TAPE RECORDER OF THE AUTOMATIC REVERSING TYPE

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to a tape recorder of the automatic reversing type wherein a 2-track head is turned over each time the feeding direction of a tape is reversed.

2) Description of the Prior Art

Generally, a head of a tape recorder is made of a permalloy, ferrite or a like material and is comparatively expensive. Particularly, a 4-track head for a tape recorder for the automatic reversing type is far more expensive than a 2-track head. Accordingly, some of late tape recorders of the automatic reversing type incorporate a head which is turned over an angle of 180 degrees around an axis perpendicular to a tape contacting face thereof for contacting with a magnetic tape each time the feeding direction of a magnetic tape is reversed.

FIG. 4 illustrates an exemplary head turning over mechanism in such tape recorders of the automatic reversing type. Referring to FIG. 4, the tape recorder shown includes a 2-track head 1 (hereinafter referred to

only as head). The head 1 is securely mounted at a forward end of a rotary member 2 which is in turn mounted on a head base 3 for rotation around an axis perpendicular to a tape contacting face of the head 1 for contacting with a magnetic tape. A rotational driving mechanism not shown is connected to the rotary member 2 so that the latter may be turned over an angle of 180 degrees in an alternate direction around the axis by the former each time the feeding direction of the tape is reversed. An abutting member 4 in the form of a flat plate extends radially outwardly from an outer periphery of the rotary member 2. Meanwhile, a pair of azimuth adjusting screws 5 are screwed in the head base 3 such that ends thereof may extend into a range of turning movement of the abutting member 4 of the rotary member 2. Accordingly, as the rotary member 2 rotates around the axis thereof, the abutting member 4 will be engaged with the end of one of the azimuth adjusting screws 5 and thus stopped from further rotation by the latter. Consequently, the head 1 will thereafter be held stationarily at the stopped position. A compression coil spring 6 is interposed between the head of each of the azimuth adjusting screws 5 and the head base 3 in order to prevent unintended eventual loosening of the azimuth adjusting screws 5 with upward urging

forces of the compression coil springs 6.

In the tape recorder of the automatic reversing type having such a construction as described above, when a tape is being fed in one direction, the abutting member 4 of the rotary member 2 is held in contact with the end of either one of the azimuth adjusting screws 5 as at a location A shown in FIG. 4. To the contrary, when an end of the tape is detected, the rotational driving mechanism not shown operates in response to such a tape end detection signal so that the rotary member 2 is rotated an angle of 180 degrees by the former until the abutting member 4 of the rotary member 2 is now engaged with and stopped by the end of the other azimuth adjusting screw 5 as at another location B shown in FIG. 4.

By the way, if the head 1 in the tape recorder described just above is positioned in a skew with respect to the tape feeding direction at one of the fixed positions of the rotary member 2 stopped by the azimuth adjusting screws 5, the pertaining azimuth adjusting screw 5 will be suitably loosened or tightened to change the stopping position at which the end of the azimuth adjusting screw 5 engages with and stops the abutting member 4 of the rotary member 2 in order to effect fine adjustment of the position of the head.

However, while in the tape recorder a countermeasure for preventing unintended eventual loosening of the azimuth adjusting screws 5 is provided by the compression coil springs 6, normally the azimuth adjusting screws 5 are readily loosened by an impact force when the abutting member 4 of the rotary member 2 is brought into contact with the end of either azimuth adjusting screw 5 each time the head 1 is turned over. If the azimuth adjusting screws 5 thus become loosened, the position of the head 1 cannot be controlled with a high degree of accuracy. As a result, the frequency characteristic of the head 1 in recording and reproduction of a tape will be deteriorated.

On the other hand, in order to prevent unintended eventual loosening of the azimuth adjusting screws 5 attributable to an impact force of the rotary member 2, it may seem recommendable to employ strong springs as the compression coil springs 6. In such a case, however, it is necessary either to decrease the pitch of the screw threads of the azimuth adjusting screws 5 or to increase the thickness of the head base 3 so as to increase the extent of screwed engagement of the azimuth adjusting screws 5 therewith in order that the urging forces of the compression coil springs 6 may be borne sufficiently. As a result, an operation for forming a

threaded-hole will become difficult. Meanwhile, where strong springs are employed as the compression coil springs 6, there is an additional disadvantage that it becomes difficult to perform an azimuth adjusting operation.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a tape recorder of the automatic reversing type wherein unintended eventual loosening of an azimuth adjusting screw can be prevented effectively and stabilization of the frequency characteristic of a magnetic head in recording and reproduction of a tape can be attained.

