"TAPE CASSETTE"

The invention relates to tape cassettes and in particular to tape cassettes for use in recording/reproducing apparatus such as video tape recorders and other information processors.

Tape cassettes have been previously proposed for use in a conventional video tape recorder (hereinafter referred to as VTR) and provided with an opening formed along one side of a cassette housing and a cut-out communicating with the opening and formed in a bottom wall of the housing. When the tape cassette is loaded into a cassette holder of the VTR, tape loading pins mounted on a loading ring are engaged in the cut-out of the cassette housing. Upon rotation of the loading ring, the tape loading pins withdraw the tape from the cassette housing to wrap the tape around the peripheral surface of a guide drum of the VTR.

Such a tape cassette is usually provided with a cover which is mounted on the housing for movement between a closed position in which it covers the opening in the housing and an open position in which the opening is exposed, whereby the tape is prevented from being accidentally damaged. When the cassette is loaded into the cassette holder, the cover is moved from the closed position to the open position to permit withdrawal of the tape through the opening.

However, the above-mentioned kind of tape cassette has a disadvantage that dust is apt to adhere on the surface of the tape, because the rear side of the tape is exposed through the cut-out even when the cover is in the closed position. Dust on the tape can cause a reduction in the quality of recording and reproduction by the tape.

According to the 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 a top wall, a bottom wall and a peripheral edge wall extending between the top and bottom walls along three sides of the housing so as to form an opening along the fourth side of the housing; first and second cut-outs in the top and bottom walls respectively communicating with the opening and extending along a portion

of the fourth side of the housing, the tape being guided between the reels in a path having a run extending along the opening; a front cover mounted on the housing and movable relative thereto between a closed position covering the opening and an open position exposing the opening; and an inner cover coupled to and movable in conjunction with the front cover between said closed position wherein the inner cover is positioned behind the front cover and said open position wherein the inner cover is moved away from the rear side of the tape so that said run of the tape can be engaged through the second cut-out for withdrawal of the tape through the opening, the inner cover having an integrally formed top portion which closes the first cut-out in said closed position and said run of the tape being enclosed by the front cover and the inner cover in said closed position.

In such a tape cassette the tape passing along an opening of the cassette can be completely enclosed when the cassette is not in use.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:-

Figure 1 is a perspective view showing a tape cassette according to the invention for a VTR;

Figure 2 is a plan view of the tape cassette of Figure 1 with an upper wall of a housing thereof partially cut away;

Figure 3 is an exploded perspective view of the front portion of the tape cassette of Figures 1 and 2;

Figure 4 is a fragmentary sectional view taken on line IV - IV of Figure 2; and

Figures 5 and 6 are views similar to Figure 4 but showing a front cover and an inner cover of the tape cassette in successive positions adopted during an opening operation.

Referring first to Figure 1, there is shown a tape cassette 1 for a VTR, the tape cassette 1 comprising a housing formed by an upper half 2 and a lower half 3 both made of a synthetic resin. The upper half 2 and the lower half 3 are vertically fitted together. The housing accommodates, as shown in Figure 2, rotatably mounted tape reels 4 and 5, and a magnetic tape 6 (hereinafter referred to as "the tape") is wound around the tape reels 4 and 5.

In the front edge of the housing of the tape cassette 1, as shown in Figures 2 and 3, an opening 9 is provided extending for almost the full width

of the cassette, while a substantially trapezoidal cut-out 11 contiguous to the opening 9 is formed in a bottom wall 10 of the lower half 3. A cut-out 13 contiguous with the opening 9 is formed in a top wall 12, and extends for substantially the entire width of the cassette.

The opening 9 is normally covered by a generally U-shaped front cover 14. The cut-out 13 can be closed by a top cover portion 41 of an inner cover 34 described hereinafter. A pair of pivot projections 17 are integrally and coaxially formed on the inner faces of side limb portions 15 and 16 of the U-shaped front cover 14. The pivot projections 17 engage in apertures 18 formed in the side edges of the housing of the tape cassette 1. The front cover 14 is pivotable on the pivot projections 17 through an angle of about 90°. A pair of torsion springs 19 are mounted on the pivot projections 17. Front and rear limbs 19a and 19b of the torsion springs 19 are respectively supported by spring fixing projections 55 formed integrally to extend inward from limb portions 15 and 16 of the front cover 14 and by spring holding steps 56 formed at each end of the tape cassette 1. The front cover 14 is constantly biased in a closing direction by the torsion springs 19. The pivots 17 are supported at positions slightly rearwardly of the positions at which they are provided in a conventional tape cassette. With this arrangement, the pivot locus of the front cover 14 may not overly extend in front of the tape cassette 1.

