

A DEVICE FOR ALTERING A TAPE DRIVE MODE

This invention relates to a device for altering a tape drive mode comprising tape tensioning means for preventing tape looseness during exchange of the tape drive mode. The device may be suitable for tape recording and/or playing devices such as video tape recorders, video tape players, DAT and camera recorders for home or business use as well as combination recorders with a television, or indeed any other visual or audio device having a tape recorder and/or player.

Prior recorders and/or players with tape-winding systems have generally included a tape deck on which a tape cassette is removably set, a torque transmission means through which either one of tape reels contained in the tape cassette on the tape deck is alternately rotated in a forward or backward direction by means of a drive motor, means for loading/unloading a tape cassette from an inlet port to the tape deck and vice-versa, means for supporting a tape supplied from the tape reels to a head cylinder in a suitable stretched condition, means for driving a capstan roller, and means for operating a pinch roller selectively to be carried either to a position in which the pinch roller is biased toward the capstan roller to pinching the tape or to a position in which the pinch roller is spaced away from the capstan roller.

In order to carry a tape to the periphery of the head

cylinder under the playing/recording mode, the tape loading/unloading means had been provided with a pair of tape loading pins adapted to support the tape between the tape reels and head cylinder, and the tape supporting means
5 had included means for applying a tension to the tape to prevent the tape looseness.

The construction of the prior tape supporting means unavoidably included the problem that, as the tape-winding system was altered from the playing/recording mode to the
10 quick rewinding mode or the same rewinding mode under the playing condition, the pinch roller was relieved from the pinching position in a manner to be away from the capstan roller, and the tension applying means was simultaneously operated to leave away from the tape, before the torque
15 transmission means exchanged power transmission from one of the tape reels to the other one, whereby the tape between the tape reels and head cylinders could become undesirably loose.

According to a first aspect of the present invention
20 there is provided a device for altering a tape drive mode, comprising tape tensioning means for tensioning a tape during playback and/or recordal mode, said tape tensioning means being arranged to maintain tape tensioning during alteration of the tape drive mode from playback and/or
25 recordal mode to rewind mode until tape transport operates in the rewind mode.

According to a second aspect of the present invention there is provided a device for altering a tape drive mode, including torque transmission means for selectively driving the tape reels of a tape cassette in forward and backward
5 directions, a tape loading/unloading device including a pair of tape loading pins adapted to support the tape between the tape reels and a head cylinder, means for applying tension to the tape to prevent looseness of the tape during playback and/or recordal mode, means for
10 driving a capstan roller, and means for operating a pinch roller to be selectively carried into cooperation with the capstan roller, the torque transmission means being provided on a shift member adapted to alter the intermeshing of gears through which the rotating power from
15 the drive motor is in use, transmitted to one of the tape reels, the device further comprising a second shift member operable as the torque transmission means is altered between its various operating modes, the second shift member having an engagement portion adapted to bring the
20 first shift member to one of its exchanging positions in a manner to set the gear intermeshing to the rewinding mode, and a cam-shaped portion, and means for keeping the tension applying means in a tension condition with a cam follow member contacting the cam-shaped portion of the second
25 shift member until the tape transport operates by cooperation of the capstan roller and the pinch roller, after the power transmission is exchanged to either one of

the tape reels for shifting the device from the playing/recording mode to the rewinding mode.

There is thus provided a device for altering a tape mode, which can prevent loosening of a tape taken out between tape reels and applied to a head cylinder as the power transmission is exchanged to either one of the tape reels.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Fig. 1 is a plan view of a tape recording and playing device, without a tape cassette set on a tape deck disposed in a chassis, including an embodiment of device in accordance with the present invention;

Fig. 2 is an enlarged bottom view of the apparatus of Fig. 1, showing a tape cassette set on the tape deck;

Fig. 3 is a enlarged plan view of a portion of the apparatus of Fig. 1;

