

DEVICE FOR SELECTING TAPE-REEL CONTROL MODE

The present invention relates to a device for selecting a tape-reel control mode for use in a tape recording and/or playing device such as a video tape recorder, a video tape player, DAT and camera recorder for home or business use as well as combination recorder with a television, and the other visual or audio device having a tape recorder and/or player.

10 Previously, recorders and/or players with tape-winding systems have generally included a tape deck having a pair of tape-reel setting discs to which a pair of tape-reels journaled in a tape-cassette are removably engaged as the tape-cassette is set on the deck, a torque transmission
15 means through which either one of the setting discs is alternately rotated in a forward or backward direction by means of a drive motor, and means for selecting a prescribed tape-reel control mode from various control modes such as a recording mode, a playing mode, fast-
20 running mode, rewinding mode, etc., thereby to drive the setting disc at a speed depending on the selected control mode mentioned above.

In order to maintain a tape in a manner such that it is partially stretched between the tape-reels, the tape-
25 winding system mentioned above includes means for braking the setting discs when the setting disc runs in a reverse direction, the regulation depending on the prescribed control mode, together with means for preventing the stretched portion of the tape from being relieved.

30 However, with the prior art recorders and/or players it was necessary to provide a separate motor or electromagnetic solenoid device together with means for biasing the braking members into suitable positions relative to the setting disc and torque transmission means.
35 It is undesirable to increase the number of parts, weight and cost of the device, as well as the complexity of

construction.

According to the present invention there is provided a device for selecting a tape-reel control mode in a tape recorder and/or player including a tape deck having a pair
5 of tape-reel setting discs to which a pair of tape-reels journaled in a tape-cassette are removably engaged as the tape-cassette is set on the deck, a torque transmission device for selectively delivering torque from a drive motor to either one of the tape-reel setting discs, and means for
10 braking the setting discs in a prescribed control mode together with means for preventing relief of a portion of a tape between the tape-reels, the braking means including members for braking the tape-reel setting discs, the device comprising:

15 a shift member retractably supported on a chassis and adapted to regulate the action of the braking members;

means for biasing the shift member towards a braking position as the control mode is exchanged from a fast-running mode to another mode;

20 a mode selecting cam associated with the shift member via a cam follower member;

a cam-drive motor;

a locking member adapted to lock the cam follower member in a position corresponding to the fast-running
25 mode, against the bias of the biasing means;

first unlocking means for unlocking the locking member from the cam follower member to enable the mode selecting cam to be driven by the cam-drive motor in the same direction, just after a change of control mode, as that
30 prior to such a change of the control mode; and

second unlocking means being operative to unlock the locking member when the mode selecting cam is not yet being driven by the cam-drive motor thus causing the braking members to actuate when the device is changed from the
35 fast-running mode, prior to starting of the drive motor in the next mode, without the cam-drive motor being loaded by the mode selecting cam,

said first unlocking means including an abutting member attached to the locking member and a guide piece mounted on the mode selecting cam disc such that the locking member is turned by its abutting member by being
5 displaced by the guide piece, causing the free end of the cam follower member to be disengaged from a locking notch formed in the locking member when the cam disc is rotated.

The hereinafter described and illustrated first embodiment of the present invention provides a device for
10 selecting a tape-reel control mode for use in a tape recorder and/or player wherein the means for biasing the braking members can be regulated by means of a drive motor, which is adapted to regulate a mode selecting cam member and a shift member, the shift member being adapted to set a
15 torque transmission device and means for controlling the braking members and other associated members according to the prescribed control mode, without the need for an additional motor or solenoid device.

The device is adapted for selecting a tape-reel
20 control mode for use in a tape recorder and/or player wherein there is provided a means for locking the shift member in a fast-running mode position, and means for relieving the shift member from the locked condition in such a manner that the mode selecting cam is shifted by the
25 drive motor in the same direction as that in the previous mode, just after the control mode is exchanged from the previous mode to the next mode.

The device is further adapted for selecting a tape-reel control for use in a tape recorder and/or player
30 wherein there is provided a means for locking the shift member in a fast-running mode position, and means for relieving the shift member from the locked condition at a time when the mode selecting cam is not yet being driven by the drive motor when the control mode is exchanged from the
35 previous mode, thereby to actuate the braking members before the drive motor starts under the next mode and

without it being loaded by the mode selecting cam.