Along the trapezoidal cut-out 11, as shown in Figure 3, a vertical partition 22 projecting from the bottom wall 10 stands upright and abuts a vertical partition 22 projecting from the top wall 12, whereby the interior of the tape cassette 1 is partitioned from the cut-out 11 and the cut-out 13 by the vertical partition 22.

A pair of tape guide portions 23, the surfaces of which are rounded and smooth, are formed one at each end of the vertical partition 22, whereby the tape 6 is guided and passed along the opening 9. A respective generally upright guide groove 24 is formed in each of inwardly facing side portions 22a of the vertical partition 22, at the sides of the cut-out 11. the guide grooves 24 serve to guide a pair of pins 49 of the inner cover 34. Each guide groove 24 comprises a rearwardly inclined portion 25, a generally vertical portion 26 and a curved portion 27, as shown in Figures 4 to 6. The portions of the housing forming the opposite sides of each of the pair of guide grooves 24 are formed one by the top half 2 and the other by the

bottom half 3 so as to avoid undercuts in moulds used to form the housing halves 2 and 3.

As shown in Figures 3, the front cover 14 includes a front plate 30 and a top plate 31 which cover the opening 9 and part of the cut-out 13, respectively. A pair of brackets 32 are formed on the underside of the top plate 31 of the front cover at positions adjacent the end portions thereof. In apertures 33 in the brackets 32 are engaged support pins 35, which are arranged integrally and coaxially at approximately the mid-position in the height of the inner cover 34. Therefore, the inner cover 34 can pivot on the pair of support pins 35.

Portions of the inner cover 34 extend from the support pins 35 at an angle to one another as shown in Figure 4. The portion extending downwardly from the support pins 35 is an opposing portion 36 extending parallel to the rear surface of the tape 6. At the lower edge of the opposing portion 36 there is an inclined portion 38 which is inclined toward a lower edge 37 of the front plate 30. A lower end 39 of the inclined portion 38 is normally in contact with the lower end 37 of the front plate 30. The portion extending upwardly from the support pins 35 forms a substantially U-shaped bent portion 40. The top cover portion 41 is integrally coupled to the upper end of the bent portion 40. The top cover portion 41 is normally coplanar with the top plate 31 of the front cover 14 and the top wall 12 of the housing upper half 2 so as completely to close the cut-out 13 as shown in Figure 4. More specifically, inclined surface portions 42 and 43 are formed at the front and rear edges of the top cover portion 41. Inclined surface portions 44 and 45 are formed at the rear edge of the top plate 31 and on the housing half 12 at the edge of the cut-out 13, respectively. The inclined surface portions 42, 44, 43 and 45 are in tight contact with each other to close the cut-out 13.

As shown in Figures 2 to 6, a pair of integral brackets 48 project from the rear face of the inclined portion 38 of the inner cover 34, at the ends thereof. The pins 49, which are formed integrally and coaxially with each other, are attached to tip end portions of the pair of brackets 48 and project horizontally outwardly. The pins 49 are slidably engaged in the pair of guide grooves 24 formed in the inwardly facing side portions 22a at the ends of the vertical partition 22.

In the tape cassette 1 having the construction described above, normally the front surface of the portion of the tape 6 passing along the opening 9 is covered by the front cover 14 and its rear surface is covered by the inner cover 34, that is to say the position shown in Figure 4. The cut-out 13 is completely sealed by the top plate 31 of the front cover 14 and the top cover portion 41 of the inner cover 34. Therefore, the tape 6 passing along the opening 9 is almost sealed by the front cover 14 and the inner cover 34, and is thereby protected against damage.

When the tape cassette 1 is loaded into a VTR, the front cover 14 and the inner cover 34 pivot upward, whereby the front and the rear faces of the tape 6 are exposed. At the same time, a tape loading guide (not shown) is inserted through the cut-out 11 to allow loading of the tape 6. For example, when the tape cassette 1 is inserted into a cassette holder or the like of the VTR, and is then moved downward towards a cassette loading position, one of the end limbs 15 and 16 of the front cover 14 is pushed up by a projection 52 on the VTR so that the front cover 14 is pivoted upwardly against the torsion springs 19. Meanwhile, the pins 49 of the inner cover 34 move upward and are guided by the pair of guide grooves 24. Therefore, the inner cover 34 is also opened while being guided by the pair of guide grooves 24. More specifically, in the initial stages of the covers opening operation, the pair of pins 49 are guided by the pair of inclined portions 25 to be moved upwardly and rearwardly. The inner cover 34 thus pivots counterclockwise about the support pins 35, and the lower edge 39 of the inner cover 34 rapidly moves rearwardly behind the tape 6. Then, a large space is formed between the lower edge 37 of the front cover 14 and the lower edge 39 of the inner cover 34. Even if the tape 6 is slightly slack, it will not be damaged by being pressed against the front cover 14 or the inner cover 34.

