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TAPE CASSETTES

This invention relates to tape cassettes. Embodiments of the invention are particularly, but not exclusively, suitable for use in magnetic recording and/or reproducing apparatus such as video tape recorders and various other magnetic recording and/or reproducing type information processors.

In magnetic tape cassettes for video tape recorders, an opening is formed in one side thereof and a recessed portion adjacent to the opening is formed in the lower surface of the cassette. On loading the tape cassette onto a video tape recorder, a tape loading guide is inserted via the recessed portion into a position inward of the tape in the cassette, and thereafter by moving the tape loading guide from the opening to the exterior of the cassette, the tape is drawn out of the cassette and loaded in a predetermined tape transport path.

Conventional tape cassettes of this sort have a pivotable cover mounted in front of the opening to prevent the tape from accidentally jumping out of the cassette and being damaged, and when the tape cassette is loaded onto a video tape recorder, the pivotable cover is pivotally opened.

However, with such conventional tape cassettes, dust or the like can enter the cassette through the recessed portion, and may adhere to the magnetic surface of the tape, thus resulting in drop-out. Moreover, the tape extending across the opening may become loose due to vibration, and when the tape loading guide is inserted into the recessed portion, it may strike against the tape and damage it.

According to the present invention there is provided a tape cassette comprising:

a housing of generally rectangular configuration containing reels on which a supply of tape is wound and having top and bottom walls and a peripheral wall extending between said top and bottom walls along three sides of the housing so as to form an opening along the fourth side of the housing, said bottom wall having a recess communicating with said opening and extending along a portion of said fourth side of the housing, the tape being guided between said reels in a path having a run extending along said opening;

a front lid mounted on said housing and movable relative thereto between a closed position covering said opening and an open position exposing said opening; and

a back lid movable in connection with the movement of said front lid between said closed position wherein said back lid is positioned behind said front lid thereby to enclose said tape in cooperation with said front lid and said open position wherein said back lid is moved away from the rear side of said tape so that said run of the tape can be engaged through said recess for withdrawal of the tape through said opening.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like references designate like elements, and in which:

Figure 1 is a perspective view of an embodiment of tape cassette according to the invention;

Figure 2 is a perspective view of the tape cassette as when loaded onto a video tape recorder;

Figure 3 is an exploded perspective view of the tape cassette;

Figure 4 is an enlarged perspective view of a front cover portion of the tape cassette;

Figure 5 is a plan view of the tape cassette;

Figure 6 is a view of the underside of the tape cassette;

Figure 7 is a sectional view taken on the line VII-VII of Figure 5;

Figures 8 and 9 illustrate opening and closing operations of a cover of the tape cassette;

Figure 10 is a partial side view of the tape cassette;

Figures 11 and 12 illustrate unlocking of the front cover;

Figure 13 is an enlarged plan view of a reel locking pawl portion shown in Figure 5 in a loaded state of the tape cassette;

Figure 14 is an exploded perspective view of the reel locking pawl portion; and

Figure 15 is a sectional view taken on the line XV-XV of Figure 13.

Referring first to Figures 1 to 3, there is shown a tape cassette 1 for a video tape recorder and which comprises an upper half 2 and a lower half 3 both moulded from synthetic resin. The upper half 2 and the lower half 3 are fitted together from a vertical direction and held with screws 4 to 6 to form a housing. Within the tape cassette 1 is rotatably mounted a pair of

tape reels 7 and 8, and a magnetic tape 9 is wound round the tape reels 7 and 8. As shown in Figure 14, the tape reels 7 and 8 are placed on a bottom portion 10 of the lower half 3, and as shown in Figure 6, they are positioned by being fitted in a pair of reel insertion holes 11 and 12 formed in the bottom portion 10. In Figure 3, are shown a pair of tape reel presser springs 13 and a pair of caps 14 applied to upper end portions of the presser springs 13.

In the front face of the tape cassette 1, as shown in Figure 2, an opening 15 is formed across nearly the full width of the tape cassette 1, while in the bottom portion 10 of the lower half 3 there is formed a recessed portion 16 adjacent to the opening 15 as is shown in Figures 2, 3 and 6. At an edge portion of the recessed portion 16, as shown in Figures 2 and 3, there is formed a vertical partition 17 which extends perpendicularly upward from the above edge portion and joins the upper half 2, whereby the recessed portion 16 and the interior of the tape cassette 1 are separated from each other. At the right and left end portions of the vertical partition 17 there are formed respective tape guide portions 18 and 19 whereby the tape 9 is guided and extended along the opening 15.

