. Alternatively, the adjusting device may be an adjusting wedge which is movably guided directly on the mounting portion.

By means of the adjusting device the position of the magnetic head of the scanning device can be adjusted in the axial direction, as stated in the foregoing. However, in order to guarantee correct recording and/or reproduction by the magnetic head of the scanning device, it is effective to provide an adjustment of the position of the magnetic head in at least one direction which is perpendicular to the axis of rotation in addition to the adjustment of its position in the axial direction. In the known scanning device such an adjustment is not possible because of the arrangement of the mounting portion, the connecting members

and the carrier portion of the head mount in one plane. However, in the scanning device in accordance with the invention the U-shaped connecting member also permits adjustment in a direction perpendicular to the axis of rotation, so that an adjustment of the carrier portion relative to the mounting portion in at least one direction within the plane of the carrier portion is readily possible. therefore it is found to be advantageous if the carrier portion comprises at least one contact surface, and the mounting portion comprises at least one abutment surface, for at least one further adjusting device for adjusting the carrier portion relative to the mounting portion in at least one direction within the plane of the carrier portion. Thus, in addition to the position of the carrier portion relative to the mounting portion in the direction of the axis of rotation, the position of the carrier portion with the magnetic head arranged on it can be adjusted simply and easily in at least one direction within the plane of the carrier portion, i.e. perpendicular to the axis of rotation.

It is then found to be advantageous if the carrier portion comprises two substantially opposed contact surfaces, and the mounting portion comprises two substantially opposed abutment surfaces, for at least one further adjusting device for adjusting the carrier portion relative to the mounting portion in directions within the plane of the carrier portion and perpendicular to the radial line. This permits a simple adjustment of the position of the magnetic head on the carrier portion relative to the cylindrical surface of the scanning device into two opposite circumferential directions. This is of particular importance for a scanning device comprising at least two magnetic heads arranged at uniform angular distances from each other, because it enables the angular distances between the magnetic heads in the circumferential direction, i.e. the circumferential position of the magnetic heads, to be adjusted exactly, which is essential for correct recording and/or playback.

For an additional adjustment of the position of the magnetic head of the scanning device it is also found

(15)

to be advantageous if the carrier portion comprises two further substantially opposed contact surfaces, and the mounting portion comprises two further substantially opposed abutment surfaces, for at least one further adjusting device for adjusting the carrier portion relative to the mounting portion in directions within the plane of the carrier portion which coincide with said radial line. This enables the position of the magnetic head relative to the circumferential surface of the scanning device to be adjusted simply in two opposite radial directions also. This is important because this adjustment of the radial position of the magnetic head makes it possible to optimize the distance between the magnetic head and the record carrier which is scanned by said head and which is wrapped at least partly around the circumferential surface of the scanning device, which is also important for correct recording and/or reproducing.

The contact surfaces on the carrier portion and the abutment surfaces on the mounting portion may be constituted by offset tabs, recessed grooves or projecting ridges, which co-operate with the relevant further adjusting device, which may, for example, comprise set-screws or adjusting wedges. However, it is found to be advantageous if the carrier portion and the mounting portion are each formed with a hole, which holes have bounding walls which are substantially concentric with each other in the direction of the axis of rotation, and into which holes a pin-shaped adjustment tool can be inserted in the direction of the axis of rotation, which tool serves as further adjusting device and, for adjusting the carrier portion relative to the mounting portion in at least one direction within the plane of the carrier portion, is manually pivotable, the adjustment tool, as it is pivoted, acting on a contact surface formed by a portion of the bounding wall of the hole in the carrier portion while bearing against an abutment surface formed by a portion of the bounding wall of the hole in the mounting portion. This results in a particularly simple

construction not only for the contact surfaces and the abutment surfaces but also for the further adjusting device for adjusting the position of the magnetic head. The holes in the carrier portion and mounting portion may, 5 for example, be of square or rectangular shape thus providing adjustment of the carrier portion in two mutually perpendicular directions within the plane of the carrier portion. Alternatively, the holes may be of circular shape, thereby providing simple adjustment of the carrier portion 10 in arbitrary directions within the plane of the carrier portion. The holes of circular shape in the mounting portion and the carrier portion may have equal diameters, they may alternatively have different diameters.

The member which integrally connects the carrier 15 portion to the mounting portion may be elastically deformable in at least one direction within the plane of the carrier portion for adjusting this portion relative to the mounting portion, after which adjustment the carrier portion is fixed in its adjusted position, for example, 20 by screws or by glueing. However, it is found to be particularly advantageous, if the connecting member is plastically deformable within the adjustment range for adjusting the carrier portion relative to the mounting portion in at least one direction within the plane of the carrier portion. 25 This ensures that the carrier portion remains in its adjusted position as a result of the plastic deformation of the connecting member, without a separate fixing being necessary. The plastic deformability of the connecting member within its adjustment range, which range is 30 comparatively small in practice, is obtained by a suitable choice of the material of the connecting member and thus of the one-piece head mount. It is advantageous to use, for example, soft-annealed brass; it is alternatively possible to employ steel with a low elastic limit.

