

1. TITLE OF THE INVENTION

A device for loading/unloading a tape cassette.

2. BACKGROUND OF THE INVENTION

The present invention relates to a device for loading/unloading a tape cassette to a tape deck adapted to 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 a combination recorder with a television, and other visual or audio devices having a tape recorder and/or player.

The prior recorders and/or players with tape-winding systems had 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, and means for loading/unloading a tape cassette from an inlet port to the tape deck and in reverse.

In order to avoid a shocking motion of the tape cassette applied to a tape deck at the final stage, at which the tape cassette is set on the tape deck, the tape recording and/or regenerating device mentioned above had been provided with a complicated and bulky construction used under a such condition on which the tape cassette being fast-set.

3. OBJECTS OF THE INVENTION

An object of this invention provides a device for loading/unloading a tape cassette to or from a tape deck, so improved as to decrease the shocking motion of the tape cassette with its simple and compact cam assembly under the fast setting of the tape cassette.

A second object of this invention provides a device for loading/unloading a tape cassette to or from a tape deck, so improved as to maintain a satisfactory stroke with its simple and compact cam assembly applied to a transportation by which the tape cassette is smoothly carried from an inlet port to the tape deck.

A third object of this invention provides a device for loading/unloading a tape cassette to or from a tape deck, so

improved as to set the tape cassette to the tape deck in a secured condition after its transportation.

GB Application No. 9513490.4, divided from the present application, concerns a tape recorder and/or player

5 comprising:

(i) a torque transmission means for rotating, in a forward or backward direction and by means of a drive motor, at least one of a plurality of tape reels contained in a tape cassette on a tape deck;

10 (ii) a cam disc rotatably attached to a chassis and having a plurality of guide routes extending both in the direction of rotation of the cam disc and radially with respect to the axis of rotation of the cam disc;

(iii) a cam drive motor for rotating the cam disc in a
15 forward or a backward direction;

(iv) a swinging arm having a cam follow pin engaging one of the guide routes and supported by the chassis, a shift member for transporting a cassette holder in cooperation with the swinging arm, and means for transporting the tape
20 cassette together with the cassette holder from an inlet port to the tape deck and vice versa upon rotation of the cam disc; and

(v) a loading lever associated with a pair of slide members for guiding the tape of the tape cassette to a
25 periphery of a head cylinder, a guide pin engaging another of the guide routes for operating the slide members, and a transmitting means for transmitting the tape to a periphery of the head cylinder upon rotation of the cam disc.

According to the present invention, there is provided a
30 device for loading/unloading a tape cassette into/from a tape recorder and/or player having a cassette holder adapted to hold the tape cassette as it is passed through an inlet port, a tape deck to which the tape cassette is removably set together with the cassette holder, and a torque transmission
35 means through which either one of the tape reels contained in the tape cassette on the tape deck may be rotated in a forward or backward direction by means of a drive motor, the device comprising a cam disc rotatably supported by a

chassis, at least one guide route being disposed on the cam disc and extending from near the rotating axis of the disc towards the periphery thereof to extend both in the rotating direction and radially with respect to the rotating axis, a swinging arm pivoted to the chassis and having a cam follow pin associated with the guide route, and means for transporting the tape cassette together with the cassette holder from the inlet port to the tape deck and in reverse, the transporting means including a shift member adapted to guide the cassette holder in accordance with movement of the swing arm, said guide route including a first portion arranged to cause movement of the swinging arm, upon rotation of the cam disc, in an initial stage of loading of the tape cassette, and a second portion, continuous with the first portion, arranged to cause movement of the swinging arm in a subsequent stage of loading of the tape cassette and said guide route being arranged to guide the cam follow pin along the guide route to cause the swinging arm to turn quickly when the cam follow pin is guided along the first portion of the cam disc guide route and to turn slowly when the cam follow pin is guided along the second portion of the cam disc guide route.

Further features and advantages of the present invention will be apparent from the following description taken with reference to the accompanying drawings.

FIG. 1 is a plan view of a tape recording and playing device including means for loading/unloading a tape cassette according to an embodiment of this invention wherein a tape cassette is not yet set on a tape deck disposed in a 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 a side view of the essential part of the embodiment mentioned above wherein the tape cassette is not yet set on the tape deck;

FIG. 4 is an enlarged plan view of the essential part of the embodiment mentioned above wherein the tape cassette is not yet

set on the tape deck;

FIG. 5 is an enlarged plan view of the essential part of the embodiment mentioned above wherein a cam disc is illustrated in detail;

FIG. 6 is a side view of the essential part of the embodiment mentioned above wherein the tape cassette is carried on a transporting way;

FIG. 7 is an enlarged plan view of the essential part of the embodiment mentioned above wherein the tape cassette is set on the tape deck;

FIG. 8 is an enlarged plan view of the essential part of another embodiment of this invention modified from the first embodiment;

FIG. 9 is an enlarged plan view of the essential part of the other embodiment of this invention further modified from the first embodiment;

FIG. 10 is a diagrammatic plan view of the essential part of the further embodiment of this invention;

FIG. 11 is a side view of the part of the embodiment illustrated in FIG. 10; and

FIG. 12 is a vertical section of the part of a cassette holder illustrated in a front view of the embodiment of this invention mentioned above.