The device in accordance with the present invention and its method of operation will now be described by way of example only, with reference to the accompanying drawings
5 in which:-

Fig. 1 is a plan view of a tape recording and playing device including means for selecting a tape-reel control mode according to an embodiment of this invention wherein a tape cassette is yet not set on a tape deck disposed in a
10 chassis;

Fig. 2 is a bottom view of the embodiment mentioned above wherein the tape cassette is set on the tape deck;

Fig. 3 is an enlarged plan view of the essential part of the embodiment mentioned above, wherein the tape
15 cassette is set on the tape deck in a fast-running mode;

Fig. 4 is an enlarged plan view of the essential part of the embodiment mentioned above wherein the tape cassette is set on the tape deck in a braking condition after the fast-running mode;

Fig. 5 is an enlarged plan view of the essential part of the embodiment mentioned above showing the means for controlling a shift member included in this invention;

Fig. 6 is an enlarged plan view of the essential part illustrated in Fig. 5 with some parts demounted;

Fig. 7 is an enlarged vertical view of the part
25 illustrated in Fig. 5;

Fig. 8 is a vertical cross-section of the part of the embodiment wherein a mode selecting cam and the other members associated thereto are illustrated;

Fig. 9 is a plan view of the part of the embodiment wherein a locking member and the other members associated thereto are disassembled for simple illustration;

Fig. 10 is a vertical cross-section of the part of the embodiment wherein means for transmitting rotation from a
35 cam-drive motor to the mode selecting cam is illustrated;

Fig. 11 is a bottom view and a perspective view of

part of the embodiment, showing a driven pulley and means for delaying the rotation from the pulley to the mode selecting cam involved in the transmitting means; and

Fig. 12 is a plan view of another embodiment of this invention showing a shift member and the other members associated thereto.

The tape recorder and/or playing device in this embodiment includes a tape deck chassis 1 having a pair of tape-reel setting discs 10 and 11 with rotating 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 as the tape-cassette 9 is set on the deck, and a torque transmission device for alternately supplying a driving torque from a drive motor 40 to either one of the tape discs 10 and 11. The drive motor 40 includes a fly wheel and an output shaft with a capstan roller 14.

The device further includes a cassette holder 16 for guiding the tape-cassette 9 along side guide members 17 and 18 to the tape-reel setting discs 10 and 11, a pinch roller 15 adapted to pinch the tape to the capstan roller 14, a head cylinder 2, an audio signal input and output head 12, an erasing head 13, a pair of slide members 7 and 8 with tape-loading pins 3 and 4 adapted to guide the tape to the periphery of the head cylinder 2 when the cassette 9 is loaded on the tape-reel setting discs, a pair of guide rails 5 and 6 disposed to the chassis 1, and means for carrying the slide members 7 and 8 along the guide rails.

Referring to Figure 2, the carrying means includes two link members 32 pivoted to the slide members 7 and 8 respectively, two loading arms 33 pivoted to the link members 32 respectively and rotatably supported to the back side of the chassis 1 by means of pivots 35 and 36, two gears 37 fixed to the loading arms 33 respectively and intermeshed to each other, a pinion 38 coaxially secured to the left side of one of the gears 37, and a loading lever

31 retractably supported to the back side of the chassis 1 and having rack teeth 39 intermeshed to the pinion 38 so that the loading lever 31 is carried when the tape-cassette 9 is loaded to the tape-reel discs.

5 In order to carry the cassette holder 16 with the tape-cassette 9 from an input and output portion of the chassis 1 to the tape-reel setting discs or vice versa, there are provided a carrying lever 28, a rack gear member 29 shifted by the motion of the carrying lever 28, and
10 gears 30 rotatably supported to both sides of the cassette holder 16 so as to be driven by the rack gear member 29 with its intermeshing thereto.

 In this embodiment, the torque transmission device comprises two gears 50 and 51 coaxially attached to the
15 tape-reel setting discs 10 and 11, a selecting gear 47 alternately intermeshed to the gears 50 and 51 and journaled to a shift member 45, the shift member 45 being swingably supported to a shaft 46 mounted on the chassis 1 so as to engage with the selecting gear 47 with either one
20 of the gears 50 and 51, a gear 44 with a clutch member (not shown) generally intermeshing to the selecting gear 47, a drive pulley 41 connected to the output shaft 14, a driven pulley 43 coaxially supported to the shaft 46 with its clutch member (not shown) being fictionally engaged to the
25 clutch member mentioned above, and an endless belt 42 stretchedly wound around both pulleys 41 and 43.

