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A TAPE TENSIONING MECHANISM

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The invention concerns a tape tensioning mechanism for a magnetic tape recording and playback apparatus with a magnetic tape loading mechanism, in particular, a helical scan system as used in a video tape recorder and digital audio tape recorder.

In a conventional magnetic tape recording and playback apparatus with a helical scan system, a rotating drum equipped with a magnetic head device that has rotating magnetic heads is, for example, installed on a mechanical chassis in a state coaxial with a fixed drum. A magnetic tape is made to run along the peripheries of these drums so that when the heads rotate at high speed, recording tracks are formed at an inclined angle on the tape. In this way, signals may be recorded or played back.

In such a magnetic tape recording and playback apparatus, there is provided a loading mechanism which takes out the tape from a tape cassette, and winds it around the drums automatically. This loading mechanism comprises a loading block with tape guides, such as a return guide and an inclined guide which engage with and guide the magnetic tape.

The loading block may be driven by rotating member such as a loading ring which rotates so as to bring the

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tape from the cassette to a specific loading position near the drums. The rotating member is driven by a motor and the position of the loading block is detected by a switch.

This magnetic tape recording and playback apparatus also has a pinch roller pressure mechanism which presses a pinch roller on a capstan. The pressure mechanism may comprise a pinch arm which is for example free to pivot at one end, the other end thereof being fitted with the pinch roller, and the pinch roller being pressed to the capstan by the action of a solenoid or of a control motor and cam.

In this apparatus, when the pinch roller is pressed against the capstan (i.e. when the pinch roller is ON), the magnetic tape runs at a constant rate, and when the pinch roller is released from the capstan (i.e. when the pinch roller is OFF), the magnetic tape can be moved in fast forward or rewind mode etc.

Figure 4 is a perspective view of a conventional magnetic tape recording and playback device as disclosed in Utility Model Application Laid-Open No. 34633/1986. In the figure, 101 is a chassis, 102 is a capstan, and 103 is a pinch roller. 104 is a drive shaft, and 105 is a circular cam. 107 is a lever which rotates on pivot 106, and 109 is a lever which rotates on pivot 108. 110 is a pinch arm which rotates on pivot 108, and 111 is a spring which pulls lever 109 and pinch arm 110. 112 is a

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cam groove formed on circular cam 105, and 113 is a pin which is mounted on one end of lever 107 and moves in cam groove 112. 114 is a pin mounted on the other end of lever 107, 115 is a slit which is formed on lever 109 and engages with pin 114, and 116 is a stopper which determines the positions of levers 109 and 110.

The operation of this device will be explained below. Cam 105 is rotated via a worm or other means by any drive mechanism, e.g. a motor not shown. Pin 113 moves along the side walls of cam groove 112, and lever 107 rotates on pivot 106. The rotation direction of lever 107 depends on the rotation direction of cam 105 and the shape of cam groove 112. Assuming that lever 107 rotates on pivot 106 in a clockwise direction, pin 114 then moves in slit 115 while maintaining contact with the side walls of the slit, which causes lever 109 to rotate in the anticlockwise direction under the action of a moment on pivot 108. Spring 111 is the extended, pinch arm 110 is rotated in the anticlockwise direction on pivot 108, and pinch roller 103 which is attached on pinch arm 110 also rotates. When the angle of rotation reaches a specific value, pinch roller 103 comes into contact with capstan 102, and the extending force by spring 111, because of further rotation of lever 109, maintains pinch roller 103 in contact with capstan 102.

In the conventional magnetic tape recording and



playback device described above, circular cam 105 is used. From a view of strength, the cam has a to be made thick, and this makes it difficult to make the device thin. Also the components of the device are arranged around circular cam 105, which leads to less freedom of design.