35 The mounting portion and the carrier portion may be interconnected by a single connecting member, which may be arranged symmetrically or asymmetrically relative to the relevant radial line. However, it is found to be particu-

larly advantageous if two connecting members are provided which are spaced from each other along the bending axis and which are disposed symmetrically on opposite sides of said radial line. This guarantees a particularly stable connection between the carrier portion and the mounting portion, which is of advantage for a reliable and correct mounting of the magnetic head on the scanning device. The symmetrical arrangement of the two connecting members also ensures that the forces exerted in opposite directions during adjustment of the carrier portion relative to the mounting portion are the same.

Two embodiments of the invention will be described in more detail, by way of non-limitative example, with reference to the drawings. Fig. 1 is a schematic plan view of a part of a recording and/or reproducing apparatus for a record carrier in the form of a tape accommodated in a cassette, which tape is partly wrapped around a two-part drum-shaped scanning device in accordance with a first embodiment of the invention. Fig. 2 is a sectional view taken on the line II-II in Fig. 1, of the scanning device in the apparatus shown in Fig. 1. Fig. 3 is a sectional view, taken on the line III-III in Fig. 2, of the rotary part of the scanning device shown in Fig. 2. Fig. 4 shows the rotary part of the scanning device of Fig. 2 in a sectional view taken on the line IV-IV in Fig. 3. Fig. 5 is a view similar to Fig. 3 of the rotary part of a scanning device in a second embodiment of the invention. Fig. 6 shows the rotary part of the scanning device shown in Fig. 5 in a sectional view taken on the line VI-VI in Fig. 5.

Fig. 1 schematically represents a part of a recording and/or reproducing apparatus 1 for recording and/or reproducing video and audio information on a magnetizable record carrier 2 which is in the form of a tape and is hereinafter referred to as such. The apparatus 1 comprises a deck plate 3 which carries a supply mandrel 4 and a take-up mandrel 5, which mandrels serve to drive a supply reel 6 and a take-up reel 7 respectively which can be fitted on the corresponding winding mandrels 4 and 5. Between the

(18)

winding reel 6 and the take-up reel 7 the tape 2 passes round a pin-shaped tape guide 8 for diverting the tape, over a magnetic erase head 9 for erasing all the information stored on the tape, round two further pin-shaped tape guides 10 and 11 for diverting the tape, round a drum-shaped scanning device 12, which will be described in more detail hereinafter, round two further pin-shaped tape guides 13 and 14 for diverting the tape, over a magnetic erase head 15 for erasing audio information, over a magnetic recording and/or playback head 16 for recording and/or reproducing audio information, over a capstan 17 which, in conjunction with a pressure roller 18 which can be pressed against the capstan in a manner not shown, provides a uniform tape transport during recording and/or reproducing, and round a further pin-shaped tape guide 19 for diverting the tape 2. The supply reel 6, the take-up reel 7 and the two tape guides 8 and 19 are arranged in a cassette 20, which is represented schematically, a device which can be set to two operating positions and which may, for example, comprise the tape guides 10 and 11 and the tape guides 13 and 14, enabling the tape to be extracted from the cassette and laid on said elements, which is not shown in more detail because it is irrelevant to the present invention.

As is customary in such equipment, the tape 2 is helically wrapped around the cylindrical surface 21 of the drum-shaped scanning device 12 through an angle of approximately 180° , which scanning device and also the tape guides 11 and 13 are inclined relative to the deck plate 3, but for the sake of simplicity this is not shown in Fig. 1. At least one rotatable magnetic head, which serves for recording and/or reproducing video information and which is arranged on the scanning device 12, co-operates with the tape 2 wrapped around the cylindrical surface 21 of the scanning device 12 and scans the tape along information tracks which are inclined relative to the longitudinal direction of said tape.

As can be seen in Fig. 2 the drum-shaped scanning device 12 in the present embodiment comprises a stationary

(19)

drum half 22 and a drum half 23 which is coaxial with the stationary drum half and is rotatable about an axis 24. The rotary drum half 23 comprises a hub 25 mounted on the free end 27 of a shaft 26 which is rotatable about the axis 24.