 The shift member 45 can be turned to cause the selecting gear 47 to be intermeshed to either one of the gears 50 and 51 due to the rotating torque applied to the
30 shift member 45 through the transmission route when the direction of the drive motor 40 is reversed when the tape-reel control mode is changed. In this case, the swinging motion of the shift member 45 may be limited to a prescribed scope by means of stoppers 49.

35 The tape recorder further includes means for braking the tape-reel setting discs 10 and 11 according to the

prescribed control mode together with means for preventing the stretched portion of a tape between the tape-reels from being relieved. The braking means includes braking members 53, 55 and 54, 56 respectively acting on the tape-reel setting discs 10 and 11, all of the braking members being pivotally supported on the chassis 1 by means of pivot posts 53a, 55a and 54a, 56a, and biased towards the tape-reel setting discs 10 and 11 by means of tension spring members 73. 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 to which a shift pin is engaged. The shift pin is attached to a lever 55b which is provided with a cam follower pin and pivotally supported on the chassis 1 by means of a pivot post 55c.

The means for preventing the stretch portion of the tape from being relieved primarily includes a tape tension lever 52 pivotally supported on the chassis 1, a back-tension post 52a attached to the free end of the lever 52, a brake releasing lever 52b, and a band brake member 52c disposed around the tape-reel setting disc 10 so as to be in contact with the periphery of the setting disc 10 during a braking operation, the band brake member 52c having its ends connected to the levers 52a and 52b.

The present invention is particularly provided with a shift member 57 retractably and slidably supported by the chassis 1 by means of guide slots 59 formed in the shift member 57 and guide posts 58 attached to the chassis 1, the shift member 57 being adapted to control the braking members by means of respective cam surfaces formed to the edge thereof in such a manner that the cam follower pins follow the pattern of the cam. The present invention is also provided with means for biasing the shift member into a braking position as the control mode is changed from a fast-running mode to another mode, the biasing means consisting of a torsional spring member 72 in this

embodiment. The device further comprises: a mode selecting cam 20 communicable with the shift member 57 via a cam follow member 60; a cam-drive motor 22; a locking member 62 adapted to lock the cam follower member 60 in a position
5 corresponding to the fast-running mode, against the bias of the torsional spring member 72; and means for releasing 75,85 the locked condition of the locking member 62 to the cam follower member 60 by use of the cam-drive motor 22 whilst the mode selecting cam 20 remains in the same
10 position as that in the previous mode, i.e. a fast-running mode, after the control mode is changed from the previous mode to the next mode.

In this embodiment, the cam disc 20 is rotatably supported on the chassis 1 with its cam shaft 68. The cam
15 follower member 60 has a follower pin which is guided along a cam groove 63 formed in the cam disc 20 and a pivot 61 journaled to the chassis 1 in the middle of the cam follower. At one end, the cam follower, pivotally engages the shift member 57 and at its other end is disengagably
20 lockable to the locking member 62 by means of an engaging notch 65 formed in the locking member 62. The torsional spring member 72 biases the cam followed member 60 in an anti-clockwise direction (as viewed in Fig. 3) in this embodiment. This causes the shift member 57 to be biased
25 in a rightward direction (as viewed in Fig. 3). The locking member 62 is pivotably supported on the chassis 1 by a journal post 69 standing through the chassis 1 and has a gear 67 intermeshed to a gear 27 integrally formed to the periphery of the cam disc 20, and further comprises a
30 compression spring member 66 adapted to bias the gear 67 against the rotation applied to the gear 67. The cam disc 20 further includes cam grooves for guiding a swinging lever attached to the pinch roller 15 and the carrying level 28 already mentioned.

35 In order to transmit a driving torque from the cam-drive motor 22 to the cam disc 20, the device of this

invention includes a reversible worm 26 intermeshed to the worm gear 27 and having a shaft 79 which is journaled to bearings supported by the chassis 1 and coaxially connected to a driven pulley 24 rotatably supported on the shaft 79
5 via means for delaying the transmission of the rotation when the cam-drive motor changes direction, the driven pulley 24 having a journal 78 integrally formed to one side thereof. Furthermore, the driven pulley 24 is rotated by a drive pulley 23 connected to the output shaft of the cam-
10 drive motor 22 via an endless belt 25 stretched around the pulleys 23 and 24.