As shown in Figures 3 and 4, the opening 15 is covered with a generally ⌋-shaped front cover 20, and inside the right and left end portions 21 of the front cover 20 are integrally formed a pair of pivot pins 22. Formed in the right and left end portions 23 of the opening 15 belonging to the lower half 3 are respective holes 24, in which are fitted the pivot pins 22 whereby the front cover 20 is made pivotable in the vertical direction. A torsion bar 26 moulded from plastics material is disposed along an upper end portion 25 of the front cover 20 as is shown in Figure 4. The right and left end portions 27 of the torsion bar 26 are pivotably attached to the upper end portion 25 of the front cover 20, and its central portion 28 is fixed to the upper end portion 25 of the front cover 20. Adjacent to the right and left end portions 27 of the torsion bar 26 are fixed the right and left end portions 30 of an upper cover 29. The upper cover 29 is arranged to cover an upper recessed portion 31, formed at an upper edge of the vertical partition 17, so as to improve the appearance. As shown in Figures 2 to 9, when the front cover 20 is pivoted upwardly, the upper cover 29 slides on the upper wall of the upper half 2 towards the back of the upper recessed portion 31. Consequently, when the front cover 20 pivots upward, the torsion bar 26 is

twisted and urges the upper cover 29 pivotally in a counter-clockwise direction in Figure 9, and by virtue of the reaction force, the front cover 20 is urged in a clockwise direction in Figure 9. As mentioned above, the upper cover 29 is provided for the sake of good appearance so that the upper recessed portion 31 cannot be seen directly. Therefore it is not always necessary to provide it, from a functional standpoint of the tape cassette 1. That is, if there is provided some other means normally pivotally to urge the front cover 20 in a clockwise direction in Figure 9, then functionally the upper cover 29 becomes no longer necessary. For example, this urging means may be a torsion spring attached to one or both sides of the pair of pivot pins 22.

As shown in Figures 4 and 7 to 9, formed from the upper end portion 25 of the front cover 20 downward to the side of a lower end portion 34 is an inner plate 35 which nearly covers an upper half of the back of the front cover 20. A pair of holes 36 are formed in both right and left end portions of the lower end of the inner plate 35, and a pair of pivot pins 38 formed at both right and left end portions of the upper end of an inner cover 37 are fitted in the holes 36. That is, the inner cover 37 may turn freely on the pivot pins 38, and as shown in Figure 7, in a pivoted position, in which a lower end portion 39 of the inner cover 37 contacts the inside of the lower end portion 34 of the front cover 20, there is formed a tape chamber 40 partitioned by the inner plate 35 and the inner cover 37 on the rear of the front cover 20. As shown in Figures 7 to 9, the lower end portion 39 of the inner cover 37 is rounded in section so that it may contact the inside of the lower end portion 34 of the front cover 20 closely without leaving a space.

As shown in Figures 4 and 7 to 9, respective guided pins 41 are provided at the right and left end portions of the inner cover 37. The guided pins 41 are attached to free end portions of a pair of brackets 42 which respectively project from nearly central parts of the right and left portions of the inner cover 37 towards the side opposite to the front cover 20, and the guided pins 41 project horizontally towards the outside. On the other hand, as shown in Figures 7 to 9, respective guide grooves 44 facing the recessed portion 16 are formed in right and left side portions 43 of the vertical partition 17 and face each other. The guide grooves 44 are formed obliquely from rear upper portions (left upper portions in Figures 7 to 9) of the side portions 43 to front lower portions (right lower portions in the same

figures) thereof, and central portions 45 of the guide grooves 44 are somewhat closer to the pivot pins 22. That is, the guide grooves 44 have a curved V-shaped form wherein the central portions 45 are closest to the pivot pins 22. The guided pins 41 are inserted in the guide grooves 44, and when the front cover 20 is pivoted, the guided pins 41 are guided by the guide grooves 44 while being in sliding contact therewith. That is, in a completely closed state of the front cover 20 as shown in Figure 7, or in a completely open state as shown in Figure 9, the lower end portion 39 of the inner cover 37 contacts the inside of the lower end portion 34 of the front cover 20. However, during opening or closing of the front cover 20, the guided pins 41 of the inner cover 37 approach the pivot pins 22 and the inner cover 37 pivots about the pivot pins 38.