In order to attain the above specified object, according to the present invention, there is provided a tape recorder of the automatic reversing type which comprises a 2-track head having a tape contacting face thereon, mounting means for mounting the head for turning motion around an axis perpendicular to the tape contacting face of the head, an abutting element mounted for turning motion around the axis in an integral relationship with the head, a pair of headed azimuth adjusting screws each having an end adjustably screwed in the mounting means, and a single stopper member in

the form of a resilient plate having a substantially U-shape and having adjacent opposite ends of the U-shape thereof a pair of azimuth adjusting portions each of which has an opening formed therein, the azimuth adjusting screws extending through the openings of the stopper member, the stopper member being mounted such that the bottom portion of the U-shape thereof is fixedly supported on the mounting means while the azimuth adjusting portions thereof contact with the heads of the azimuth adjusting screws to normally urge the azimuth adjusting screws in a direction away from the mounting means due to the resiliency of the stopper member, the stopper member further having a pair of stopping portions which are located for abutting engagement by the abutting element so as to define a range of turning motion of the abutting element and hence of the head within an angle of about 180 degrees, the azimuth adjusting portions of the stopper member being connected to the stopping portions such that when one of the azimuth adjusting portions is adjusted by adjustment of an associated one of the azimuth adjusting screws, a corresponding one of the stopping portions may also be adjusted following the adjusted azimuth adjusting portion, but when one of the stopping portions is abutted by the abutting element, substantially no

impact force may be transmitted to a corresponding one of the azimuth adjusting portions.

According to the tape recorder, as the head is turned, the abutting element is turned in an integral relationship with the head and abutted with one of the stopping portions of the resilient stopper member. Thereupon, an impact force of the abutting element is absorbed exclusively by the resilient stopping portion of the stopper member and will not be transmitted to the azimuth adjusting screws. Accordingly, unintended eventual loosening of the azimuth adjusting screws is prevented effectively. As a result, the position of the head can be controlled with a high degree of accuracy and the frequency characteristic of the head in recording and reproduction of a tape will be stabilized.

A specific embodiment of the present invention will now be described in detail by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view of a head turning over mechanism of a tape recorder of the automatic reversing type showing an embodiment of the present invention;

FIG. 2 is a rear perspective view of the head

turning over mechanism of FIG. 1;

FIG. 3 is a vertical sectional view of a rotary member and a stopper member in the head turning mechanism of FIG. 1; and

FIG. 4 is a front elevational view of a head turning over mechanism of an exemplary conventional tape recorder.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring first to FIGS. 1 and 2, there is shown a head turning over mechanism of a tape recorder of the automatic reversing type according to a preferred embodiment of the present invention. The head turning over mechanism shown includes a cylindrical head support or rotary member 12 having a head 11 securely mounted at a forward end thereof. An abutting member 13 in the form of a flat plate or blade extends radially outwardly from an outer periphery of the rotary member 12. The rotary member 12 has a smaller diameter portion 14 formed at a rear end thereof and is mounted on a head base 15 for rotation around an axis C perpendicular to a tape contacting face 11a of the head 11 for contacting with a magnetic tape not shown on the tape recorder.

In particular, a wall member 16 is integrally formed on and extends uprightly from the head base 15

and includes opposing front and rear wall sections 16a, 16b and a pair of opposite side wall sections 16c defining a substantial spacing therein. A fitting hole 17 is formed in the front wall section 16a while another fitting hole 18 is formed in the rear wall section 16b of the wall member 16, and the rotary member 12 is received at a forward end portion thereof in the fitting hole 17 with the abutting member 13 located in the spacing within the wall member 16 while the smaller diameter portion 14 of the rotary member 12 is received in the fitting hole 18. Thus, the rotary member 12 is mounted for rotation around the axis C on the front and rear wall sections 16a, 16b of the wall member 16 on the head base 15. It is to be noted that a rear end of the smaller diameter portion 14 of the rotary member 2 is projected outwardly from the rear wall section 16b of the wall member 16.