In this embodiment, the delaying means involves a hole 82 (see Figure 10) formed in the end portion of the gear 26 with its inner periphery having a stop protrusion 84, and a
15 pushing protrusion 83 formed on the end portion of the journal 78 so that the pushing protrusion 83 is turnably inserted into the hole 82 and adapted to engage the stop protrusion 84 thereby to transmit the driving torque from the pulley 24 to the gear 26 except in the interval when
20 the protrusion 83 is carried away from the one side of the protrusion 84 and around to the other side thereof in the hole 82 due to the cam-drive motor changing direction.

When the mode selecting cam 20 is rotated clockwise by the drive motor 22 from the unloaded position (shown in
25 Fig. 4) to the position corresponding to the fast-running mode (shown in Fig. 3), the mode selecting cam is engaged in the locked position. Thus, the device of this invention is further provided with means for releasing the shift member 57 from this locked condition.

30 In this embodiment as shown in Figure 3, the releasing means includes an abutting member 71 attached to the locking member 62 and a guide piece 70 mounted on the cam disc 20. The locking member 62 is turned by its abutting member 71 being displaced by guide piece 70 in a manner to
35 cause the free end of the cam follow member 60 to be disengaged from the notch 65, when the cam disc 20 is

rotated from the position illustrated in Fig. 3 in a clockwise direction.

The releasing means further includes a fast-release means 75, 85 for rapidly releasing the cam follow member 60 from the locked condition without the mode selecting cam 20 being driven by the drive motor 22 due to the operation of the delaying means mentioned above when the control mode is changed from the fast-running mode to another mode, e.g. the stop mode.

10 In this embodiment as shown in Fig. 9 and 11, the fast-release means consists of a kick lever 74 fixedly connected to the locking member 62 via the journal post 69, a kick arm 75 pivoted on the kick lever 74 and having a loop spring portion 76 integrally formed thereto so as to
15 bias the kick arm 75 toward a stopper portion 77 formed on the kick lever 74, and a plurality of radial abutting ribs 85 mounted on one side face of the driven pulley 24 and arranged in a circle coaxially defined to the pulley axis with a prescribed constant interval between each one. The
20 stopper portion 77 being adapted to support the kick arm against the bias of the spring portion 76. The kick arm 75, further being biased by the loop spring portion 76 to be inserted into the recessed area between the abutting ribs 85, is driven by the rotation of the pulley 24.
25 Accordingly, when the drive motor 22 drives the pulley 24 during any of the fast-running, recording or playing modes, the kick arm 75 is shifted to by being pushed by one of the abutting ribs 85 on the pulley 24. When the control mode changes, the cam-drive motor 22 reverses its direction of
30 rotation, the delaying means allowing the pulley 24 to rotate without the cam disc 20 rotating initially. The ribs 85 engage the kick arm 75 which is restricted from moving relative to the kick lever due to the stopper 77, causing the locking member 62 to turn.

35 As a result, the lock condition between the notch 65 and the free end of the cam follow member 60 is released

causing the shift member 57, as a result of the bias of the torsional spring member 72, to actuate the braking members prior to the drive motor 22 starting under the next mode, without the motor 22 being loaded by the mode selecting cam
5 20.

In this embodiment, the locking member 62 is preferably formed with the kick lever 74 in an integral shape, by means of a moulding process, on both sides of the chassis plate 1A.

10 The shift member 57, brake members 53, 54 and 56, and lever 55b may be assembled to the upper side of the chassis 1 as shown in Fig. 6 and 7. In this case, the guide posts, for example, the guide post 55c (as shown in Fig. 7) are integrally formed with a plastic moulding piece 158 which
15 is mounted on the chassis 1 by means of the moulding process mentioned above and which has hooks 158a extending upwards through the guide groove 59.

Accordingly, the shift member 57 can be slidably supported on the upper surface of the chassis 1 with the
20 hooks 158a depressing the upper surface of the shift member 57 without any other supporting member, and the brake members and lever can be also supported under the turnable condition between the shift member 57 and the chassis 1, in such manner that the lever 55b is, for example, supported
25 on the upper surface of the chassis 1 as shown in Fig. 7 with its pivot portion being sandwiched between the shift member 57 and the chassis 1 without any other supported member. The assembly including the shift member, brake member, lever and guide posts mentioned above is very
30 simple and reliable as compared to the prior art constructions including the same members.