Figs. 7 and 8 are plan views of the second conventional magnetic tape recording and playback apparatus in states of loading and unloading, respectively, as disclosed in Utility Model Application Laid-Open No. 105938/1986. In the figures 501 is a chassis, 502 and 503 are guide grooves formed on chassis 501, and 504 and 505 are tape loading blocks. 506 and 507 are stoppers for stopping tape loading blocks 504 and 505 at specific positions. 510 is a rotating drum, and 511 is a tension arm. 512 and 513 are a tension post and a pin attached to one end and another of tension arm 511, respectively. 514 is a pivot fixed on chassis 501 for pivotably supporting tension arm 511. 515 is a spring for pulling tension arm 511 in the anticlockwise direction. Loading cam member 520 is driven by a motor (not shown). The first sliding lever 521 has slots 524 and 525 in which pins 522 and 523 attached on chassis 501 are inserted so that lever 521 can slide linearly on chassis 501. Lever 521 slides linearly in accordance with rotation of loading cam member 520 because pin 526 fixed on lever 521 engages with a cam groove (not shown)

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formed on loading cam member 520. The second sliding lever 527 having rack 528 is mounted on lever 521 so as to be slidable. Pinch arm 529 having pinch roller 531 is supported rotatably on chassis 501 through pin 530. 532 is a gear portion engaging with rack 528, and 533 is a capstan mounted on chassis 501. Arm 534 having pin 534a engaging with groove 536 formed on lever 521 is supported rotatably on chassis 501 through pin 535. 537 is a slidable lever of which one end is connected with arm 534 and another has slot 539 in which pin 538 fixed on chassis 501 is inserted.

A transmission mechanism (not shown) is interposed between loading cam member 520 and tape loading blocks 504 and 505, so that tape loading blocks 504 and 505 can move according to rotation of loading cam member 520.

The operation will be described below. In the state of loading shown in Fig. 7 tape loading blocks 504 and 505 engage with stoppers 506 and 507, pinch roller 531 is pressed on capstan 533, and a magnetic tape (not shown) is loaded in a specific path so that information can be recorded and played back. At this time tension arm 511 is located in the loading position so as to be able to control a tension of magnetic tape.

When unloading is started, loading cam member 520 is rotated by a motor, and in accordance with the rotation, the first sliding lever 521 moves in the direction of arrow A. Since gear portion 532 is engaging



with rack 528, pinch arm 529 is rotated in the direction of arrow B. Arm 534 is rotated by engagement between pin 534a and groove 536, so lever 537 moves in the direction of arrow C. When end 537a of lever 537 engages with pin 513 attached on tension arm 511, tension arm 511 is rotated in the direction of arrow D. Also tape loading blocks 504 and 505 are moved in the directions of unloading by rotation of loading cam member 520 through transmission mechanism.

Rotation of loading cam member 520 brings the unloading state as shown in Fig. 8, where tape loading blocks 504 and 505, and tension post 512 are located inside of tape cassette 508.

Loading operation will be described below. The operation is reverse to the unloading one. Namely, according to the rotation of a motor, tape loading blocks 504 and 505 moves along guide grooves 502 and 503, and engage with stoppers 506 and 507, respectively. Also, the first lever 521, arm 534 and lever 537 move in the directions reverse to the unloading ones by the rotation of loading cam member 520. Since pulled by spring 515 in the anticlockwise direction, tension arm 511 is rotated in the anticlockwise direction while maintaining contact between pin 513 and end 537a of lever 537. When tension arm 511 reaches a specific position, end 537a is separated from pin 513, so that tension arm 511 can control a tape tension.



The conventional magnetic tape recording and playback apparatus described above suffers from problems arising as a result of the tension arm 511 being located far from loading cam 520 which drives it, and the drive transmission mechanism from the cam to the arm therefore needs many components such as levers. As a result, it is difficult to ensure the precision of components or dimensional precision among many components, and the structure also takes up too much space.

The object of the invention is to solve the problems stated above.

A further object of the invention is to provide a magnetic tape recording and playback device which is thin and compact with more freedom in arrangement of the components.

Another object of the invention is to provide a magnetic tape recording and playback device with a tape loading mechanism wherein a drive transmission mechanism comprises a small number of components, dimensional errors among components are eliminated, and the structure takes up small space.