Fig. 4 is an enlarged plan view of the right side portion of the apparatus of Fig. 1, showing a pinch roller relieved away from a capstan roller;

Fig. 5 is a plan view of the front portion of the apparatus of Fig. 1, showing the shift members;

Fig. 6 is an enlarged plan view of the left side portion of the apparatus of Fig. 1;

Fig. 7 is an enlarged plan view of the right side portion of the apparatus of Fig. 1, showing the pinch
5 roller pushed toward the capstan roller;

Fig. 8 is an enlarged side sectional view of part of the apparatus mentioned above;

Fig. 9 is an enlarged section of another part of the apparatus mentioned above;

10 Fig. 10 is a side view of a spring bias means adapted to the apparatus mentioned above; and

Fig. 11 is a side view of the spring bias means of Fig. 10 in disassembled condition.

The illustrated tape recording and/or playing device
15 includes a tape deck chassis 1 having a pair of tape-reel setting discs 10 and 11 with rotatable shafts 10a and 11a to which a pair of tape reels (not shown by any reference number) journaled in a tape cassette 9 are removably
engaged when the tape cassette 9 is set on the deck, and a
20 torque transmission device for alternately supplying torque power from a drive motor 40 to either one of the tape discs 10 and 11. The drive motor 40 includes a flywheel and an output shaft 14 to which a capstan roller 14 is coaxially
attached. There are further provided a pinch roller 15 to
25 pinch the tape to the capstan roller 14, a head cylinder 2, an audio-signal input and output head 12 and an erasing head 13, both heads 12, 13 being provided on the chassis at

positions near to both sides of the head cylinder 2. In the illustrated embodiment, the pinch roller 15 is pivotally supported on a pinch lever 103, which is pivotable about a shaft 104 provided on the chassis 1 and has a hook 103a integrally formed at an edge thereof. A cam lever 105 is rotatably supported on the shaft 104 in a manner to be turned by suitable cam means (mentioned hereinafter) and is biased toward the hook 103a by means of a torsion spring member 106.

10 The device includes a cassette holder 16 for guiding the tape cassette 9 along side guide members 17 and 18 from an inlet/outlet port to the tape reel setting discs 10 and 11. In order to carry the cassette holder 16 with the tape-cassette 9, the device further includes a carrying lever 28, a rack gear member 29 shifted by motion of the carrying lever 28, and rotatable gears 30 provided on both sides of the cassette holder 16 so as to be driven by the rack gear member 29 by intermeshing therewith, thereby to carry the tape cassette 9 to the tape deck together with the cassette holder 16 and then to set the tape reels to the tape reel setting discs 10 and 11.

25 A pair of slide members 7 and 8 are provided, with tape loading pins 3 and 4 to guide the tape to the periphery of the head cylinder 2 when the cassette 9 together with the cassette holder 16 is loaded on the tape-reel setting discs, together with a pair of guide rails 5 and 6 provided by chassis 1 and means for carrying the

slide members 7 and 8 along the guide rails.

The carrying means includes two link members 32 pivotally attached to the slide members 7 and 8 respectively, and two loading arms 33 and 34 pivotally attached to the link members 32 respectively and rotatably attached to the back side of the chassis 1 by means of pivots 35 and 36. Two gears 37 are provided, connected to the loading arms 33 and 34 respectively and intermeshed with each other, a pinion 38 being coaxially secured to the left side one of the gears 37 in Fig. 2, and a tape loading lever 31 being retractably provided on the back side of the chassis 1, the tape loading lever 31 having rack teeth 39 intermeshed with the teeth of the pinion 38 so that the tape loading lever 31 may be carried by means of cam system (as mentioned hereinafter) when the tape cassette 9 is loaded to the tape reel discs.