5 For this purpose the hub 25 has a hollow cylindrical sleeve-shaped portion which tapers externally towards the free end 27 of the shaft 26 and onto which is slid a self-locking clamping ring 28 which, in order to secure the drum half 23 to the shaft 26, clamps the sleeve-shaped portion of the

10 hub 25 onto the shaft 26. The shaft 26, and thus the drum half 23, is driven directly by a motor 29 which is represented schematically and the rotor 30 of which is coaxially mounted on and connected to the shaft 26. The stator 31 of the motor 29 is accommodated in a motor housing 32, which

15 forms a unit with the stationary drum half 22. In this way the motor 29 and the entire drum-shaped scanning device 12 constitute a simple, easy-to-mount constructional unit. It is to be noted that in the present case the circumferential surface 21 of the scanning device 12 comprises the two

20 cylindrical circumferential surfaces of the two drum halves 22 and 23, the circumferential surface 21 being divided by a gap 33 formed between the two drum halves 22 and 23.

On the rotatable drum half 23 of the scanning device 12 two magnetic heads 34 and 35 are arranged, whose

25 head faces 36 and 37, in which the head gaps are formed, project from the gap 33 formed between the two drum halves 22 and 23 in order to co-operate with the tape 2 wrapped round the circumferential surface 21. As is apparent from Figures 3 and 4, the two magnetic heads 34 and 35 are situ-

30 ated at the same level perpendicular to the axis of rotation 24 and are uniformly spaced from each other in the circumferential direction of the drum half 23, so that the angular distance between the two magnetic heads is 180° . Each magnetic head 34 or 35 respectively is arranged symme-

35 trically relative to a radial line 38 or 39 respectively through the axis of rotation 24 and is cemented onto a schematically represented, piezo-electrically controllable bimorph-strip element 40 or 41 respectively by means of

(20)

which, through the application of appropriate control signals, the magnetic head arranged on the respective element can be deflected out of a rest position between two extreme positions in the direction of the axis of rotation 24, in order to ensure accurate tracking of an information track to be scanned on the tape 2. Such a measure is known and is not described in more detail because it is irrelevant to the present invention.

For mounting each magnetic head 34 or 35 on the rotary drum half 23 the scanning device 12 comprises a one-piece head mount 42 or 43 respectively which for mounting on the scanning device 12 comprises a planar mounting portion 44 or 45 respectively which is glued to the drum half 23, and for carrying the respective magnetic head 34 or 35 comprises a planar carrier portion 46 or 47 respectively, the planes of the mounting portions and the carrier portions being substantially perpendicular to the axis of rotation 24. For positioning each of the two one-piece head mounts 42 and 43 on the rotary drum half 23, this drum half comprises two locating pins 48, 49 and 50, 51 respectively, which co-operate with locating surfaces 52, 53 and 54, 55 respectively on the respective mounting portions 44 and 45 of the head mounts 42 and 43 respectively. The locating surfaces 53 and 55 are V-shaped and the locating surfaces 52 and 54 are straight, which ensures a correct positioning of each head mount 42 or 43 on the drum half 23. Positioning is effected in such a way that the magnetic head 34 or 35 carried by each head mount is disposed symmetrically relative to the respective radial line 38 or 39 through the axis of rotation 24, as already stated in the foregoing. Each magnetic head 34 or 35 is carried on the respective carrier portion 46 or 47 via the respective strip element 40 or 41, the strip element 40 or 41 being cemented onto the carrier portion. In the present case each carrier portion 46 or 47 is integrally connected to the respective mounting portion 44 or 45 by two flexible strip-shaped connecting members 56 and 57 or 58 and 59 respectively which function as deformable integral hinges.

(21)

The respective connecting members 56 and 57 or 58 and 59 of each mount 42 or 43 are each bent into a U-shape about a bending axis 60 or 61 respectively, which is schematically represented by dash-dot lines in Figures 3 and 4 and which is parallel to the planes of the respective mounting portion 44 or 45 and the respective carrier portion 46 or 47 and perpendicular to the respective radial line 38 or 39. The strip-shaped connecting members 56 and 57 or 58 and 59 are arranged with their limbs extending substantially parallel to each other and in the same direction as the respective radial line 38 or 39, are spaced from each other along the bending axis 60 or 61 respectively and are disposed symmetrically on opposite sides of the respective radial line 38 or 39. The members 56 and 57 or 58 and 59 integrally interconnect the mounting portion 44 or 45 respectively and the carrier portion 46 or 47 respectively of each head mount 42 or 43 at the edges of said portions which are remote from the circumferential surface 21 of the scanning device 12 and keep the mounting portion and carrier portion of each head resiliently biased towards each other in the axial direction with their major surfaces disposed above one another in the direction of the axis of rotation, which is achieved by suitable pre-stressing the connecting members in their bent positions. Since the mounting portion and the carrier portion of each head mount are disposed above one another, the head mount construction can be very compact and occupy a minimal space.