At the front edge parts of the right and left end portions 23 of the lower half 3 there are integrally formed respective locking pawls 48 as is shown in Figures 2, 3, 10 and 11. More particularly, the locking pawls 48 are formed at free end portions of a pair of leaf spring portions 49 which project from the upper ends of both front edge parts of the end portion 23 towards the lower ends thereof, the locking pawls 48 being movable resiliently in the right and left directions in Figure 12. On the other hand, as shown in Figure 4, a pair of locking holes 50 are formed in lower ends of both right and left end portions of the front cover 20. When the front cover 20 is closed, as shown in Figure 10, the locking pawls 48 are fitted in the locking holes 50 to lock the front cover 20. The leaf spring portions 49 are arcuate around the pin holes 24 so as not to impede the opening and closing operation for the front cover 20. In a lower edge portion of the front cover 20 there are formed a pair of slits 51 just below the locking holes 50. When the front cover 20 is in the fully closed state, as shown in Figure 10, the slits 51 are positioned just in front of the free end parts of the leaf spring portions 49. When loading the tape cassette 1 onto a cassette holder, as shown in Figure 11, a pair of projections 52 formed on the cassette holder are inserted through the slits 51 and urge the free end parts of the leaf spring portions 49 to allow the locking pawls 48 to be disengaged from the locking holes 50. The locking pawls 48 have inclined portions 53 as is shown in Figures 11 and 12, and when closing the front cover 20 the inner walls of the slits 51 urge the inclined portions 53, so that the free end portions of the leaf spring portions 49 are bent to the left in the case of Figure 11. That is,

immediately thereafter, the locking pawls 48 and the locking holes 50 are click-wise engaged with each other by the restoring force of the leaf spring portions 49.

In the tape cassette 1, as shown in Figure 5, there is arranged a reel locking pawl 57 between the tape reels 7 and 8. The reel locking pawl 57 is integrally moulded from plastics material, and as shown in Figure 14, it mainly comprises a first]-shaped plate portion 58, a second]-shaped plate portion 59, a Y-shaped leaf spring portion 60, and on the free ends of the plate portions 59 respective wedge-like pawl portions 61. On the other hand, lower side plates 56 of the tape reels 7 and 8 are provided at the respective outer peripheral portions with saw-toothed portions 62 as is shown in Figures 13 and 14, with which are engaged the pair of pawl portions 61 of the reel locking pawl 57 so that the rotation of the tape reels 7 and 8 in the tape slackening direction can be locked. That is, the pawl portions 61 of the reel locking pawl 57 mounted in the tape cassette 1 are made movable in the longitudinal direction (in the vertical direction in Figure 13) by the resilience of the leaf spring portion 60, and normally (while the tape cassette 1 is not loaded) the pawl portions 61 are held in pressure engagement with the pair of saw-toothed portions 62 by the spring force of the leaf spring portion 60. The second plate portion 59 and the leaf spring portion 60 are provided with a pair of apertures 63 and a pair of apertures 64, respectively, whereby the portions 59 and 60 are given a moderate resilience.

For loading the reel locking pawl 57 into the tape cassette 1, as shown in detail in Figure 14, a pawl loading notch 65 is formed in each of the upper and lower halves 2 and 3 (in Figure 14 there is shown only a pawl loading notch 65 of the lower half 3), when fitting together the upper and lower halves 2 and 3 from above and below, the reel locking pawl 57 is loaded or fitted into the pawl loading notches 65. And as indicated with alternate long and short dash lines in Figure 13, the pawl portion 61 projects to the tape reels 7 and 8 side from a pair of right and left opening portions 66 of the pawl loading notch 65 of the lower half 3.

At a central part of the second plate portion 59 of the reel locking pawl 57 there is formed an inclined surface 67 as is shown in Figures 14 and 15. On the other hand, in the bottom portion of the pawl loading notch 65 there is formed a pin hole 68 in a position just below the inclined surface 67.