Meanwhile, a stopper member 19 formed from a single leaf spring having a substantially flattened U-shaped front elevation is located in the spacing of the wall member 16 on the head base 15. The stopper member 19 has, at each of opposite end portions thereof, an azimuth adjusting portion 21 in which a screw fitting hole 20 is formed and a stopping portion 22 in the form of a tongue branched from the azimuth adjusting portion

21 with a slit 21a of a suitable length left between the azimuth adjusting portions 21 and the stopping portion 22 and having a smaller outward extent than the azimuth adjusting portion 21. Referring to FIG. 3, a central lowermost portion of the stopper member 19 is located below the rotary member 12 while the opposite end portions of the stopper member 19 are located at substantially same vertical positions with the rotary member 12 on opposite sides with respect to the rotary member 12. Referring to FIGS. 1 and 3, the stopper member 29 has an angular positioning hole 33 formed in the central lowermost portion thereof, and a projection 34 in the form of an angular post formed on the head base 15 is fitted in the angular positioning hole 33 of the stopper member 19 so that the stopper member 19 is positioned relative to the head base 15 and held from rotation by the projection 34. The stopper member 19 is mounted on the head base 15 by means of a pair of azimuth adjusting screws 23 which extend downwardly through the screw insertion holes 20 of the azimuth adjusting portions 21 of the stopper member 19 and are screwed into threaded holes 24 (only one is shown in FIG. 1) formed in the head base 15. In the assembled condition of the stopper member 19, the central lowermost portion thereof lies and is supported on an

upper face of the head base 15 as seen in FIG. 3.

The stopper member 19 is so shaped and arranged that, in the assembled condition thereof, the azimuth adjusting screws 23 may be urged upwardly through engagement of the azimuth adjusting portions 21 of the stopper member 19 with the heads of the azimuth adjusting screws 23 by the elasticity of the stopper member 19 itself in the form of a leaf spring. Accordingly, unintended eventual loosening of the azimuth adjusting screws 23 can be prevented. Thus, if the azimuth adjusting screws 23 are tightened or loosened, the stopping portions 22 will be displaced following the azimuth adjusting portions 21. In the meantime, the stopping portions 22 of the stopper member 19 in the assembled condition are located in a locus of turning motion of the abutting member 13 of the rotary member 12 so that as the rotary member 12 is rotated around the axis C, the abutting member 13 may be contacted with and stopped by an upper face of either one of the stopping portions 22 of the stopper member 19. Apparently, the contacting positions between the stopping portions 22 of the stopper member 19 and the abutting member 13 of the rotary member 12 and accordingly the range of rotation of the rotary member 12 defined by the contacting positions can be adjusted

by adjusting the azimuth adjusting screws 23, and each of the contacting positions is selected such that, in the contacting position, the head 11 may assume an appropriate position with respect to a tape not shown being fed in either direction for recording or reproduction.

Referring now to FIG. 2, a gear 25 is attached to the rear end of the smaller diameter portion 14 of the rotary member 12 projected outwardly from the rear wall section 16b of the wall member 16, and a compression spring 40 is interposed between the gear 25 and the wall section 16b for urging the gear 25 and accordingly the rotary member 12 in the rearward direction so that a front conical portion 12a of the rotary member 12 may be received by the front wall section 16a of the wall member 16 around the fitting hole 17. Thus, in assembling the rotary member 12 and the gear 25, the rotary member 12 is first inserted into the fitting hole 17 of the front wall section 16a of the wall member 16 until the smaller diameter portion 14 thereof is projected rearwardly outwardly through the fitting hole 18 of the rear wall section 16b and the front conical portion 12a thereof is contacted with the front wall section 16a around the fitting hole 17, and then the compression spring 40 is fitted around the rearwardly

projected smaller diameter portion 14 of the rotary member 12 whereafter the gear 25 is fitted on and secured to the smaller diameter portion 14 by a suitable means against the compression spring 40. Referring back to FIG. 1, in order to allow the abutting member 13 of the rotary member 12 to be located in the spacing within the wall member 16 in the assembled condition of the rotary member 12, the front wall section 16a of the wall member 16 has a pair of horizontal openings or slots 17a formed in contiguous relationship on opposite sides of the fitting hole 17 therein. Thus, in assembling the rotary member 12, the abutting member 13 thereof is passed through either one of the slots 17a of the front wall section 16a.

Referring again to FIG. 2, a gear member 26 is mounted for rotation on the rear wall section 16b of the wall member 16 adjacent the gear 25. The gear member 26 includes a sector gear 27 normally held in meshed engagement with the gear 25, and a pinion 28 formed in a coaxial integral relationship with the sector gear 27 and normally held in meshed engagement with a rack 29. The rack 29 extends in a horizontal direction and is supported for longitudinal axial movement by suitable means not shown. A torsion toggle spring 30 extends between a pin 30a on the rear wall section 16b of the