According to the invention there is provided a tape tensioning mechanism for a magnetic tape recording and playback apparatus, the mechanism comprising:

a pivotable member in the form of a fan shaped plate which is pivotable about a first pivot, a first



spring and a tension arm which is pivotable about a second pivot to tension a tape by a tension post or pinch roller, wherein the tension post or pinch roller is separated from the magnetic tape in a first position and is urged against a magnetic tape by the first spring in a second position of the pivotable member.

Reference with now be made to the accompanying figures wherein:

Fig. 1 is a perspective view of a magnetic tape recording and playback apparatus according to an embodiment of the invention.

Figs. 2 and 3 are plan views of the magnetic tape recording and playback apparatus as shown in Fig. 1.

Fig. 4 is a perspective view of a conventional magnetic tape recording and playback device.

Fig. 5 is a plan view of a further embodiment of the invention in a state of loading.

Fig. 6 is a plan view of the embodiment shown in Fig. 5 in which a tension arm is in a state of unloading.

Fig. 7 is a plan view of a second conventional device in a state of loading.

Fig. 8 is a plan view of the device shown in Fig. 7 in a state of unloading.

The first embodiment of this invention will be explained with reference to Figs. 1 to 3. In Fig. 1, 117 is a drive motor and 118 is a gear driven by drive motor 117. 119 is a fan-shaped pivotable member with an arc-

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shaped gear area 119a which engages with gear 118. 120 is a pivot and is a centre of rotation of fan-shaped pivotable member 119 and 121 is a guide groove formed on fan-shaped pivotable member 119. 122 is a lever on which pin 124 moving in guide groove 121 is fixed and which rotates on pivot 125. 124 is a lever rotating on pivot 125. 126 is a lever (pinch arm) on which pin 127 being in contact with lever 124 is attached and which rotates on pivot 128. 129 is a pinch roller fitted to lever 126, and 130 is a capstan. 131 is a spring interposed between levers 122 and 124. 132 is a pin fixed on lever 124, and 133 is a spring which pulls lever 126 in the anticlockwise direction.

The operation of this apparatus will be described below. In a state of unloading, each element is in the position shown in Fig. 2 i.e. pin 132 and lever 122 are in contact each other because of the extending force by spring 131. Furthermore, pin 127 located at one end of lever 126 is in contact with lever 124 because of the extending force by spring 133, while pinch roller 129 and capstan 130 are not in contact each other. When drive motor 117 rotates, its rotation is transmitted via gear 118 to gear area 119a of fan-shaped pivotable member 119, and fan-shaped pivotable member 119 rotates in the anticlockwise direction on pivot 120 as shown in the figure. Pin 123 which is engaged with guide groove 121 formed on fan-shaped pivotable member 119 then receives a



force from the side walls of guide groove 121 because of the rotation of pivotable member 119. As a result, lever 122 rotates in the anticlockwise direction on pivot 125 and pulls spring 131. Because of this extending force of spring 131, lever 124 also rotates on pivot 125 in the anticlockwise direction, and presses pin 127. Lever 126 then rotates on pivot 128 in the clockwise direction, and pinch roller 129 comes into contact with capstan 130.

As shown in Fig. 3, after contact of pinch roller 129 and capstan 130, fan-shaped pivotable member 119 and lever 122 continue to rotate slightly. However, since pinch roller 129 and capstan 130 are already in contact, lever 126 cannot rotate further on pivot 128 in the clockwise direction. Lever 124 therefore also cannot move, and so the force exerted by spring 131 because of further rotation of lever 122, after pinch roller 129 has come into contact with capstan 130, is used to maintain pinch roller 129 in contact with capstan 130.

In the above embodiment, each component member has been given the direction of rotation shown in the figures, but it will be understood that other direction combinations are possible.

Also the embodiment can be applied in case of driving a tape tension arm and tape guide post arm.

The second embodiment of the invention will be described below with reference to Figs. 5 and 6 which are



plan views showing a tension arm in states of loading and unloading, respectively. Identical or equivalent elements to those in said conventional apparatus shown in Figs. 7 and 8 are given identical numbers, and their descriptions are therefore omitted.