Each carrier portion 46 or 47 is adjustable relative to the respective mounting portion 44 or 45 by deformation of the respective connecting members 56 and 57 or 58 and 59. For adjusting the carrier portion together with the magnetic head 34 or 35 mounted on it relative to the mounting portion in the direction of the axis of rotation 24, an adjusting device in the form of a set-screw 62 or 63 with a rounded end acts on the respective carrier portion 46 or 47. The set-screw 62 or 63, which is aligned in the direction of the axis of rotation 24 and which is disposed symmetrically relative to the respective radial line 38 or 39, is

(2)

accessible for adjustment from the free end 27 of the shaft 26 of the scanning device 12 via a slot 64 or 65 respectively formed in the rotary drum half 23. The abutment for the set-screw 62 or 63 acting on the carrier portion 46 or 47 respectively is constituted directly by the mounting portion 44 or 45 respectively. For this purpose each mounting portion is formed with a threaded bore, into which the set-screw is screwed. The set-screw has a fine screw-thread for fine-adjustment of the carrier portion in the direction of the axis of rotation 24, which in addition to the fine-adjustment has the advantage that the set-screw, under the influence of the bias of the carrier portion against the rounded end of the set-screw, is self-locking in the threaded bore in the mounting portion, thereby precluding inadvertent rotation.

By turning each set-screw 62 or 63 the respective carrier portion 46 or 47 co-operating therewith, together with the magnetic head 34 or 35 mounted on the carrier portion, can be adjusted relative to the mounting portion 44 or 45 respectively in the direction of the axis of rotation 24. When the set-screw 62 or 63 is turned the respective connecting members 56 and 57 or 58 and 59, which are pre-stressed to keep the mounting portion and the carrier portion biased towards each other, are elastically deformed in the axial direction and either increase or reduce the curvature of their bends depending on the direction in which the set-screw is turned. Thus, each pair of connecting members 56, 57 or 58, 59 constitutes a pivotal bearing arrangement whereby the respective carrier portion 46 or 57 is pivotable relative to the respective mounting portion 44 or 45 substantially in the direction of the axis of rotation 24. When either the set-screw is turned in one direction the respective carrier portion is adjusted in the axial direction away from the respective mounting portion, and when the set-screw is turned in the opposite direction the carrier portion is moved towards the mounting portion under the influence of the respective resiliently pre-stressed connecting members. Through these

(2)

adjustments of the carrier portion relative to the mounting portion in the direction of the axis of rotation, the set-screw provides a simple adjustment of the axial position of each magnetic head 34 or 35, which as is shown in Fig. 3 is situated at a maximum distance from the pivotal bearing arrangement constituted by the respective pair of connecting members. Each magnetic head 34 or 35 should occupy a specific rest position in the direction of the axis of rotation relative to the rotary drum half 23 when the respective piezo-electric strip element 40 or 41 receives no control signal, in order to guarantee correct recording and/or reproducing by the scanning device 12. The large distance between each magnetic head 34 or 35 and the connecting members 56 and 57 or 58 and 59 respectively of the respective head mount 42 or 43 carrying said magnetic head, which members constitute the pivotal bearing arrangement for the respective carrier portion 46 or 47 when this portion is adjusted in the direction of the axis of rotation, results in a large adjustment radius which ensures that this adjustment, which in practice is at the most some tenths of millimeters, does not change the inclined position of the respective magnetic head 34 or 35, which position should always be such that the entire head face 36 or 37 of the relevant magnetic head co-operates with the tape, which is the case if the magnetic head 34 or 35 is always substantially disposed in a plane perpendicular to the axis of rotation, as is shown in Figure 4.

In practice it is found that for correct recording and/or reproducing it does not always suffice to adjust the axial position of the magnetic heads 34 and 35 in the direction of the axis of rotation 24 of the scanning device 12 and that it is advantageous to adjust also the position of the magnetic head in a plane perpendicular to the axis of rotation. Owing to the U-shape of the members 56, 57 and 58, 59 these members are readily deformable also in directions perpendicular to the axis of rotation, so that by means of a small force the carrier portion 46 or 47 can be simply adjusted relative to the mounting portion 44

(24)

or 45 respectively in at least one direction within the plane of the carrier portion. For this purpose, as can be seen in Figures 3 and 4, circular holes formed by bores 66 or 67 and 68 or 69 respectively, are formed in the carrier portion 46 or 47 respectively and the mounting portion 44 or 45 respectively of each head mount 42 or 43 respectively, the holes having bounding walls which are aligned with each other in the direction of the axis of rotation and being disposed symmetrically relative to the radial line 38 or 39 respectively. The hole 66 or 67 in each carrier portion has a smaller diameter than the hole 68 or 69 respectively in the associated mounting portion. Those two portions 70 and 71 or 72 and 73 of the bounding wall of the respective hole 66 or 67 in the carrier portion 46 or 47 respectively at which planes tangential to the respective wall extend parallel to the radial line 38 or 39 respectively, constitute two opposed contact surfaces, and those two portions 74 and 75 or 76 and 77 of the bounding wall of the hole 68 or 69 respectively in the respective mounting portion 44 or 45, at which planes tangential to the respective wall also extend parallel to the respective radial line 38 or 39, constitute two opposed abutment surfaces, for a further adjusting device for adjusting the respective carrier portion 46 or 47 relative to the mounting portion 44 or 45 respectively in directions within the plane of the carrier portion and perpendicular to the radial line 38 or 39. Those two portions 78 and 79 or 80 and 81 of the bounding wall of the respective hole 66 or 67 formed in the respective carrier portion 46 or 47, at which planes tangential to the respective wall extend perpendicularly to the radial line 38 or 39 respectively, constitute two further opposed contact surfaces, and those two portions 82 and 83 or 84 and 85 of the bounding wall of the hole 68 or 69 respectively in the mounting basic portion 44 or 45 respectively, at which planes tangential to the respective wall also extend perpendicularly to the respective radial line 38 or 39, constitute two further opposing abutment surfaces, for a further adjusting device for adjusting the respective