wall member 16 and another pin 30b on the rack 29 and is arranged such that a maximum compression energy may be accumulated in the toggle spring 30 when the rack 29 is in a particular neutral position in which an imaginary line interconnecting the pins 30a, 30b at the opposite ends of the toggle spring 30 intersects the longitudinal axis of the rack 29 at a right angle, but if the rack 29 is displaced from the particular position, the energy accumulated in the toggle spring 30 may be discharged therefrom so that the rack 29 may be urged and moved in either longitudinal axial direction away from the particular position. The rack 29 has a pawl 35 formed at an end thereof remote from the pinion 28 and received in a spacing between a pair of pawls 37, 38 formed at an end of a pivotal switching plate 36. The pivotal switching plate 36 is mounted for pivotal motion around a capstan not shown of the tape recorder and is connected to a tape end detecting mechanism not shown such that it may be pivoted in an alternate direction each time an end of a tape is detected and accordingly the feeding direction of the tape is to be reversed. Such pivotal motion of the pivotal switching plate 36 is transmitted to the rack 29 through the engagement of the pawl 37 or 38 of the former with the pawl 35 of the latter so that the rack 29 is moved in the longitudinal

axial direction thereby to rotate the pinion 28 of the gear member 26. Rotation of the pinion 28 is transmitted to rotate the rotary member 12 via the sector gear 27 and the gear 25 until the abutting member 13 of the rotary member 12 is abutted with and stopped by one of the stopping portions 22 of the stopper member 19 whereupon the longitudinal axial movement of the rack 29 is also stopped against the urging force of the toggle spring 30.

It is to be noted that the pawl 35 of the rack 29 and the spacing between the pawls 37, 38 of the pivotal switching plate 36 are dimensioned so as to provide a lost motion connection between the pivotal switching plate 36 and the rack 29. Thus, in either one of actuated positions of the rack 29 which are defined by the contacting positions between the abutting member 13 of the rotary member 12 and the stopping portions 22 of the stopper member 19, the pawl 35 of the rack 29 is suitably spaced from both of the pawls 37, 38 of the pivotal switching plate 36, but when the pivotal switching plate 36 is pivoted, either one of the pawls 37, 38 thereon will be engaged with and push the pawl 35 to move the rack 29 at least to a position a little farther than the particular position of the rack 29 at which a maximum compression energy is accumulated in the

toggle spring 30 as described hereinabove. As the rack 29 is moved farther than the particular position in this manner, it is thereafter moved in the same direction by the urging force of the toggle spring 30 until the other actuated position thereof is reached. Accordingly, while the extent of the pivotal motion of the pivotal switching plate 36 which is pivoted each time the feeding direction of a tape is reversed is constant, the abutting member 13 of the rotary member 12 is assuredly brought into and thereafter held in contact with either one of the stopping portions 22 of the stopper member 19 under the urging force of the toggle spring 30. This applies even after required azimuth adjustment is performed.

It is to be noted that when the rotary member 12 is at a turned over position thereof in which the abutting member 13 thereof is contacted with either one of the stopping portions 22 of the stopper element 22 and accordingly the rack 29 is at one of the actuated positions, the abutting member 13 lies in a substantially horizontal plane as seen in FIG. 3, but it lies in a horizontal plane though not shown when the rack 29 is at its particular neutral position as described hereinabove.

In the tape recorder of the automatic reversing

type described above, when a tape is being fed in one direction, the abutting member 13 of the rotary member 12 is held in contact with one of the stopping portions 22 of the stopper member as at a location A in FIG. 3. But when an end of the tape is detected, the pivotal switching plate 36 is pivoted in one direction in response to a detection signal. Consequently, the rotary member 12 is rotated an angle of 180 degrees around the axis C until the abutting member 13 of the rotary member 12 is abutted now with the other stopping portion 22 as at a location B in FIG. 3. When the abutting member 13 of the rotary member 12 is abutted with the stopping portion 22 of the stopper member 19, an impact force is caused by the abutting member 13. However, the impact force then will be absorbed wholly by the resilient stopping portion 22. Accordingly, the impact force is not transmitted to the adjacent azimuth adjusting portion 21 nor to the azimuth adjusting screw 23 which extends through the azimuth adjusting portion 21.