In the illustrated embodiment, the torque transmission device comprises two gears 50 and 51 coaxially attached to the tape-reel setting discs 10 and 11, a selecting gear 47 which may be alternately intermeshed with the gears 50 and 51 and is journaled to a shift member 45, the shift member 45 being pivotally attached by shaft 46 to the chassis 1 and arranged to pivot to engage the selecting gear 47 with either one of the gears 50 and 51, a gear 44 with a clutch member (not shown) generally intermeshing with the selecting gear 47, a drive pulley 41 connected to the output shaft 14, a driven pulley 43 coaxial with the

positions near to both sides of the head cylinder 2. In the illustrated embodiment, the pinch roller 15 is pivotally supported on a pinch lever 103, which is pivotable about a shaft 104 provided on the chassis 1 and has a hook 103a integrally formed at an edge thereof. A cam lever 105 is rotatably supported on the shaft 104 in a manner to be turned by suitable cam means (mentioned hereinafter) and is biased toward the hook 103a by means of a torsion spring member 106.

10 The device includes a cassette holder 16 for guiding the tape cassette 9 along side guide members 17 and 18 from an inlet/outlet port to the tape reel setting discs 10 and 11. In order to carry the cassette holder 16 with the tape-cassette 9, the device further includes a carrying lever 28, a rack gear member 29 shifted by motion of the carrying lever 28, and rotatable gears 30 provided on both sides of the cassette holder 16 so as to be driven by the rack gear member 29 by intermeshing therewith, thereby to carry the tape cassette 9 to the tape deck together with the cassette holder 16 and then to set the tape reels to the tape reel setting discs 10 and 11.

 A pair of slide members 7 and 8 are provided, with tape loading pins 3 and 4 to guide the tape to the periphery of the head cylinder 2 when the cassette 9 together with the cassette holder 16 is loaded on the tape-reel setting discs, together with a pair of guide rails 5 and 6 provided by chassis 1 and means for carrying the

slide members 7 and 8 along the guide rails.

The carrying means includes two link members 32 pivotally attached to the slide members 7 and 8 respectively, and two loading arms 33 and 34 pivotally attached to the link members 32 respectively and rotatably attached to the back side of the chassis 1 by means of pivots 35 and 36. Two gears 37 are provided, connected to the loading arms 33 and 34 respectively and intermeshed with each other, a pinion 38 being coaxially secured to the left side one of the gears 37 in Fig. 2, and a tape loading lever 31 being retractably provided on the back side of the chassis 1, the tape loading lever 31 having rack teeth 39 intermeshed with the teeth of the pinion 38 so that the tape loading lever 31 may be carried by means of cam system (as mentioned hereinafter) when the tape cassette 9 is loaded to the tape reel discs.

In the illustrated embodiment, the torque transmission device comprises two gears 50 and 51 coaxially attached to the tape-reel setting discs 10 and 11, a selecting gear 47 which may be alternately intermeshed with the gears 50 and 51 and is journaled to a shift member 45, the shift member 45 being pivotally attached by shaft 46 to the chassis 1 and arranged to pivot to engage the selecting gear 47 with either one of the gears 50 and 51, a gear 44 with a clutch member (not shown) generally intermeshing with the selecting gear 47, a drive pulley 41 connected to the output shaft 14, a driven pulley 43 coaxial with the

shaft 46 with its clutch member (not shown) being frictionally engaged to the clutch member mentioned above, and an endless belt 42 stretched between both pulleys 41 and 43.

5 The shift member 45 can be operated by means of a pusher 69, whereby to intermesh the selecting gear 47 with the gear 51, and can be turned to cause the selecting gear 47 to intermesh with either one of the gears 50 and 51 due to the rotating torque applied to the shift member through
10 the transmission route when the drive motor 40 is switched to its reverse direction by altering the tape-reel control mode. The maximum swinging motion of the shift member 46 may be limited in scope by means of stoppers 49. The shift member 45 is maintained in its altered position by the
15 rotating torque applied thereto.

