

A CASSETTE LOADING MECHANISM FOR USE IN THE
HOUSING OF A VIDEO CASSETTE TAPE RECORDER

The present invention relates to a cassette loading/unloading mechanism, for use in the housing of a video cassette tape recorder (VTR).

Conventionally, a VTR includes a housing motor for moving the video cassette tape in and out of the VTR, and a separate loading motor for moving the inserted video cassette tape in and out of engagement with the playback and recording tape heads. The housing motor and the loading motor are separately driven during the initial operation and the final positioning of the VCT.

Thus, the conventional VTR, having a plurality of component elements for both the housing motor and the loading motor, becomes quite complicated. As a result of the added complication of a separate housing and loading motor, the rate of malfunctioning is quite high, repairs become more difficult, and the size and weight

of the VTR must be increased to accommodate the added components. Consequently, it becomes difficult to make a compact and light VTR having both a loading motor and a housing motor.

The object of the present invention is to simplify the arrangement so that a single loading motor can mount and dismount a VCT from the VTR as well as load and unload the VCT from the playback and recording tape heads. The invention consists in:

- a cassette loading mechanism for location in the housing of a video cassette tape recorder, comprising:

- a single reversible drive motor drivingly connectable to a transmission gearing;

- a cassette transporting holder for receiving a video cassette tape, said transporting holder being movable between an unloaded position for ejection or receipt of the cassette tape and a loaded position at which the cassette tape is in full engagement with playback and recording tape heads;

- and the drive means comprising a timing gear which couples the drive from the transmission gearing directly to the cassette transporting holder for its movement between the unloaded position and substantially the loaded position, but which allows the drive to the cassette transporting holder to slip during continued motion of the transmission gearing.

The mechanism of the present invention is preferably used in a front loading VTR, for recording and reproducing video signals on a magnetic tape.

Embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which :-

Figure 1 is a plan view of a tape recorder housing of an embodiment of the present invention;

Figure 2A is a side view illustrating a VCT inserted into the idling rotation mechanism of an embodiment of the present invention;

Figure 2B is a perspective view illustrating assembly of various component parts of an embodiment of the present invention;

Figure 2C is an exploded perspective view illustrating various component parts of an embodiment of the present invention;

Figure 3 is a side view of the tape recorder housing illustrating the initial stage before a VCT is inserted into the VTR; and

Figure 4 is a side view illustrating the tape recorder

housing after a VCT has been loaded into the VTR.

The present invention will now be described specifically with reference to the attached drawings.

Figure 1 is a plan view of a VTR housing 1 which includes a cassette switch 29 that is activated when VCT 32 is inserted into the VTR. The VTR includes an idling rotation mechanism comprising an arm gear 13, a side arm 7, timing gear 19 and relay gear 6. Connected to side arm 7 is a guide pin 16 which is also connected to an inside holder 30. Guide pin 16 is moved along guide slot 5, in support plate 33, by side arm 7 so that inside holder 30 can mount and load, or unload and dismount, the VCT 32 from the VTR.

Figure 2A is a side view illustrating a VCT 32 being inserted into the idling rotation mechanism. During insertion, VCT 32 first passes through entrance 31 of housing 1 and then moves past inlet 27 of holder 30 so as to be positioned in holder 30.

Referring to Figure 2B, bevel gear 18 is shown, mounted on shaft 4, having a small gear 18a mounted on the back side of bevel gear 18 so that small gear 18a can transmit the driving force of motor 26 (figure 3) to timing gear 19.

Figure 2B also shows the timing gear 19, rotatably mounted on shaft 3, having a gear part 19a and a rotating plate 19b. Gear part 19a further comprises a sliding part 19a' whose length approximately amounts to the arc length of a half circle of gear part 19a. Moreover, sliding part 19a' partially overlays the gear teeth of gear part 19a. Rotating plate 19b, however, is partially cut-away and, on one end of the perimeter thereof along edge parts 19b', has a stopper 19' projecting outwards. In addition, a guide hole 20, on rotating plate 19b, facilitates the alignment of arm gear 13 and timing gear 19 during the assembly of the idling rotation mechanism. Specifically, guide hole 20 is aligned, during assembly, with a portion of arm gear 13 so that the first tooth of geared part 13a can be properly positioned on gear part 19a for the coordinated rotation of arm gear 13 and timing gear 19.