Thus, according to the tape recorder of the automatic reversing type described above, unintended eventual loosening of the azimuth adjusting screws 23 attributable to a turning over operation of the head 11 can be prevented effectively. Further, since an impact

force appearing as the abutting member 13 of the rotary member 12 is abutted with either one of the stopping portions 22 of the stopper member 19 is absorbed wholly by the stopping portion 22 of the stopper member 19 which is formed from a single leaf spring, the stopper member 19 need not have a very high elasticity only if the stopping portions 22 can support the abutting member 13 of the rotary member 12 against the urging force of the toggle spring 30. Accordingly, the stopper member 19 will provide no trouble against an azimuth adjusting operation by adjustment of the azimuth adjusting screws 23. Besides, since the stopping portions 22 of the stopper member 19 have a smaller outward extent than the azimuth adjusting portions 21, the displacement of each of the stopping portions 22 when the associated azimuth adjusting screw 23 is tightened or loosened is smaller than that of the azimuth adjusting portion 21. This allows fine adjustment of the position of the head 11 in the tape recorder of the present embodiment.

It is to be noted here that while in the embodiment described above each of the stopping portions 22 is in the form of a tongue branched from the corresponding azimuth adjusting portion 21 with the slit 21a of a suitable length left therebetween, it may assume any other form only if it is adjusted following

the corresponding azimuth adjusting portion 21 when the latter is adjusted by adjustment of its associated azimuth adjusting screw 23, but when it is abutted by the abutting member 13, substantially no impact force is transmitted to the corresponding azimuth adjusting portion 21. For example, each of the stopping portions 22 may be formed as a tongue or extension which extends in a transverse or lateral direction, that is, in a direction parallel to the axis C of the rotary member 12, or in some other oblique direction from the corresponding azimuth adjusting portion 21 preferably with a slit of a suitable length left therebetween.



CLAIMS:

1. A tape recorder of the automatic reversing type, comprising a 2-track head having a tape contacting face thereon, mounting means for mounting said head for turning motion around an axis perpendicular to said tape contacting face of said head, an abutting element mounted for turning motion around said axis in an integral relationship with said head, a pair of headed azimuth adjusting screws each having an end adjustably screwed in said mounting means, and a single stopper member in the form of a resilient plate having a substantially U-shape and having adjacent opposite ends of the U-shape thereof a pair of azimuth adjusting portions each of which has an opening formed therein, said azimuth adjusting screws extending through said openings of said stopper member, said stopper member being mounted such that the bottom portion of the U-shape thereof is fixedly supported on said mounting means while said azimuth adjusting portions thereof are maintained in contact with the heads of said azimuth adjusting screws to normally urge said azimuth adjusting screws in a direction away from said mounting means due to the resiliency of said stopper member, said stopper member further having a pair of stopping portions which are

located for abutting engagement by said abutting element so as to define a range of turning motion of said abutting element and hence of said head within an angle of about 180 degrees, said azimuth adjusting portions of said stopper member being connected to said stopping portions such that when one of said azimuth adjusting portions is adjusted by adjustment of an associated one of said azimuth adjusting screws, a corresponding one of said stopping portions may also be adjusted following the adjusted azimuth adjusting portion, but when one of said stopping portions is abutted by said abutting element, substantially no impact force may be transmitted to a corresponding one of said azimuth adjusting portions.

2. A tape recorder as set forth in claim 1, wherein each of said stopping portions of said stopper member is branched from and extends in the same direction with a corresponding one of said azimuth adjusting portions with a slit of a certain length left therebetween.

3. A tape recorder as set forth in claim 2, wherein said stopping portions of said stopper member have a smaller extent than said azimuth adjusting portions.

4. A tape recorder as set forth in claim 1,

wherein each of said stopping portions of said stopper member extends in a transverse direction from a corresponding one of said azimuth adjusting portions with a slit of a certain length left therebetween.

5. A tape recorder as set forth in any one of the preceding claims, wherein said stopper member has an angular hole formed at a central portion thereof, and a corresponding angular projection is formed on said mounting means and fitted in said angular hole of said stopper member thereby to position said stopper member relative to said mounting means and hold said stopper member from rotation.

6. A tape recorder as set forth in any one of the preceding claims, wherein said mounting means includes a fixed base member and a pair of opposing wall sections on said base member each having a hole formed therein, and said head is located at an end of a rotatable member which is received at different portions thereof for rotation in said holes of said wall sections, said abutting member being located in a spacing between said wall sections, one of said wall sections further having an opening formed in contiguous relationship to said hole therein for allowing said abutting member to pass therethrough into said spacing.

7. A tape recorder as set forth in any one of

the preceding claims, wherein said stopper member is alternatively urged away from a neutral position thereof intermediate said range of turning motion thereof to either one of opposite positions thereof at opposite ends of said range by means of a toggle spring.

8. A tape recorder as set forth in claim 6, wherein said head is connected to means for turning said stopper member from either one of said opposite positions farther than said neutral position against the urging force of said toggle spring.

9. A tape recorder substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.