The illustrated tape recorder further includes means for braking the tape-reel setting discs 10 and 11 under a prescribed control mode, together with means for preventing relief of the stretched portion of a tape between the tape-
20 reels. The braking means includes braking member 53, 55 and 54, 56 provided for the tape-reel setting discs 10 and 11 respectively, the braking members being pivotally supported to the chassis 1 by means of pivot posts 53a, 55a and 54a, 56 and biased to the tape-reel setting discs 10
25 and 11 by means of tension spring members 100. The braking members 53, 54 and 56 are provided with cam follower pins (not shown by reference numbers), and the braking member 55

is provided with a guide fork with which a shift pin is engaged. The shift pin is attached to a lever 55b which is provided with a cam follow pin and rotatably supported on the chassis 1 by means of a pivot post 55c.

5 In order to prevent the tape during the playing/recording mode, or fast-running mode under the playing condition, becoming loose, there is provided means for applying a tension to the tape, which mainly includes a tape tension lever 52 pivotally supported on the chassis 1
10 by means of a pivot 52a, a back-tension post 63 attached to the free end of the lever 52, a regulating member 67 with a roller-shaped cam follow member 75 rotatably supported by means of a pivot 66 and a tensioned coiled bias spring member 68 stretched between the tape tension lever 52 and
15 the regulating member 67, whereby the tape portion 78 taken out between the reel on the disc 10 and the head cylinder 2 can be spanned between a guide roller 76 and a static post 77 to be pushed by the back-tension post 63 so as to tension the tape portion 78.

20 The tension applying means also includes a review guide post 107 mounted on a lever 108 which is rotatably attached to a shaft 109 positioned on the right side portion of the chassis 1 and is biased by means of a tension spring member 111, so that the guide post 107 can
25 be operated to stretch the tape portion between a static guide post 110 and the tape reel set on the setting disc 11 when the pinch roller 15 is moved away from the capstan.

roller 14.

The tension applying means provided to operate the back-tension post 63 is associated to brake the setting disc 10 by suitable means which may, as shown, include a
5 brake releasing lever 65 and a band brake member 62 disposed around the setting disc 10 in a manner to touch the periphery of the setting disc 10 under the braking operation, the band brake member 62 having its ends connected to the levers 52 and 65.

10 The tape recorder further includes a shift member 57 slidably supported on chassis 1 by means of guide slits 59 formed in the shift member 57 and guide posts 58 provided on the chassis 1, the shift member 57 being adapted to regulate the respective braking member by means of cam
15 surfaces formed at the edge thereof in such manner that the cam follow pins follow the pattern of the cam as the shift member 57 is slidably shifted along a straight line defined by means of the guide slits 59 and guide posts 58 when the tape mode is altered.

20 The tape recorder includes means for biasing the shift member to a braking position, the biasing means consisting of a torsional spring member 101 in this embodiment, a cam disc 20 associated with the shift member 57 through a cam follow member 60, a cam-drive motor 22, a
25 locking member 102 adapted to lock the cam follow member 60 against the bias of the torsional spring member 101, and means for relieving the lock condition of the locking

member 102 to the cam follow member 60 in such manner that the mode selecting cam 20 is regulated by the cam-drive motor 22.

5 The cam disc 20 has some cam grooves, one of which acts as a cam guide 112 to guide the aforementioned cam lever 105. The cam follow member 60 has an abutment 113 which contacts one end of the lever 108 to regulate the review guide post 107.

10 In order to transmit torque power from the cam-drive motor 22 to the cam disc 20, the device includes a reversible worm gear 26 intermeshed with a gear 27 formed around the periphery of the cam disc 20, the worm gear 26 having a shaft which is journalled in bearings provided on the chassis 1 and coaxially connected to a driven pulley 24
15 rotatably supported on the shaft, the driven pulley 24 being rotated through a drive pulley 23 connected to the output shaft of the cam-drive motor 22 via an endless belt 25 stretched between the pulleys 23 and 24.