Furthermore, the braking members 53 and 56 may be supported on the chassis 1 in a different place by means of a cover plate 1b which is attached to the chassis 1 by
35 means of a set of screws 1c so as to overhang the braking members 53 and 56 partially.

Another embodiment of the present invention as shown in Fig. 12 which includes a shift member 57' which is biased by means of an electromagnetic solenoid 72' instead of the torsional bias spring member used in the first embodiment mentioned above. In this embodiment, the solenoid 72' is attached to the chassis 1 and has an electromagnet member, with a ferrite piece 101 set opposite it. The ferrite piece 101 is attached to a shift lever 102, which is attached to the chassis 1 and is rotatable by means of a supporting post 103 and which is biased by means of a tension spring member 104 in the direction in which the ferrite piece 101 is attracted to the electromagnet member when the solenoid 72' is energised. The shift lever 102 further includes a shift roller 105 pivoted on the free end thereof, the shift roller 105 follows an abutting edge 106 formed on the shift member 57' so that the shift member 57' can be moved by the bias of the spring member 104 as well as by the attraction force due to the solenoid when the cam-follow member 60 under a fast-running mode causes the shift member 57' to be shifted in a leftwise direction (see in Figure 12).

The shift member 57' is biased by a tension spring member 106 of which the bias is larger than that of the spring member 104 but is smaller than that of the spring member 104 in combination with the magnetic force applied by the solenoid 72'. Accordingly, the shift member 57' can be carried by the bias of the spring member 106 in a rightwise direction (see Figure 12) when the solenoid 72' is de-energised during a control mode for braking the tape-reel. In this embodiment, a solenoid smaller than that of the prior art can be used for biasing the shift member 57', because the spring member 104 assists the magnetic force applied to the solenoid against the spring member 106.

C L A I M S

1. A device for selecting a tape-reel control mode in a tape recorder and/or player including a tape deck having a pair of tape-reel setting discs to which a pair of tape-reels journaled in a tape-cassette are removably engaged as the tape-cassette is set on the deck, a torque transmission device for selectively delivering torque from a drive motor to either one of the tape-reel setting discs, and means for braking the setting discs in a prescribed control mode together with means for preventing relief of a portion of a tape between the tape-reels, the braking means including members for braking the tape-reel setting discs, the device comprising:
 - a shift member retractably supported on a chassis and adapted to regulate the action of the braking members;
means for biasing the shift member towards a braking position as the control mode is exchanged from a fast-running mode to another mode;
 - a mode selecting cam associated with the shift member via a cam follower member;
a cam-drive motor;
 - a locking member adapted to lock the cam follower member in a position corresponding to the fast-running mode, against the bias of the biasing means;
first unlocking means for unlocking the locking member from the cam follower member to enable the mode selecting cam to be driven by the cam-drive motor in the same direction, just after a change of control mode, as that prior to such a change of the control mode; and
second unlocking means being operative to unlock the locking member when the mode selecting cam is not yet being driven by the cam-drive motor thus causing the braking members to actuate when the device is changed from the fast-running mode, prior to starting of the drive motor in the next mode, without the cam-drive motor being loaded by

the mode selecting cam,

said first unlocking means including an abutting member attached to the locking member and a guide piece mounted on the mode selecting cam disc such that the
5 locking member is turned by its abutting member by being displaced by the guide piece, causing the free end of the cam follower member to be disengaged from a locking notch formed in the locking member when the cam disc is rotated.

10 2. A device according claim 1 in which the second unlocking means is a fast-release means for rapidly releasing the cam follower member from the locked condition due to the operation of a delaying means when the control mode is changed from the previous fast-running mode.

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3. A device according to claim 1 or 2 in which the second unlocking means consists of: a kick lever fixedly connected to the locking member via a journal post;

a kick arm pivoted to the kick lever and having a loop
20 spring portion integrally formed thereto so as to bias the kick arm toward a stopper portion formed to the kick lever; and

a plurality of radial abutting ribs mounted on one side face of a drive pulley and arranged in a circle
25 coaxially defined to the pulley axis with a prescribed constant interval between each one, the kick arm being capable of being biased by the loop spring portion to be inserted into the recessed area between the abutting ribs wherein the kick arm is driven by the rotation of the
30 pulley.