carrier portion 46 or 47 relative to the mounting portion 44 or 45 respectively in directions within the plane of the carrier portion which coincide with the respective radial line 38 or 39.

5 In the present case a pin-shaped adjustment tool 86 serves as a further adjusting device for adjusting each carrier portion 46 or 47 relative to the mounting portion 44 or 45 respectively in directions within the plane of the carrier portion. The adjustment tool can be inserted in the
10 direction of the axis of rotation 24 into the holes 68 and 66 or 69 and 67 respectively from the side of the free end 27 of the shaft 26 of the scanning device 12, as is indicated by the dotted lines in Fig. 4. At its end which co-
operates with the holes the adjustment tool 86 is stepped
15 in conformity with the different diameters of the aligned holes. When the adjustment tool is inserted into the holes 68 and 66 or 69 and 67 respectively, the shoulder formed by the stepped portion of the tool abuts the major surface of the respective carrier portion 46 or 47 which faces the
20 mounting portion 44 or 45, respectively, so that the penetration depth of the adjustment tool 68 in the direction of the axis of rotation 24 is limited. This prevents the adjustment tool being inserted too far into the holes and possibly damaging the strip element 40 or 41 which extends
25 over the respective hole 66 or 67 in the carrier portion 46 or 47 respectively. If the holes 68 and 66 and 69 and 67 all have equal diameters, the adjustment tool may be stepped in such a way that it abuts that major surface of the mounting portion which is remote from the carrier portion, so
30 that the penetration depth of this adjustment tool in the direction of the axis of rotation is again limited.

For adjusting each carrier portion 46 or 47 relative to the respective mounting portion 44 or 45 in at least one direction within the plane of the carrier portion
35 the adjustment tool 86 is simply tilted manually in a direction opposite to said direction. When the adjustment tool 86 is thus tilted its stepped end acts on a wall portion of the hole 66 or 67 in the carrier portion 46

or 47 respectively which serves as a contact surface, while bearing against a wall portion of the hole 68 or 69 in the respective mounting portion 44 or 45 which serves as an abutment surface. By tilting the adjustment tool 86 in directions perpendicular to the radial line 38 or 39 the respective carrier portion 46 or 47 can be adjusted relative to the mounting portion 44 or 45 respectively in an opposite direction which is perpendicular to the respective radial line within the plane of the carrier portion, thus effecting adjustment of the position of the magnetic head 34 or 35 respectively in a tangential direction relative to the cylindrical surface 21 of the scanning device 12. During such an adjustment the adjustment tool 86, depending on the direction in which it is tilted, acts on one of the portions 70, 71 or 72, 73 respectively of the bounding wall of the hole 66 or 67 respectively in the carrier portion 46 or 47 respectively while bearing against one of the portions 74, 75 or 76, 77 respectively of the bounding wall of the respective hole 68 or 69 in the mounting portion 44 or 45 respectively. The symmetrical arrangement of the connecting members 56 and 57 and of the connecting members 58 and 59 relative to the respective radial line 38 and 39 ensures that equal forces are applied for adjustments in opposite directions, which is achieved by the symmetry of forces. By tilting the adjustment tool 86 in a direction which coincides with the radial line 38 or 39 the carrier portion 46 or 47 respectively can be adjusted relative to the mounting portion 44 or 45 respectively in an opposite direction which coincides with the respective radial line within the plane of the carrier portion, thereby effecting radial adjustment of the position of the respective magnetic head 34 or 35 relative to the circumferential surface 21 of the scanning device 12. During such an adjustment the adjustment tool 86, depending on the direction in which it is tilted, acts on one of the portions 78, 79 or 80, 81 respectively of the bounding wall of the respective hole 66 or 67 in the carrier portion 46 or 47 respectively while bearing against one of the portions 82, 83

(2)

or 84, 85 respectively of the bounding wall of the respective hole 68 or 69 in the mounting portion 44 or 45 respectively. Also during this adjustment a symmetry of forces is obtained because of the symmetrical arrangement of the connecting members 56 and 57 and of the connecting members 58 and 59 relative to the radial line 38 and 39 respectively.