In the figures, 511A is a tension arm which is pulled in the clockwise direction by spring 515A interposed between one end of tension arm 511A and chassis 501. Transmission arm 540 supported rotatably on chassis 501 through pivot 541 is pulled in the anticlockwise direction by spring 542 interposed between one end of transmission arm 540 and chassis 501. 543 is a stopper mounted on chassis 501 for stopping transmission arm 540. Fan-shaped pivotable member 545 with pin 546 is supported rotatably on chassis 501 through pivot 547. 599 is a gear which is driven by a motor not shown and engages with gear portion 598 formed on the periphery of pivotable member 545.

Now the operation will be described below. In Fig. 5 which is a plan view showing a state of loading of magnetic tape and tension arm, magnetic tape 550 is located in a path where recording and playback can be done. At the time of unloading, pivotable member 545 is rotated in the direction of arrow E by a motor through gear 599 and gear portion 598. Accordingly, pin 546 fitted on pivotable member 545 rotates in the direction of arrow E, and transmission arm 540, engaging with pin



546, rotates together with pin 546 in the anticlockwise direction because spring 542 pulls arm 540 in that direction. When end 540a of transmission arm 540 engages with the middle of tension arm 511A, tension arm 511A is rotated on pivot 514 in the anticlockwise direction in opposition to the force of spring 515A which is weaker than that of spring 542. Therefore, tension post 512 is separated from magnetic tape 550 and comes into the unloading state. Although pivotable member 545 rotates further in the direction of arrow E, transmission arm 540 is kept in a specific position where it engages with stopper 543.

At the time of loading, a motor is rotated and pivotable member 545 starts to rotate through gear 599 and gear portion 598 in the direction of arrow F in Fig. 6. When pin 546 fixed on pivotable member 545 engages with the middle of transmission arm 540, transmission arm 540 rotates on pivot 541 attached on chassis 501 in the clockwise direction in opposition to the force of spring 542. Since pulled by spring 515A, tension arm 511A rotates on pivot 514 fitted on chassis 501 in the clockwise direction in accordance with the rotation of end 540a of transmission arm 540 in the clockwise direction. Therefore, tension post 512 attached on tension arm 511A engages with magnetic tape 550. When end 540a is separated from tension arm 511A by further rotation of transmission arm 540 in the clockwise

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direction, tension arm 511A stops in the state where the tensions of spring 515A and magnetic tape 550 balance each other as shown in Fig. 5. Thus the tension of magnetic tape is controlled.

When the plane of pivotable member 545 is wide, the degree of freedom to attach pin 546 on the plate is improved, so it can be located at the best position in order to load tension arm 511A efficiently.

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CLAIMS

1. A tape tensioning mechanism for a magnetic tape recording and playback apparatus, the mechanism comprising:

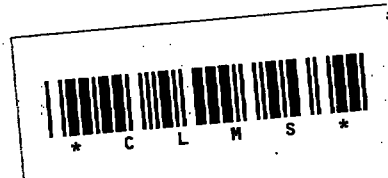
a pivotable member (545,119) in the form of a fan shaped plate which is pivotable about a first pivot (547, 120); a first spring (515A, 131); and a tension arm (511A, 126) which is pivotable about a second pivot (514,128) to tension a tape by a tension post or pinch roller (512, 129), wherein the tension post or pinch roller is separated from the magnetic tape in a first position and is urged against a magnetic tape (550) by the first spring in a second position of the pivotable member.

2. A mechanism according to claim 1, wherein the pinch roller (129) urges the magnetic tape against a capstan (130) in the second position.

3. A mechanism according to claim 2, wherein the plate portion of the pivotable member (119) has at least one guide groove (121) and the mechanism further comprises a first lever (124) and a movable member (122), the movable member having a first pin (123) which engages in the guide groove (121) of the pivotable member (119) wherein the first spring (131) is adapted to couple and apply a tension between movable member (122) and the

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first lever (124).

4. A mechanism according to claim 3, wherein the movable member (122) is pivotable about a third pivot (125).

5. A mechanism according to claim 4, further comprising a second pin (127) which is attached on the first lever (124) or the tension arm (126) for engaging with the tension arm or first lever and a second spring (133) for urging the tension arm (126) in such a direction that the pinch roller (129) is separated from the capstan (130).

