

DEVICE FOR LOADING A TAPE

This invention relates to a device for loading a tape to a head cylinder as a tape cassette is loaded into a tape deck of a recording and/or playback device. The tape deck may be part of a recording and/or playback device such as a video tape recorder, a video tape player, a DAT and camera recorder for home or business use or a combination recorder with a television, or other visual or audio device having a tape recorder and/or player.

Prior art recorders and/or players incorporating tape-winding systems have generally included a tape deck on which a tape cassette is removably positioned, a torque transmission means through which either one of the tape reels contained in the tape cassette on the tape deck is rotatable in a forward or backward direction by means of a drive motor, means for loading the tape cassette from an inlet port to the tape deck and unloading it in reverse and means for loading/unloading the tape to/from a head cylinder as the tape cassette is loaded into the tape deck or removed.

In order to carry a tape to the periphery of the head cylinder or remove it therefrom, tape loading/unloading means have generally comprised a pair of tape loading pins adapted to support and transport the tape between the tape reels and head cylinder, gears linkage means connecting the tape loading pins to the gears and a tape loading lever having a rack member and movable by means of a cam disc driven by a drive motor the track member being intermeshed with a pinion associated with the gears. Prior art tape loading/unloading means of this construction have the problem that the tape loading lever

sweeps a large area as it is moved because the tape loading lever has a pivot shaft around which it moves under the guidance of the cam, thereby preventing the compact design of the device as well as causing the complicated

5 constitution of the tape loading/unloading means mentioned above.

According to a first aspect of the present invention there is provided a device for loading a tape to a head cylinder as a tape cassette is loaded into a tape deck, the
10 device comprising:

a pair of sliding members arranged to be guided in movement by grooves provided on a chassis;

a pair of tape loading pins, each mounted on a respective one of the sliding members;

15 a pair of tape loading arms, each mounted on one of a pair of pivots attached to said chassis;

a pair of linkage members each linking a sliding member with a respective tape loading arm;

20 a pair of gears, each gear being secured to a tape loading arm and intermeshed with the other gear for pivoting said tape loading arms, one of said gears being provided with a pinion;

a tape loading lever having rack teeth for rotating said pinion; and

25 a cam disc rotatably mounted on said chassis to be driven by a cam driving motor and having a guide path on the surface thereof for moving said tape loading lever in a linear direction;

30 wherein the pivot supporting one of said gears is provided with a centre hole having a circular protrusion formed on the inner periphery thereof, said protrusion being engageable with a hook formed within the centre hole of said one gear when said one gear is fitted to said pivot.

35 Movement of the rack means, or tape loading lever, in a linear direction can have an advantage in reducing the

area swept thereby relative to the swept area of the prior art arrangement described above, allowing the construction of the device to be kept simple and/or compact.

In order that the invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings, in which:-

Fig. 1 is a plan view of a tape recorder and player including a first embodiment of device for loading a tape according to the present invention, showing a tape cassette before it is set on a tape deck disposed on a chassis;

Fig. 2 is a bottom view of the embodiment of Fig. 1 showing the tape cassette set on the tape deck;

Fig. 3 is a side view of the device of Fig. 1;

Fig. 4 is an enlarged bottom view of the device of Fig.

1, showing the tape cassette set on the tape deck;

Fig. 5 is an exploded cross-sectional side view of part of the device illustrated in Fig. 3;

Fig. 6 is an enlarged cross-sectional side view of the Fig. 1 embodiment showing a part of the device associated with a cam disc;

Fig. 7 is an enlarged plan view of the front part of the Fig. 1 embodiment;

Fig. 8 is an enlarged plan view of the side part of the Fig. 1 embodiment;

Fig. 9 is an enlarged bottom view of a second embodiment of a device in accordance with the present invention;

Fig. 10 is a cross-sectional side view of a part of the Fig. 9 embodiment;

Fig. 11 is a plan view of a gear and tape loading pin linkage member suitable for incorporation in a device in accordance with the present invention;

Fig. 12 is a side view of the gear and linkage member of Fig. 11;

Fig. 13 is a plan view of another gear and tape loading linkage member suitable for use with the gear and linkage member of Fig. 11;

Fig. 14 is a side view of the gear and linkage member of Fig. 13; and

Fig. 15 is a cross-sectional side view of the linkage member of Fig. 11, viewed along line A-A.

The following drawings illustrate embodiments of a device for loading/unloading a tape to/from a head cylinder as a tape cassette is loaded/unloaded into/from the tape deck of a tape

recorder and/or player.

The illustrated tape recording and/or playing device includes a tape deck chassis 1 having a pair of tape-reel setting discs 10, 11, with rotating shafts 10a, 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 supplying torque from a drive motor to either one of the tape discs 10, 11. The drive motor 40 includes a flywheel and an output shaft with a capstan roller 14.