In the manner described in the foregoing it is possible to adjust the circumferential position of the magnetic head 34 or 35 in a tangential direction relative to the circumferential surface 21 of the scanning device 12 and the radial position of each magnetic head in a radial direction relative to the circumferential surface 21. Thus, it is possible to ensure in a simple manner that the magnetic heads are accurately spaced from each other by the same angle, which is exactly 180° in the present case, and that in the radial direction the magnetic heads project by exactly the same distance from the circumferential surface 21 of the scanning device 12 with their head faces 36 and 37 in which the head gaps are formed, in order to achieve a uniform and consequently an optimum contact with the tape 2 which is wrapped around the circumferential surface 21. By means of these two adjustments in directions which are perpendicular to each other, which adjustments are possible in addition to the adjustment of the axial position of the magnetic heads, correct recording and/or reproducing by the magnet heads of the scanning device is achieved.

During adjustment of the carrier portion 46 or 47 relative to the respective mounting portion 44 or 45 in at least one direction within the plane of the carrier portion, the connecting members 56 and 57 or 58 and 59 respectively which connect the carrier portion integrally to the mounting portion, are also deformed but in a different manner from that of their deformation during adjustment of the position of the respective magnetic head 34 or 35 in the direction of the axis of rotation by means of the respective set-screw 62 or 63. When the carrier portion is adjusted relative to the mounting portion in at least one direction

within the plane of the carrier portion the connecting members 56 and 57 or 58 and 59 are subjected to plastic deformation over their adjustment range. The plastic deformability of the connecting members is obtained by a
5 suitable choice of the material of said members and thus of the head mounts 42 and 43. It is found that for this purpose it is effective to use, for example, soft-annealed brass, which has a particularly low elastic limit, but it is
10 alternatively possible to employ steel with low elastic limit. The plastic deformation of the connecting members 56 and 57 or 58 and 59 of each head mount 42 or 43 respectively over their adjustment range during adjustment of the respective carrier portion 46 or 47 relative to the
15 mounting portion 44 or 45 respectively in at least one direction within the plane of the carrier portion ensures that after such an adjustment the respective connecting members, which have been subject to plastic deformation, automatically maintain the respective carrier portion 46
20 or 47 in its adjusted position, so that no separate fixing of the carrier portion in its adjusted position is required, as will be apparent from Figures 3 and 4.

As is apparent from the foregoing, the scanning device comprises head mounts of simple construction for mounting the magnetic heads. Since the connecting members
25 are U-shaped and the carrier portion and the mounting portion of each head mount are situated above each other in the direction of the axis of rotation, the head mounts can be of compact construction, so that they occupy a minimal space. This results in a scanning device of small diameter,
30 as is necessary for a compact recording and/or reproducing apparatus with a high storage capacity. The U-shaped connecting members of each head mount connect the carrier portion to the mounting portion at their ends which are remote from the circumferential surface of the scanning
35 device, i.e. at a maximal distance from the magnetic head which is mounted on the carrier portion and which is situated at the circumferential surface. Since the connecting members constitute a pivotal bearing arrangement

(29)

for the carrier portion carrying the magnetic head, a maximum adjustment range for the magnetic head is obtained, in the direction of the axis of rotation in order to adjust the axial position of the magnetic head, which yields the advantage, that the displacement of the magnetic head during adjustment of its axial position hardly affects and consequently does not alter its inclined position. Due to the arrangement of the carrier portion and the mounting portion above each other the mounting portion of each head mount may be used as abutment for the adjusting device formed by the set-screw, which is simple, saves providing a separate abutment, and eliminates certain disadvantages which may arise in mounting the separate abutment on the mounting portion. As a result of the resilient connection of the carrier portion to the mounting portion by the pre-stressed connecting members the carrier portion remains always positioned against the set-screw regardless of the direction of adjustment of the set-screw, thus permitting the carrier portion to be simply adjusted in either axial direction by means of the set-screw. Since the carrier portion is always resiliently urged against the set-screw by the pre-stressed connecting members, said portion continuously exerts a force on the set-screw, which ensures that the fine-thread set-screw is self-locking by frictional contact with the threaded bore in the mounting portion, thereby preventing an inadvertent alteration of the adjustment, so that separate locking of the set-screw is not necessary. Due to their U-shaped construction the connecting members can be deformed with a comparatively small force, also when the carrier portion is adjusted relative to the mounting portion in at least one direction within the plane of the carrier portion, so that a simple and accurate adjustment of the position of the magnetic head is possible. The symmetrical arrangement of the connecting members of each head mount relative to the associated radial line ensures that equal forces obtain when adjusting the position of the magnetic head in opposite directions.