The shift member 57 is integrally formed with an
20 engaging portion which is already described as a pusher 69 and which is adapted to bring the shift member 45 to one of its exchanging positions, in a manner to intermesh the gear 47 to the gear 50 for rewinding mode. A cam-shaped portion is formed at the edge of the shift member 57 and
25 has three stepped stages 71, 72 and 73 to which the cam follow member 75 depends for fast-running mode, playing mode and rewinding mode. The intervals between the stages

71 and 72 and stages 72 and 73 are sloped.

When the cam disc 20 is rotated for playing/recording mode, the cam follow member 60 is moved and the shift member 57 is thus shifted to cause the cam follow member 75 to be guided from the stage 71 to the stage 72, to keep the back-tension post 63 in the position shown in full line in Fig. 6, because the lever 52 is kept under the maximum bias of the spring member 68, and to pinch the tape to the capstan roller 14 by means of the pinch roller 15 due to the motion of the cam lever 105.

When the cam disc 20 is rotated to alter the system from the playing/recording mode to the rewinding mode, the control motion is conveyed to the shift member 57 through the cam follow member 60 and is further shifted at a first stage to cause the pusher 69 to push the end portion 70 of the shift member 45 to intermesh the selecting gear 47 to the gear 50 before the drive motor 40 starts its rotation to a reverse direction, and at a second stage to cause the cam follow member 75 to be guided from the stage 72 to the stage 73. During movement of the cam follow member 75 the motion of the shift member 45 switches a micro-switch (not shown) to alter the drive motor 40 to its reverse direction and at the same time as the cam follow member 75 reaches the stage 73 the lever 52 slightly recedes as shown by a broken line with a reference A in Fig. 6 due to the tape tension against the relaxed bias of the spring member 68, thereby to alter the system from the playing/recording mode

to the rewinding mode.

When the lever 108 is turned by the motion of the cam follow member 60 with its end being carried away from the abutment 113 by the bias of the spring member 111 at the first stage so as to cause the review guide post 107 to be advanced to the stretched tape portion between the guide post 110 and the tape reel on the setting disc 11, the lever 103 is carried away from the capstan roller 14 due to the cam lever 105 belonging to the motion of the cam disc 20, thereby to cause the pinch roller 15 to recede away from the tape slipped to the capstan roller 14.

When the cam disc 20 is rotated from a starting position shown in Fig. 1, the carrying lever 28 is turned in a manner to shift the rack gear member 29. Accordingly, the tape cassette 9 is carried toward the tape deck and, at a final stage, set on the tape reel setting discs.

When the tape cassette is unloaded from the tape deck, the cam-drive motor is energized in a reverse direction, so that the cam disc 20 is rotated in reverse thereby to return the carrying lever 28 and then to shift the rack gear member 29 backwards. Accordingly, the tape cassette 9 together with the cassette holder 16 is carried to the output position.

In this embodiment, the lever 52 for applying tension to the back-tension post 63 may be provided with a hook 83 engaged with the tension spring member 68 at a desired position defined by a distance (H), said distance being

half the distance of the length L of the rotational support of the pivot shaft 52a by a bearing member 79 attached to the chassis 1, as shown in Fig. 8. If necessary, the tension spring member 68 may be adjusted so as to keep a
5 constant bias. In an embodiment illustrated in Figs. 10 and 11, the tension spring member 68 is a coiled member having hooks 68a and 68b formed at both ends. A stretching rod 116 is inserted into the coiled member. The stretching rod 116 has an annular groove 116a. The spring member 68
10 may be stretched to its prescribed length, and a E-shaped clip 117 inserted through the interval between the turns of the coil member to be fitted to the groove 116a to thereby to obtain a constant initial tension.

The bias spring member 111 for supporting the review
15 guide post 107 may be used an electric earth member with its extended portion 111a slidably touching the bottom of the cassette holder 16 as shown in Fig. 9. In this case, the extended portion 111a is held by a protrusion 1a cut into the chassis 1. The abutment 113 may be used as a
20 supporter with its contact surface being tilted so as to depress the lever 108 toward the upper portion of the chassis 1 together with the function of a bearing member 115 through which the pivot 109 is supported under the rotatable condition.