When loading the tape cassette 1, as shown in Figure 15, an unlocking pin 69 is inserted through the pin hole 68 in the direction of an arrow "b" and its end portion bears on the inclined surface 67. That is, at the time of loading of the tape cassette 1, the first and second plate portions 58 and 59 move in the direction of an arrow "c" in Figure 15 together with the pawl portions 61, and thereby unlock the tape reels 7 and 8.

In the tape cassette 1, as shown in Figure 7, the front surface of the tape 9 extending along the opening 15 is covered with the front cover 20 and its back surface is covered with the inner plate 35 and the inner cover 37. That is, the tape 9 is enclosed in the tape chamber 40 between the front cover 20 on the one hand and the inner plate 35 and inner cover 37 on the other. In this enclosed state, as shown in Figure 10, the locking pawls 48 are in engagement with the locking holes 50 to lock the front cover 20, whereby the front cover 20 is prevented from opening accidentally. At this time, since the upper recessed portion 31 is covered with the upper cover 29, the tape cassette 1 presents a good appearance.

On the other hand, when the tape cassette 1 is loaded onto a video tape recorder, the front cover 20 and the inner cover 37 pivots upwards as shown in Figure 9, whereby the front and the back of the tape 9 are exposed. That is, for example, when the tape cassette 1 is inserted into a cassette holder disposed in the video tape recorder body, the right and left projections 52 formed on the cassette holder are inserted from the slits 51 in the direction of an arrow "a" and urge the free end portions 49, as shown in Figure 11. As a result, the leaf spring portions 49 are bent to the left in Figure 11 against their spring forces, thus allowing the locking pawls 48 to be disengaged from the locking holes 50 to unlock the front cover 20.

Next, when the tape cassette 1 is moved downward in Figure 11 and loaded in the cassette loading position, the front cover 20 is pushed up by a projection (not shown) formed on the video tape recorder body, so that as shown in Figure 12, the front cover 20 is opened while twisting the torsion bar 26. When the front cover 20 pivots upward, the guided pins 41 of the inner cover 37 are guided by the guide grooves 44. Consequently, the guided pins 41 approach the pivot pins 22 in the section from the lower end portions up to the central portions 45 of the guide grooves 44, so that the inner cover 37 pivots counter-clockwise about the pivot pins 38 in Figure 8 with respect to the front cover 20. As a result, the space between the lower end portion

39 of the inner cover 37 and the lower end portion 34 of the front cover 20 becomes larger, thus preventing the front cover 20 and the inner cover 37 from contacting the tape 9 during their opening motion. After passing the central portions 45 of the guide grooves 44, the guided pins 41 gradually move away from the pivot pins 22, and the inner cover 37 pivots clockwise in Figure 8 with respect to the front cover 20. When the front cover 20 is fully open, as shown in Figure 9, the inner cover 37 assumes a horizontal state and its lower end portion 39 contacts the inner surface of the lower end portion 34 of the front cover 20. Consequently, a wide space is ensured behind the tape 9, thus eliminating any inconvenience such as a tape loading guide (not shown) inserted from the recessed portion 16 and the inner cover 37 striking against each other. Moreover, since the inner cover 37 is opened and closed with the recessed portion 16, the space for tape cassette loading within the video tape recorder body can be kept small.

On the other hand, along with the upward pivotal movement of the front cover 20, the upper cover 29 slides backward on the upper wall of the upper half 2. Therefore, the right and left end portions 30 of the torsion bar 26 do not pivot and only its central portion 28 is twisted by the upper end portion 25 of the front cover 20, so that elastic energy which urges the upper cover 29 pivotally in a counter-clockwise direction in Figure 9 is accumulated. Consequently, the front cover 20 is urged in a clockwise direction in Figure 9 by virtue of a reaction force acting on the upper cover 29, and when removing the tape cassette 1 from the video tape recorder body, the front cover 20 is closed by the force of the torsion bar 26.