In this embodiment, the torque transmission device comprises two gears 50, 51, each coaxially attached to a tape-reel setting disc 10, 11, and a selecting gear 47 journaled to a shift member 45 which is pivotally supported on a shaft 46 mounted on the chassis 1 and which may be pivoted to engage the selecting gear 47 with either one of the gears 50, 51. The torque transmission device further comprises a gear 44, with a clutch member (not shown), intermeshed with the selecting gear 47, a drive pulley 41 connected to the output shaft 14, a driven pulley 43 coaxially supported by the shaft 46 and with its clutch member (not shown) frictionally engaged with the clutch member mentioned above, and an endless belt 42 stretched around both pulleys 41, 43.

The shift member 45 can pivot to cause the selecting gear 47 to intermesh with either one of the gears 50, 51 due to the rotating torque applied to the shift member through the transmission route when the drive motor 40 is switched to rotate in an opposite direction. The maximum extent of the swinging motion of the shift member 45 may, as shown, be

limited by means of stoppers 49.

The tape recorder further includes means for braking the tape-reel setting discs 10, 11, together with means for preventing relief of the stretched portion of tape between the tape-reels when required by the selected control mode of the recorder. The braking means includes braking members 53, 55, 54, 56 arranged to contact the tape-reel setting discs 10, 11, all of the braking members being pivotally supported on the chassis 1 by means of pivot posts 53a, 55a, 54a, 56a and being biased towards the tape-reel setting discs 10, 11 by means of tension spring members 100. The braking members 53, 54, 56 are provided with cam follow pins 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 follow pin and pivotally attached to the chassis 1 by means of a pivot post 55c.

The means for preventing the tape relief include a tape tension lever 52 pivotally attached to 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 touch the periphery of the setting disc 10 in the braking condition, the band brake member 52c having its ends connected to the levers 52, 52b.

The tape recorder further includes a shift member 57 retractably supported on chassis 1 by means of guide slits 59 formed in the shift member 57 and cooperating guide posts 58 provided on the chassis 1, the shift member 57 being adapted to regulate the respective braking member by means of cam surfaces

provided on the edge thereof in such manner that the cam follow pins follow the pattern of the cam. Biasing means are provided for biasing the shift member to a braking position, the biasing means comprising a torsional spring member 101 in this embodiment. The tape recorder also includes a cam disc 20 associated with shift member 57 through a cam follow member 60, a cam-drive motor 22, a 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 locked condition of the locking member 102 of the cam follow member 60 in such manner that the mode selecting cam 20 is regulated by the cam-drive motor 22.

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

The device further includes a cassette holder 16 for guiding the tape cassette 9 along side guide members 17, 18 to the tape reel setting discs 10, 11. A pinch roller 15 is arranged to pinch the tape against a capstan roller 14. A head cylinder 2 is provided, around which are disposed an audio signal input/output head 12, an erasing head 13, a pair of slide members 7, 8 with tape loading pins 3, 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, 6 provided by the chassis 1 and means for carrying the slide members 7 and 8 along the guide rails.

The carrying means includes two link members 32 pivoted to the slide members 7,8 respectively, two loading arms 33 and 34 pivoted to the link members 32 respectively and rotatably supported on the back side of the chassis 1 by means of pivots 35, 36, two gears 37 connected to the loading arms 33, 34 respectively and intermeshed with each other, a pinion 38 coaxially secured to the left side one of the gears 37 (as shown in Fig. 4) and a tape loading lever 31 movably supported on the back side of the chassis 1. The tape loading lever 31 is supported by means of a guide pin 63 mounted to the tape loading lever 31 and a guide slit 69 formed in the tape loading lever 31, the guide pin 63 being slidably received in a guide slit 65 formed in the chassis 1 and the pivot 36 being slidably received in the guide slit 69, the tape loading lever 31 having rack teeth 39 intermeshed with the teeth of the pinion 38 such that the tape loading lever 31 is carried along the guide slits 65, 69 in a straight line by means of a cam system (as mentioned hereinafter) when the tape cassette 9 is loaded to the tape reel discs.

The carrying means further includes at least one guide path 64 disposed on the cam disc 20, extending from near the axis of rotation of the cam disc towards its periphery, and means for transporting the tape cassette 9 together with the cassette holder 16 from the inlet port to the tape deck and in

reverse. The top end of the guide pin 63 is inserted into the guide path 64 to act as a cam follower pin, so that the guide pin 63 is moved in a direction defined by the guide slit 65 by sliding in the guide path 64 upon rotation of the cam disc 20.

In order to carry the cassette holder 16 and tape-cassette 9 from the input/output portion of the chassis 1 to the tape reel setting discs or vice-versa, the loading/unloading device further includes a carrying lever 28, a rack gear member 29 moved by the carrying lever 28 and gears 30 rotatably supported on both sides of the cassette holder 16 so as to be driven by intermeshing with the rack gear member 29, whereby to carry the tape cassette 9 to the tape deck together with the cassette holder 16 and then to position the tape reels with respect to the tape reel setting discs 10, 11.

When the cam disc 20 is rotated from its starting position shown in Fig. 1, the carrying lever 28 is turned in a manner to move the rack gear member 29 whereby the tape cassette 9 is carried toward the tape deck and then positioned 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 to thereby return the carrying lever 28 and to move the rack gear member 29 backwards, to carry the tape cassette 9, together with the cassette holder 16, to its output position.