As shown in Figures 2B and 2C, the arm gear 13, rotatably mounted on shaft 2, has a geared part 13a formed partially along its perimeter. Furthermore, a pin 14 projects towards timing gear 19 from the end of geared part 13a. As the arm gear 13 is rotated during the mounting and loading of the VCT, when the geared part 13a of arm gear 13 become disengaged from the gear part 19a, sliding part 19a' which does not have any gear

teeth contacts the portion of arm gear 13 that has no teeth and further rotates arm gear 13 by frictional contact, so that pin 14 contacts edge part 19b' of rotating plate 19b.

Also shown in figures 2B and 2C is side arm 7. Side arm 7 is rotatably mounted on shaft 2 so as to be coaxially mounted with respect to arm gear 13. Moreover, side arm 7 has a gear portion 12 formed on its perimeter so as to engage relay gear 6. A stopper 12a which projects inwardly from gear portion 12 is provided so as to abut stop 21 on the beginning of geared part 13a. Also, a projecting lug 12b is formed on the opposite side of gear portion 12 so as to project towards arm gear 13. Thus, any excessive rotation of side arm 7 with respect to arm gear 13 will result in projecting lug 12b contacting arm gear 13.

Side arm 7 also comprises a spring holder 17 that, in conjunction with spring holder 15 on arm gear 13, holds ejector spring 17c so that stop 21 and stopper 12a are urged into abutting engagement. Side arm 7 also has a gripper 9 to grip guide pin 16 which is connected with the inside holder 30. A boss 8, formed on the inner side of gripper 9, projects from side arm 7 so as to hold torsion spring 11 in conjunction with torsion spring holders 10. Figures 3 and 4 show bevel gear 18

engaged with an ejector gear 22 mounted inside a deck 23. Moreover, ejector gear 22 is connected with a loading motor 26 via worm 24 and worm gear 25. As a result of the above interaction of bevel gear 18, ejector gear 22, worm 24, and worm gear 25, the rotational speed of motor 26 can be varied. In addition, ejector gear 22 also engages master cam 35, of a mounting mechanism, so that the VCT can be drawn into or ejected from holder 30.

The operation of the above-described embodiment will now be described.

As shown in Figures 2A, 2B, 3 and 4, when VCT 32 is inserted through entrance 31 and inlet 27, VCT 32 contacts cassette switch 29 which activates the loading motor 26. The rotation of loading motor 26 is determined by a system controller circuit in the VTR.

Since worm 24 is connected to loading motor 26, the rotation of loading motor 26 causes worm 24, worm gear 25 and ejector gear 22 to rotate. The rotation of ejector gear 22 then causes bevel gear 18 and master cam 35 to be rotated in a counter-clockwise rotation. The mounting mechanism then draws VCT 32 into holder 30. Small gear 18a then rotates timing gear 19, due to the connection between small gear 18a and gear part 19a, in

the clockwise direction which in turn rotates arm gear 13 in the counter-clockwise direction, due to the connection between geared part 13a and gear part 19a. The projecting pin 14 is unobstructed by the plate 19b because of the cut-out sector.

As a result of the abutting engagement between arm gear 13 and stopper 12a of side arm 7 and the mounting of arm gear 13 and side arm 7 coaxially on shaft 2, the rotation of arm gear 13 will cause side arm 7 to also be rotated in a counter-clockwise direction. Therefore, as side arm 7 rotates guide pin 16 is moved along slot 5 by gripper 9. Accordingly, holder 30 and VCT 32 are moved along with guide pin 16. While guide pin 16 is moving along guide slot 5, gear portion 12 of side arm 7 causes relay gear 6 to be rotated in the clockwise direction so as to close access doors at entrance 31 of the VTR as the VCT is moved into the VTR.

When guide pin 16 reaches position A on guide slot 5 (figure 4), gear part 19a becomes disengaged from geared part 13a and sliding part 19a' contacts the portion of geared part 13a that does not have any gear teeth. The frictional contact between gear part 13a and sliding part 19a' causes gear part 13a to rotate so as to complete the loading action by the inside system controller before pin 14 abuts the stopper 19'. Simultaneously, guide pin 16 is moved to position B. Then the loading motor is stopped. In this condition, if the timing gear

19 abnormally keeps on rotating, the stopper 19' is obstructed by the pin 14 so as to prevent the timing gear 19 from rotating.