6. DETAILED DESCRIPTION

A device of this invention is provided for loading/unloading a tape cassette adapted to a tape recorder and/or player as well as a combination thereof which is illustrated in the drawings and described hereinafter as an embodiment.

The tape recording 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 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 torque power from a drive motor (not shown) to either one of the tape discs 10 and 11. The drive motor includes a fly wheel 14a 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 to which are disposed an input and output head 12 applied to audio-signal and 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 together with the cassette holder 16 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.

The carrying means includes two link members 54 pivoted to the slide members 7 and 8 respectively, two loading arms 55 and 56 pivoted to the link members 54 respectively and rotatably supported to the back side of the chassis 1 by means of pivots 57, two gears 58 fixed to the loading arms 55 and 56 respectively and intermeshed to each other, a pinion 59 coaxially secured to the left side of one of the gears 58, and a loading lever 53 swingingly supported to the back side of the chassis 1 by means of a pivot pin 52 and having rack teeth 60 intermeshed to the pinion 59 so that the loading lever 53 is carried by means of a cam system (mentioned hereinafter) when the tape cassette 9 is loaded to the tape reel discs, as shown in FIG. 2 in detail.

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 in reverse it vice versa, there is provided a device for loading/unloading the tape cassette 9 together with the cassette holder 16, which includes a cam disc 24 rotatably supported to a chassis 1 by means of a cam shaft 61 and at least one guide route 64 disposed thereon with it extending from the near side of the rotating axis thereof to the periphery side thereof in a manner to be topologically shifted in the rotating direction, a swinging arm 25 pivoted to the chassis 1 by means of a pivot pin 62 and having a cam follow pin 65 belonging to the guide route 64, and means for transporting the tape cassette 9 together with the cassette holder 16 from the inlet port 21 to the tape deck and in reverse.

The loading/unloading device further includes a shift member 40 retractively supported by means of upper and lower guide rails 42 and 43 at the one side of the chassis 1 with its rear end

having a notch 48 engaged to a coupling roller 47, which is pivoted to the swinging arm 25, the shift member 40 having a rack gear 40a integrally formed to the front portion thereof, a guide slit 44 and a guide pin 45, a sub-shift member 41 retractively supported by the same means of the guide rails 42 together with the shift member 40 and biased to a rear side by means of a tension spring member 46 bridged between both shift members 40 and 41, the sub-shift member 41 having a rack gear 41a integrally formed to the front portion thereof in a manner to be contiguously aligned to the rack gear 40a, a guide slit 44 slidably guide the guide pin 45 and a guide pin 45a being slidably inserted to the guide slit 44, a pair of gears 36 pivotally supported to both side guide members 17 and 18 by means of pivot axis 37 and having fork-shaped guide arms 35 respectively, the right side gear 36 only being alternately intermeshed to the rack gear 40a and 41a, a pair of sector gears 39 pivoted to the side guide members 17 and 18 with their being connected by means of a common pivot shaft 38 journaled to the side guide members 17 and 18, the gears 39 being intermeshed to the gears 36 respectively, and a pair of guide pins 34 attached to both sides of the cassette holder 16 and penetrating through L-shaped guide slits 33 formed to the side guide members 17 and 18 in a manner to be guided along the guide slits 33 by the fork-shaped guide arms 35.

In order to transmit torque power from the cam-drive motor 27 to the cam disc 24, the device of this invention includes a reversible worm gear 31 intermeshed to a gear 32 formed to the periphery of the cam disc 24, the worm gear 31 having a shaft which is journaled to bearings disposed to the chassis 1 and coaxially connected to a driven pulley 29 rotatably supported to the shaft, the driven pulley 29 being rotated through a drive pulley 28 connected to the output shaft of the cam-drive motor 27 and an endless belt 30 stretched between the pulleys 28 and 29 in the wound condition.

In this embodiment, the loading/unloading device is provided with a control switching system having a micro-switch means 49 for starting the drive operation of the cam-drive motor 27 thereby to load the tape cassette 9 to the tape deck, and a micro-switch means 50 for stopping the drive operation of the cam-drive motor 27 thereby to unload the tape cassette 9 to the inlet port 21.