(20)

Forming the contact surfaces and abutment surfaces on the carrier portion and mounting portion respectively by portions of the bounding walls of simple holes in the form of bores is very simple. Suitably, the adjustment tool can also be very simple. Both the adjustment tool for adjusting the position of the magnetic head in a direction perpendicular to the axis of rotation and the set-screw for adjusting the position of the magnetic head in the direction of the axis of rotation are accessible from the free end of the shaft of the scanning device, which has the advantage that adjustment is also possible in the assembled condition of the rotary drum half, i.e. in the finished condition of the scanning device. The plastic deformation of the connecting members during an adjustment of the carrier portion relative to the mounting portion in a direction within the plane of the carrier portion has the advantage that the carrier portion is maintained in its adjusted position by the connecting members themselves without the provision of a separate fixing means.

Figures 5 and 6 show a rotary drum half 23 which again comprises two head mounts 42 and 43, but which each carry two magnetic heads 86 and 87 or 88 and 89 respectively, of which for example one head serves for recoding and the other for reproducing video signals. In the same way as described for the foregoing embodiment each head mount is positioned on the drum half 23 by means of locating pins 48 and 49 or 50 and 51 respectively and locating surfaces 52 and 53 or 54 and 55 respectively. Positioning is effected in such a way that the two magnetic heads 86 and 87 or 88 and 89 respectively on each head mount are disposed substantially symmetrically relative to the respective radial line 38 or 39, the magnetic heads again being cemented onto piezo-electrically movable strip elements 40 and 41. Each strip element 40 or 41 is in turn cemented onto the respective carrier portion 46 or 47 of the head mount 42 or 43 respectively, whose mounting portion 44 or 45 respectively is cemented onto the rotary drum half 23.

The mounting portion 44 or 45 of each head mount is integrally connected to the respective carrier portion 46 or 47 by a single strip-shaped connecting member 90 or 91 which functions as an integral hinge and is disposed symmetrically relative to the radial line 38 or 39 respectively and in this embodiment is elastically deformable in a direction within the plane of the respective carrier portion during adjustment of the carrier portion relative to the mounting portion. Each connecting member 90 or 91 is bent into a U-shape about a bending axis 60 or 61 respectively which is parallel to the planes of the mounting portion 44 or 45 respectively and the carrier portion 46 or 47 respectively and substantially perpendicular to the respective radial line 38 or 39, the limbs of said member extending substantially in the same direction as the respective radial line 38 or 39. Each connecting member 90 or 91 interconnects the mounting portion and the carrier portion of the head mount 42 or 43 respectively at the ends of said portions which are remote from the circumferential surface 21 of the scanning device 12 and keeps the mounting portion and the carrier portion resiliently biased towards each other in the direction of the axis of rotation with their major surfaces disposed above one another in the axial direction.

In order to adjust the carrier portion relative to the mounting portion in the direction of the axis of rotation so as to adjust the axial position of the magnetic heads 86 and 87 or 88 and 89 mounted on the carrier portion, there is provided a set-screw 62 or 63 respectively which extends parallel to the axis of rotation 24 and which is disposed symmetrically relative to the respective radial line 38 or 39, the tapered end of said screw bearing against the respective mounting portion 44 or 45, which serves as an abutment for the screw. Each screw acts on the respective carrier portion 46 or 47 via a threaded bore formed in said portion, into which bore the set-screw is screwed. The set-screws 62 and 63 can be adjusted from that side of the rotary drum half 23 from which also the head mounts 42 and 43 are mounted on the drum half 23. It is obvious

that in addition to each of the two set-screws 62 and 63 a further set-screw may be provided which extends in a direction parallel to the axis of rotation 24 but which is offset to one side of the respective radial line 38 or 39 so that by turning this set-screw a simple adjustment of the azimuth position of the relevant magnetic head is effected.

The carrier portion 46 or 47 respectively of each head mount 42 or 43 comprises two opposed contact surfaces which are disposed on opposite sides of the respective radial line 38 or 39 and which are constituted by perpendicularly bent lugs 92 and 93 or 94 and 95 respectively on the respective carrier portion 46 or 47 which lugs are disposed on opposite sides of the respective radial line 38 or 39 and are associated with further adjusting devices 96 and 97 or 98 and 99 respectively for adjusting the respective carrier portion 46 or 47 relative to the mounting portion 44 or 45 respectively in directions within the plane of the carrier portion and perpendicular to the radial line 38 or 39 respectively. Each of the further adjusting devices 96, 97, 98 and 99 comprises a further set-screw, the reaction on each of these further set-screws being taken by an associated abutment surface on the mounting portion 44 or 45 respectively. The abutment surfaces on the mounting portion of each head mount 42 or 43 are constituted by lugs 100 and 101 or 102 and 103 respectively which extend perpendicularly relative to the mounting portion, in which lugs a threaded bore is formed for co-operation with the respective further set-screw. The further set-screws 96 and 97 or 98 and 99 can be adjusted from the same side of the rotary drum half 23 as the set-screws 62 and 63 for adjusting the axial position of the magnetic heads, and serve for adjusting the circumferential position of the magnetic heads.