When the tape cassette 1 is moved downward, as shown in Figure 15, the unlocking pin 69 formed on the video tape recorder body is inserted through the pin hole 68 into the tape cassette 1 and urges the inclined surface 67 of the reel locking pawl 57, so that the first and second plate portions 58 and 59 move to the left in Figure 15 together with the pawl portions 61, thus allowing the pawl portions 61 and the toothed portion 62 of the tape reels 7 and 8 to be disengaged from each other, whereby the tape reels 7 and 8 are unlocked.

When removing the tape cassette 1 from the video tape recorder body, the operational states of the front cover 20, the inner cover 37, the upper cover 29 and the reel locking pawl 57 are all the complete reverse of the above-mentioned case, and the tape 9 extending along the opening 15 is

sealed in the tape chamber 40 while being held between the front cover 20 on the one hand and the inner plate 35 and inner cover 37 on the other, therefore there is no risk of the tape 9 being damaged by dust or the like. In the removed state of the tape cassette 1, moreover, since the tape reels 7 and 8 are locked by the reel locking pawl 57, the tape 9 extending along the opening 15 will not be loosened by vibration, and the tape loading guide when inserted will not strike the tape 9.

Even if the reel locking pawl 57 is omitted, the tape 9 will not slacken to such an extent as to cause a problem, because it is enclosed by being held in front and behind between the front cover 20 on the one hand and the inner plate 35 and inner cover 37 on the other. In this connection, a suitable cushioning material may be stuck on the inner wall surface of the front cover 20 and of the inner cover 37 so that the cushioning material lightly rests against the front and the back of the tape 9, so that the tape 9 will not slacken even in the absence of the reel locking pawl 57.

Various modifications are of course possible, for example, although in the above embodiment the back of the tape 9 is covered with the inner plate 35 and the inner cover 37, the inner plate 35 and the inner cover 37 may be made integral with each other, and the upper end portion of the inner plate 35 and that of the front cover 20 may be hinged together to open and close the integral body formed by the inner plate 35 and the inner cover 37. Moreover, although in the above embodiment the inner cover 37 is made pivotable upward, it may be made movable in the longitudinal direction.

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27

CLAIMS

1. A tape cassette comprising:
a housing of generally rectangular configuration containing reels on which a supply of tape is wound and having top and bottom walls and a peripheral wall extending between said top and bottom walls along three sides of the housing so as to form an opening along the fourth side of the housing, said bottom wall having a recess communicating with said opening and extending along a portion of said fourth side of the housing, the tape being guided between said reels in a path having a run extending along said opening;
a front lid mounted on said housing and movable relative thereto between a closed position covering said opening and an open position exposing said opening; and
a back lid movable in connection with the movement of said front lid between said closed position wherein said back lid is positioned behind said front lid thereby to enclose said tape in cooperation with said front lid and said open position wherein said back lid is moved away from the rear side of said tape so that said run of the tape can be engaged through said recess for withdrawal of the tape through said opening.

2. A tape cassette according to claim 1 wherein said back lid is hinged on said front lid, whereby said back lid is moved from said closed position to said open position by movement of said front lid from said closed position to said open position.

3. A tape cassette according to claim 2 wherein said front lid includes a front portion extending along said opening in said closed position and a back portion which partially covers a back portion of the tape and is hinged with said back lid.

4. A tape cassette according to claim 2 wherein said back lid has a guide pin on at least one end thereof, said guide pin engaging with guide groove which is formed at a portion of said peripheral wall of the housing so that said back lid is moved along said guide groove from said closed position to said open position.

5. A tape cassette according to claim 4 wherein said front lid extends along the full length of said fourth side, said front lid having ears extending at right angles to said front portion at the opposite ends of said front portion, and said ears are pivoted on portions of said peripheral wall at opposite sides of said housing, and wherein said back lid extends along the length of said recess, said housing having an inside peripheral wall along said recess, and said guide groove is formed on a portion of said inside peripheral wall.

6. A tape cassette according to claim 5 wherein said top wall of the housing has a second recess communicating with said opening and which corresponds to the first-mentioned recess in shape and location, and said back lid is raised therethrough above the housing when said front lid is rotated from said closed position to said open position.

7. A tape cassette according to claim 6 further comprising a top lid covering said second recess in said closed position, said top lid being hinged on an upper edge of said front portion of said front lid.

8. A tape cassette substantially as hereinbefore described with reference to the accompanying drawings.