Accordingly, when the tape cassette is inserted to the cassette holder 16 through the inlet port 21 and further pushed together with the cassette holder 16 in order to be loaded to the tape deck, the guide pins 34 are carried to the backside along the guide slits 33 so as to rotate the gears 36 with their guide pins 34 pushing the fork-shaped arms 35 and the opposite portion of one of the arms 35 switches on the micro-switch means 49. In this case, the sub-shift member 41 is shifted forwards against the bias of the tension spring member 46, as shown in FIG. 6. As resultant operation, the cam-drive motor 27 is energized in a general direction, so that the cam disc 24 is rotated in a clockwise direction, thereby guiding the cam follow pin 65 along the guide route 64 and then to turn the swinging arm 25 in a prescribed angular acceleration topologically varied.

At this stage, the shift member 40 overtakes to the sub-shift member 41 and pushes them with its rack gear 40a joining to the rack gear 41a in the continual aligned condition, thereby carrying the tape cassette 9 to the tape deck together with the cassette holder 16 and then setting the tape reels to the tape reel setting discs 10 and 11.

While the cam disc 24 is rotated from a starting position as shown in FIG. 6 to a finishing position as shown in FIG. 7, the cam follow pin 65 is guided along the guide route 64 in such a manner that the swinging arm 25 is quickly turned when the cam follow pin 65 is carried at the first interval portion 64a adjacent to the starting portion 64b, and the swinging arm 25 is slowly turned and settled in a constant position when the cam follow pin 65 is carried at the second interval portion 64c continuously defined to the first interval portion 64a.

Accordingly, the tape cassette 9 is quickly carried toward the tape deck at the first stage, and slowly carried toward the tape deck at the final stage so as to avoid the shock of the tape cassette 9 when it abuts the tape reel setting discs at its setting position.

When the tape cassette is unloaded from the tape deck, the cam-drive motor 27 is energized in a reverse direction, so that the cam disc 24 is rotated in a counterclockwise direction thereby to return the swinging arm 25 and then to shift the shift member 40 backwards. Accordingly, the tape cassette 9 together with the

cassette holder 16 is carried to the output position defined to the inlet port 21.

In this embodiment, the swinging arm 25 includes a penetrated slit 63 through which the cam shaft 61 is disposed in a manner to be not prevented by the swinging arm 25. And the cam disc 24 further includes some guide routes formed to the upper and lower surfaces thereof so as to guide some guide pins adapted to suitable means for recording and/or regenerating operations of this device associated with the motion of the cam disc 24.

In order to maintain the tape cassette 9 at its loading position defined to the tape deck after its loading operation mentioned above, another embodiment as shown in FIG. 8 includes means for locking the shift member 40 to the loading position. The locking means is assembled in a suitable means for shifting the pinch roller 15, which has a supporting arm 67 pivoted to the chassis 1 by means of a pivot shaft 68, a guide arm 66 pivoted by the same pivot 68 and having a guide pin 70 which is guided along a guide route 69 provided on the cam disc 23 separate to the guide route 64. A tension spring member 71 is stretched between spring holders 66a and 67a formed to the arms 66 and 67 respectively so as to bias the arm 67 toward the pinching position of the pinch roller 15 access to the capstan roller 14.

The locking means includes a stopper lever 73 pivoted to a bracket mounted on the side wall of the chassis by means of a pivot pin 72, a lock pin 74 with a hook 75 attached to the free end portion of the stopper lever 73 and adapted to lock the shift member 40 against the unloading direction when the hook 75 is engaged to the supporting arm 67 at the relieving position of the pinch roller 15, at which the stopper lever 73 is kept in the locking position against the bias of a tension spring member 76 stretchingly bridged between the hook portions, one of which is formed to the stopper lever 73 and the other of which is mounted on the side wall of the chassis.

The device of this invention may include means for keeping the loading lever 53 in its tape loading position (as shown in FIG. 2), the loading lever 53 having a guide pin 73 guided along one of the guide routes mentioned above. The keeping means consists of a lever 74, pivoted to the common pivot shaft 68 and having a free end portion capable of being engaged to the guide

pin 73 when the tape is pinched between the capstan roller 14 and the pinch roller 15, and a hook 75 adapted to push the supporting arm 67 by means of a tension spring member 76 biasing the loading lever 53 in a counterclockwise direction as shown in FIG. 9. Accordingly, the tape is slidably contacted to the periphery of the cylinder 2 by means of the loading pins 3 and 4 in a manner to be securely supported at the loading position thereof.

In this embodiment, the shaft 38 may be made of a member having a U-shaped cross-section as shown in FIGS. 10 and 11 and the sector gears 39 each having a diameter larger than that of the gear 36 intermeshed thereto, whereby the twist motion of the shaft 38 is decreased when the tape cassette 9 together with the cassette holder 16 is carried from the inlet port to the tape deck, even if the shaft 38 is slender as compared to the prior shaft, because the shifting angle of the sector gear 39 is smaller than that of the prior device. Accordingly, the cassette holder 16 is smoothly carried along the guide slits 33 by means of the guide pins 34 and fork-shaped members 35.