Hence, when the guide pin 16 is securely mounted in the position A of Figure 4, during the initial mounting of the VCT and thereafter, the idling rotation is achieved with a frictional force, guide pin 16 is moved to position B so that holder 30 strongly receives the resilient force of the torsion spring 11 so as to prevent the movement of the VCT.

When unloading, the operation is the reverse of the above described operation. Namely, the inside system controller circuit causes loading motor 26 to rotate in the opposite direction. Thereafter, loading motor 26 is driven for a few seconds so that timing gear 19 rotates in a counter-clockwise direction so as to dislodge pin 14 from edge portion 19b'. Gear part 19a of the timing gear 19 then engages geared part 13a of arm gear 13 so that both timing gear 19 and arm gear 13 rotate.

With the arm gear 13 rotating, guide pin 16 moves back along the guide slot 5 to eject VCT 32 from the VTR.

As described above, a single loading motor 26, mounts and loads, or unloads and dismounts, VCT 32 from the

VTR. In addition, the idling rotation mechanism allows VCT 32 to be mounted accurately, yet prevents the VCT from being forced when loaded in the VTR. Moreover, irrespective of the operational changes of the system controller circuit, the idling rotation mechanism of the present invention is a relatively uncomplicated structure that is easily assembled, therefore, the rate of malfunctioning can be significantly reduced and repairs easily performed.

The invention is not limited to the example described hereinabove. Various modifications of the disclosed embodiment, as well as other embodiments of the invention, will become apparent to persons skilled in the art upon reference to the description of the invention and the drawings. For example, the speed-varying elements could be partially or fully replaced by a pulley system. It is therefore intended that the appended claims will cover any such modifications or embodiments that fall within the scope of the invention.

CLAIMS:

1. A cassette loading mechanism for location in the housing of a video cassette tape recorder, comprising:

a single reversible drive motor drivingly connectable to a transmission gearing;

a cassette transporting holder for receiving a video cassette tape, said transporting holder being movable between an unloaded position for ejection or receipt of the cassette tape and a loaded position at which the cassette tape is in full engagement with playback and recording tape heads;

and drive means comprising a timing gear which couples the drive from the transmission gearing directly to the cassette transporting holder for its movement between the unloaded position and substantially the loaded position, but which allows the drive to the cassette transporting holder to slip during continued motion of the transmission gearing.

2. A mechanism according to Claim 1, in which the transmission gearing is connected drivingly, and independently of the said drive means, to means for feeding the tape from the cassette to a tape head drum,



and for removing it therefrom prior to ejection.

3. A mechanism according to Claim 1 or 2, in which the timing gear is associated with a rotational stop which prevents continued rotation of the timing gear beyond a predetermined end position beyond the position at which the cassette transporting holder reaches its loaded position.

4. A mechanism according to Claim 1, 2 or 3, comprising a drive motor control circuit responsive to insertion of the cassette to switch on the drive motor and to switch off the drive motor after continued rotation of the transmission gearing beyond the point at which the cassette transporting mechanism reaches the loaded position.

5. A mechanism according to any of Claims 1 to 4, in which the timing gear has teeth around part of its periphery, and in which the drive means comprises an arm gear for coupling rotation of the timing gear to sliding motions of the cassette transporting holder, the arm gear having gear teeth and a sliding surface on different parts of its periphery for engagement with the corresponding parts of the timing gear.



6. A mechanism as claimed in any preceding claim, wherein transmission gearing comprises: a worm drivingly connectable to an output shaft of the drive motor; a worm gear in meshing engagement with said worm; and a bevel gear, mounted on a first shaft extending from the housing, in meshing engagement with said worm gear.

7. A mechanism as claimed in any preceding claim, wherein said drive means comprises: a side arm drivingly connectable to said timing gear and having a gripper to engage a guide pin which is connected to said cassette transporting holder, so that movement of the guide pin along a guide slot formed in a support plate of said housing by the action of the side arm causes the transporting holder to move in the housing; and resilient means connectable to said side arm to engage said guide pin.

8. A mechanism as claimed in any preceding claim, comprising a relay gear connectable to the drive means and rotatable to open and close access doors of said housing.

9. A cassette loading mechanism for a video cassette tape recorder, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.



10. A video cassette tape recorder comprising a mechanism according to any preceding claim.