6. A mechanism according to claim 5, wherein the pivotable member (119), the moving member (122), the first lever (124) and the tension arm (126) are movable between respective first positions and respective second positions;

the arrangement being such that when the pivotable member (119), the moving member (122), the first lever (124) and the tension arm (126) are in their respective first positions, the pinch roller (129) is separated from the capstan (130), and;

when the pivotable member (119) is moved from its first position to its second position, the moving member (122) is moved from its first position to its second position due to the engagement between the guide groove (121) and the first pin (123), the first lever (124) is moved from its first position to its second position due





to the coupling by the first spring (131), the tension arm (126) is moved from its first position to its second position due to the engagement between the second pin (127) and the first lever (124), and the pinch roller (129) is pressed against the magnetic tape which is pressed against the capstan (130).

7. A mechanism according to claim 6, wherein a third pin (132) on the first lever (124) engageable with the moving member (122) to limit the rotation of the lever (124) due to the force of the first spring (131), wherein the third pin (132) and the moving member (122) are in engagement with each other when the moving member (122) and the first lever (124) are in their respective first positions, and the third pin (132) and the moving member (122) are disengaged from each other when the moving member (122) and the first lever (124) are in their respective second positions, so that the force of the first spring (131) is applied to the pinch roller (129) without being limited by the engagement between the third pin (132) and the moving member (122).

8. A mechanism according to claim 6 or 7, comprising means (117,118) for rotating the pivotable member (119) between its first position and its second position.

9. A mechanism according to claim 8, wherein the device further comprises a gear portion (119a) formed on the periphery of the pivotable member (119), and a gear (118) which engages with the gear portion (119a)

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and drives the pivotable member (119), said gear (118) forming part of said means for pivoting the pivotable member (119).

10. A mechanism according to claim 1, wherein the first spring (515A) pulls the tension arm (511A) in such a direction that the tension post (512) engages with a magnetic tape (550) and wherein the pivotable member (545) is adapted to move the tension arm (511A) in such a direction that the tension post (512) is separated from the magnetic tape in opposition to the force of the first spring (515A).

11. A mechanism according to claim 10, further comprising a pin (546) attached to the pivotable member (545), and a transmission arm (540) which moves the tension arm (511A) in such a direction that the tension post (512) is separated from the magnetic tape in accordance with the engagement with the pin (546).

12. A mechanism according to claim 11, wherein the transmission arm (540) is pivotable about a third pivot (541), and is engageable with the pin (546) and the tension arm (511A), and the device further comprises a second spring (542) for urging the transmission arm (540) in such a direction as to cause the tension post (512) to be separated from the magnetic tape (550).

13. A mechanism according to claim 12, wherein the tension arm (511A), the first spring (515A), the pivotable member (545), and the transmission arm (540)

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are movable between their respective first positions and their respective second positions,

the arrangement being such that when the tension arm (511A), the first spring (515A), the pivotable member (545) and the transmission arm (540) are in their respective first positions, the tension post (512) is separated from the magnetic tape (550), and when the pivotable member (545) is moved from its first position to its second position, the transmission arm (540) is rotated from its first position to its second position, due to engagement with the pin (546), against the biasing force of the second spring (542), and the tension arm (511A) is rotated from its first position to its second position due to the biasing force of the first spring (515A) so that the tension post (512) is urged against the magnetic tape (550) due to the force of the first spring (515A).

14. A mechanism according to claim 13, wherein when the pivotable member (545) is moved from its second position to its first position, the transmission arm (540) is rotated from its second position to its first position, due to the force of the second spring (542), the tension arm (511A) is rotated from its second position to its first position, by engagement with the transmission arm (540) and overcoming the force of the first spring (515A), so that the tension post (512) is separated from the magnetic tape (550).

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15. A mechanism according to claim 14, further comprising means (599) for driving the pivotable member (545) between its first and second positions.

16. A mechanism according to claim 15, wherein the mechanism further comprises a gear portion (598) formed on the periphery of the pivotable member (545), and a gear (599) which engages with the gear portion (598) and drives the pivotable member (545), said gear (598) forming part of said means (599) for rotating the rotating member (545).

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