In this embodiment, the cassette holder 16 may be made of a plastic material. In this case, the cassette holder 16 should be provided with means for discharging electrostatic energy generated thereto. For example, the cassette holder 16 may include an earth member 100 such as a coiled spring steel member (as shown in FIG. 12), or an elastic steel plate, etc., so as to leak the static electricity with its being slidably contacted to the chassis.



-10-

CLAIMS

1. A device for loading/unloading a tape cassette into/from a tape recorder and/or player having a cassette holder adapted to hold the tape cassette as it is passed through an inlet port, a tape deck to which the tape cassette is removably set together with the cassette holder, and a torque transmission means through which either one of the tape reels contained in the tape cassette on the tape deck may be rotated in a forward or backward direction by means of a drive motor, the device comprising a cam disc rotatably supported by a chassis, at least one guide route being disposed on the cam disc and extending from near the rotating axis of the disc towards the periphery thereof to extend both in the rotating direction and radially with respect to the rotating axis, a swinging arm pivoted to the chassis and having a cam follow pin associated with the guide route, and means for transporting the tape cassette together with the cassette holder from the inlet port to the tape deck and in reverse, the transporting means including a shift member adapted to guide the cassette holder in accordance with movement of the swing arm, said guide route including a first portion arranged to cause movement of the swinging arm, upon rotation of the cam disc, in an initial stage of loading of the tape cassette, and a second portion, continuous with the first portion, arranged to cause movement of the swinging arm in a subsequent stage of loading of the tape cassette and said guide route being arranged to guide the cam follow pin along the guide route to cause the swinging arm to turn quickly when the cam follow pin is guided along the first portion of the cam disc guide route and to turn slowly when the cam follow pin is guided along the second portion of the cam disc guide route.
2. A device for loading/unloading a tape cassette claimed in claim 1 in which the loading/unloading



-11-

device further includes a shift member retractively supported by means of guide rails at the one side of the chassis with its rear end having a notch engaged to a coupling roller, which is pivoted to the swinging
5 arm, the shift member having a rack gear integrally formed to the front portion thereof, a guide slit and a guide pin, a sub-shift member retractively supported by the same means of the guide rails together with the shift member and biased to a rear side by means of a tension spring
10 member, the sub-shift member having a rack gear integrally formed to the front portion thereof in a manner to be contiguously aligned to the rack gear, a guide slit slidably guide the guide pin and a guide pin being slidably inserted to the guide slit, a pair of gears pivotally
15 supported to both side guide members and having fork-shaped guide arms respectively, the one side gear only being alternately intermeshed to the rack gears, a pair of sector gears pivoted to the side guide members with their being connected by means of a common pivot shaft journalled to
20 the side guide members, the gears being intermeshed to the gears respectively, and a pair of guide pins attached to both sides of the cassette holder and penetrating through guide slits formed to the side guide members in a manner to be guided along the guide slits by the fork-shaped guide
25 arms.

3. A device for loading/unloading a tape cassette claimed in claim 1 or 2 in which there is provided means for locking a shift member which is adapted to set the tape cassette to the loading position, the locking means being
30 assembled in a suitable means for shifting a pinch roller, which has a supporting arm pivoted to the chassis, a guide arm having a guide pin which is guided along the guide route provided on the cam disc separate to the guide route, and a tension spring member stretched between the arms
35 respectively so as to bias the supporting arm toward the pinching position of the pinch roller access to the capstan



-12-

roller, the locking means including a stopper lever pivoted to a bracket mounted on the chassis, a lock pin with a hook attached to the free end portion of the stopper lever and adapted to lock the shift member against the unloading--
5 direction when the hook is engaged to the supporting arm at the relieving position of the pinch roller, at which the stopper lever is kept in the locking position against the bias of a tension spring member stretchingly bridged between the hook portions, one of which is formed to the
10 stopper lever and the other of which is mounted on the chassis.

4. A device for loading/unloading a tape cassette claimed in claim 1, 2 or 3 which is provided with means for keeping the loading lever in its tape loading position, the
15 loading lever having a guide pin guided along a separate guide route, the keeping means consists of a lever pivoted to the common pivot shaft and having a free end portion capable of being engaged to the guide pin when the tape is pinched between the capstan roller and the pinch roller,
20 and a hook adapted to push the supporting arm by means of a tension spring member biasing the loading lever, whereby the tape is slidably contacted to the periphery of a tape guide cylinder by means of loading pins in a manner to be securely supported at the loading position thereof.

25 5. A device for loading/unloading a tape cassette constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

6. A tape recorder and/or player including a
30 device according to any preceding claim.