Adjustment of the position of the magnetic heads 86 and 87 or 88 and 89 in the circumferential direction of the cylindrical surface 21 of the scanning device 12 is possible by a corresponding adjustment of the further

(23)

set-screws 96 and 97 or 98 and 99 respectively. This can be effected in that the two set-screws 96 and 97 or 98 and 99 respectively which act on the carrier portion 46 or 47 respectively which is to be adjusted, are initially dis-
5 engaged from the lugs 92 and 93 or 94 and 96 respectively, which lugs constitute the contact surfaces, after which, for the desired adjustment by means of one of the two further set-screws which act on the relevant carrier portion, the required adjustment of the carrier portion relative to
10 the associated mounting portion is effected by adjusting the lug on the carrier portion which co-operates with said set-screw. Once adjustment has been completed, the connecting member 90 or 91 being elastically deformed, the other one of the two further set-screws which act on the relevant
15 carrier portion is made to contact the associated lug on the carrier portion so that this portion is maintained in its adjusted position by the two further set-screws through the two lugs which serve as contact surfaces. After adjustment, the further set-screws may be locked against inadvertent adjustment for example by means of glue.

As is apparent from the foregoing, the head mounts of this scanning device also are of a simple construction, the mounting portion and the carrier portion being situated one above the other in the direction of the
25 axis of rotation because of the U-shape of the connecting members, which results in a very compact construction of the head mounts. In spite of this compact construction a large pivoting radius is obtained, which radius is defined by the distance between the magnetic heads on a head mount
30 and the connecting member of the head mount, which has the advantage that the adjustment of the axial position of the magnetic heads has substantially no influence on the inclined position of the magnetic heads. Again the abutment for the axial-adjustment set-screw is constituted by the
35 mounting portion itself. The use of two further set-screws, which act on the carrier portion in opposite directions for adjusting the carrier portion relative to the mounting portion in order to adjust the position of the magnet

(24)

heads in the circumferential direction, has the advantage that said screws can also be used for fixing the carrier portion in its adjusted position and for a correct fixing of the carrier portion, so that it is virtually impossible
5 for the adjustment of the carrier portion to be inadvertently disturbed. Since in this embodiment the connecting member can be deformed elastically for the adjustment of the carrier portion relative to the mounting portion in a direction within the plane of the carrier portion, the
10 material used for the head mount does not have to comply with any specific requirements as regards a low limit of elasticity, so that it is also possible to use particularly cheap materials. Owing to the symmetrical arrangement of the connecting member relative to the respective radial
15 line the forces exerted during oppositely directed adjustments are again equal.

In addition to the two embodiments described in detail several modifications are possible without departing from the scope of the invention. For example, the
20 mounting portion and the carrier portion of a head mount may also be integrally interconnected by three U-shaped connecting members. In both embodiments the width of the connecting members, measured in the direction of the axis of rotation is smaller at the bends than at the ends where
25 they are connected to the mounting portions and carrier portions; obviously, the connecting members may also be of constant width. A set-screw serving as an adjusting device for adjusting the carrier portion in the direction of the axis of rotation may also be inclined relative thereto, if
30 this is necessary or favourable for constructional reasons. This set-screw may also be disposed asymmetrically relative to the relevant radial line, which also applies to the holes in the carrier portion and mounting portion, whose bounding wall portions constitute the contact surfaces and
35 the abutment surfaces respectively. The contact surfaces and abutment surfaces may also be inclined relative to the relevant radial line, in which case, for example, the adjustment of the position of the carrier portion

(25)

relative to the mounting portion in the circumferential direction and in the radial direction is possible by means of a single adjusting operation. Instead of set-screws it is possible to employ adjustment wedges. Of course, each magnetic head may be mounted directly on the carrier portion, if no piezo-electric adjustable strip element is used. Alternatively, more than two head mounts may be arranged on one rotary drum half for a corresponding number of magnetic heads. Furthermore, a head mount may comprise one mounting portion and two or more carrier portions which are each integrally connected to the mounting portion by at least one connecting member and which each carry at least one magnetic head. Alternatively, the mounting portion of the head mount may be constituted by the rotary drum half itself. Obviously, the scanning device may also comprise two stationary drum halves, between which a circular gap is formed through which a magnetic head arranged on a rotatable arm by means of a head mount co-operates with the record carrier which is wrapped around the circumferential surface of the two stationary drum halves. Moreover, the scanning device need not have a circular cylindrical circumferential surface; it may alternatively be elliptical, in which case the axis of rotation of the rotary head mount no longer coincides with the axis of the scanning device.

30

35