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CLAIMS

1. A device for altering a tape drive mode, comprising tape tensioning means for tensioning a tape during playback and/or recordal mode, said tape tensioning means being arranged to maintain tape tensioning during alteration of the tape drive mode from playback and/or recordal mode to rewind mode until tape transport operates in the rewind mode.

2. A device as claimed in claim 1, comprising a movable shift member arranged to be moved as the tape drive mode is altered, movement of said shift member being arranged to move torque transmission means into engagement with a selected one of a pair of tape reels and to continue tensioning of the tape by the tape tensioning means during alteration of the tape drive mode from playback and/or recordal mode to rewind mode at least until the torque transmission means is moved into engagement with the selected tape reel.

3. A device as claimed in claim 2, wherein the movable shift member is provided with camming means and the tape tensioning means is provided with a cam follower to co-operate with the camming means.

4. A device as claimed in any of the preceding claims, comprising means for driving a capstan roller and means for selectively contacting a pinch roller with the capstan roller.



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5. A device for altering a tape drive mode, including torque transmission means for selectively driving the tape reels of a tape cassette in forward and backward directions, a tape loading/unloading device including a
5 pair of tape loading pins adapted to support the tape between the tape reels and a head cylinder, means for applying tension to the tape to prevent looseness of the tape during playback and/or recordal mode, means for driving a capstan roller, and means for operating a pinch
10 roller to be selectively carried into cooperation with the capstan roller, the torque transmission means being provided on a shift member adapted to alter the intermeshing of gears through which the rotating power from the drive motor is in use, transmitted to one of the tape
15 reels, the device further comprising a second shift member operable as the torque transmission means is altered between its various operating modes, the second shift member having an engagement portion adapted to bring the first shift member to one of its exchanging positions in a
20 manner to set the gear intermeshing to the rewinding mode, and a cam-shaped portion, and means for keeping the tension applying means in a tension condition with a cam follow member contacting the cam-shaped portion of the second shift member until the tape transport operates by
25 cooperation of the capstan roller and the pinch roller, after the power transmission is exchanged to either one of the tape reels for shifting the device from the



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playing/recording mode to the rewinding mode.

6. A device as claimed in claim 5, wherein the tape tension means includes a tape tension lever pivotally supported on a device chassis, a back-tension post attached to the free end of the lever, a regulating member with a cam follow member rotatably supported on the chassis, and a biasing spring member stretched between the tape tension lever and the regulating member under a tensioned condition.

7. A device as claimed in claim 6, wherein the cam-shaped portion is formed on the edge of the second shift member and has three stepped stages to which the cam follow member depends for fast-running mode, playing mode and rewinding mode.

8. A device as claimed in claim 7, whereby a tape portion spanning between the reel on the tape deck and the head cylinder is supported by the back-tension post so that the tape portion is tightened during movement of the cam follow member from the stage for playing/recording mode to the stage for rewinding mode.

9. A device as claimed in any of claims 5 to 8, wherein the tension applying means includes a review guide post mounted on a lever rotatably supported on the chassis and is biased by means of a tension spring member such that the guide post is operable to stretch the tape portion between the head cylinder and the tape reel on the tape deck when the pinch roller is carried away from the capstan.



roller.

10. A device as claimed in any of claims 5 to 9 wherein the tension spring member is a coiled member having hooks formed at both its ends, and is adjusted so as to
5 keep a constant bias.

11. A device as claimed in claim 10, wherein the constant bias is achieved using a stretching rod having an annular groove formed to its one end and a clip, the rod being inserted within the coil body until the free end of
10 the rod is pushed to one of the hooks and when the spring member is stretched to its prescribed length, the clip being inserted through the interval between the turns of the coil member to fit to the groove.

12. A device substantially as described herein with
15 reference to the accompanying drawings.

13. A tape player and/or recorder including a device as claimed in any of the preceding claims.