In the first illustrated embodiment, there are provided torsion spring members 71 wound around the bosses of the gears 37 and bridging between the gears 37 and loading arms 33, 34 in order to bias the respective tape loading pins 3, 4 against the

tension of the tape. In this case, the loading arms 33, 34 are rotatably supported by bosses of the gears 37.

In the illustrated embodiment, the guide pin 63 includes a ring roller 66, rotatably supported thereby and positioned within the guide slit 65, and a flange 67 integrally formed therewith so as to be slidably supported relative to the upper surface of the chassis 1. The pivot 35 is provided with a centre hole 72 having a circular protrusion 73 formed on the inner periphery thereof. The gear 37 is provided with a centre hole 74 to fit the outer periphery of the pivot 35, and a hook 75 formed within centre hole 74 to engage the circular protrusion 73 when the gear 37 and pivot 35 are fitted together. In this embodiment, the cam disc 20 may include guide paths formed in the upper and lower surfaces thereof for the guidance of guide pins associated with means for recording and/or playing operations of the device associated with motion of the cam disc 20.

Figs. 9 and 10 indicate another embodiment of this invention modified from the first embodiment mentioned above. In this embodiment loop spring members 71' are provided to bias the tape loading pins 3, 4 against the tape tension, the loop spring 71' being compressed between hooks 75' and joint pins 73'. The hooks 75' are provided on the loading arms 33, 34 and the joint pins 73' are attached to the base end portions of link members 32 slidably inserted into guide slits 72' formed in the free end portions of the loading arms 33, 34 respectively.

Figs. 11 to 15 indicate means for loading/unloading a tape to/from a head cylinder, which means include gears 37,

link members 32 and loading arms 33, 34 integrally formed with the gears. In this embodiment compression spring members 71" are inserted between seat portions 75" and the joint pins 73", the seat portions being formed on the loading arms and the joint pins being attached to the base end portions of the link members 32 as in the second embodiment illustrated in Figs. 9 and 10.



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CLAIMS

1. A device for loading a tape to a head cylinder as a tape cassette is loaded into a tape deck, the device
5 comprising:

a pair of sliding members arranged to be guided in movement by grooves provided on a chassis;

a pair of tape loading pins, each mounted on a respective one of the sliding members;

10 a pair of tape loading arms, each mounted on one of a pair of pivots attached to said chassis;

a pair of linkage members each linking a sliding member with a respective tape loading arm;

15 a pair of gears, each gear being secured to a tape loading arm and intermeshed with the other gear for pivoting said tape loading arms, one of said gears being provided with a pinion;

a tape loading lever having rack teeth for rotating said pinion; and

20 a cam disc rotatably mounted on said chassis to be driven by a cam driving motor and having a guide path on the surface thereof for moving said tape loading lever in a linear direction;

25 wherein the pivot supporting one of said gears is provided with a centre hole having a circular protrusion formed on the inner periphery thereof, said protrusion being engageable with a hook formed within the centre hole of said one gear when said one gear is fitted to said pivot.

30 2. A device as claimed in claim 1, wherein said tape loading lever is provided with a guide slit and an integral guide pin and is supported relative to the back side of said chassis by flanges provided on said guide pin and a pivot, a lower portion of said guide pin being
35 slidably received in a guide slit formed in said chassis parallel to the tape loading lever guide slit and an upper



portion of said guide pin being engaged in said cam disc guide path to act as a cam follower pin, said pivot being fixed to said chassis to rotatably support and secure said pinion to one of said gears and being received in the tape loading lever guide slit, and said rack teeth being integrally provided on said tape loading lever parallel to the tape loading lever guide and intermeshed with said pinion, whereby the tape loading lever is arranged to move in the direction of both the tape loading lever and chassis guide slits upon rotation after the tape cassette is loaded on said tape reel setting discs.

3. A device as claimed in claim 2, wherein a torsion spring is provided at the base of each said gear coaxial with the respective gear axis, each spring bridging between a gear and a respective tape loading arm to bias the respective tape loading pin against the tape.

4. A device as claimed in claim 2, wherein a hook is provided on each tape loading arm, a joint pin is attached to the base end portion of each said linkage member, each joint pin being slidably received in a guide slit provided at the free end portion of the respective tape loading arm, and a pair of compressed loop spring members are provided, each spring bridging between a hook and a respective joint pin to bias the respective tape loading pin against the tape.

5. A device as claimed in any one of claims 2 to 4, wherein said guide pin engaging said cam disc guide path is provided with a ring roller, positioned within said chassis guide slit, and a flange integrally formed therewith so as to be slidably supported relative to the upper surface of said chassis.

6. A device as claimed in any one of the preceding claims, wherein reverse rotation of the cam disc causes the tape to be unloaded from said head cylinder and to be withdrawn into the tape cassette.

7. A device for loading a tape to a head cylinder



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substantially as hereinbefore described with reference to the accompanying drawings.

8. A tape recorded and/or player including a device as claimed in any one of the preceding claims.