In an intermediate stage of the cover opening operation, as shown in Figure 5, the pair of pins 49 move vertically upward by being guided by the generally vertical portions 26 of the grooves 24. Then, the lower edge 39 of the inner cover 34 moves vertically upward at a spacing from the rear surface of the tape 6. On the other hand, since the pivots 17 of the front cover 14 are arranged at relatively rearward positions, the lower edge 37 of the front cover 14 does not overly project at the front side of the tape cassette 1. Accordingly, the space factor at the front side of the cassette tape 1 under the loaded mode, may be improved compared with conventional

cassettes, so that VTRs may be made more compact in size. A recess 53 is formed by the bent portion 40 of the inner cover 34. When the front cover 14 and the inner cover 34 open, as shown in Figures 5 and 6, a distal edge 54 of the top plate 31 of the front cover 14 can be smoothly engaged in this recess 53.

In the terminal stage of the covers opening operation, as shown in Figure 6, the pair of pins 49 move upward by being guided by the pair of curved portions 27 of the grooves 24. The lower edge 39 of the inner cover 34 moves upward and backward, to bring it to the outside of the cut-out 13, and the cut-out 13 is completely opened. The space between the tape 6 and the vertical partition 22 is thus relatively great and the tape loading guide of the VTR, for example, may be deeply inserted through the cut-out 11, so that the tape 6 may be correctly loaded and the tape cassette 1 may be made thin.

The above description concerns an opening operation of the front cover 14 and the inner cover 34 that is to say as a cassette 1 is loaded into the cassette loading position of a VTR. In the case of the tape cassette 1 being removed from the VTR, the cover closing operation of the front cover 14 and the inner cover 34 is the reverse of the above-mentioned case.

Various modifications are possible within the scope of the appended claims. For example, in the above embodiment, a pair of torsion springs 19 are respectively mounted on the pair of pivots 17 of the front cover 14. However, since the front cover 14 and the inner cover 34 are interlocked, a torsion springs can be mounted on either of the front cover 14 and the inner cover 34. If desired, torsion springs need not always be provided at each end in a pair, but can be sufficient if first one is provided at one end, this can be useful for facilitating the design of the tape cassette 1.

Furthermore, the invention is not limited to tape cassettes for VTRs but may be applied to tape cassettes of other various types of information processing devices.

As has been described earlier, the tape passed along the opening is almost completely sealed with a minimum number of parts comprising two covers (front cover and inner cover). Therefore, the number of parts and consequent assembly steps involved can be small, and the structure can be simple. Still, the tape cassette of the invention does not allow dust or the like to adhere to the tape, or the tape to get damaged by other causes.

Furthermore, the cut-out 13 formed in the top wall of the tape cassette and the upper cover to close this upper notched portion is opened together with the inner cover. Therefore, the space from the inside of the cut-out to the rear side of the tape is widened by the amount of the upper cut-out, and thus, the insertion of the tape loading guide or the like may be ideally performed.

The inner cover is pivotally supported to the front cover, the front cover and the inner cover are opened/closed in co-operation with each other, and the top cover plate is formed integrally with the inner cover. Therefore, opening only one of the front cover and the inner cover results in opening both covers. For this reason, the biasing means (torsion springs) for closing the front cover and the inner cover, the projections arranged at the cassette loading positions and the like may be reduced to the minimum in number, so that the tape cassette and the cassette loader may be simplified in structure.

* C L M S *

CLAIMS

1. A tape cassette comprising: a housing of generally rectangular configuration containing reels on which a supply of tape is wound and having a top wall, a bottom wall and a peripheral edge wall extending between the top and bottom walls along three sides of the housing so as to form an opening along the fourth side of the housing; first and second cut-outs in the top and bottom walls respectively communicating with the opening and extending along a portion of the fourth side of the housing, the tape being guided between the reels in a path having a run extending along the opening; a front cover mounted on the housing and movable relative thereto between a closed position covering the opening and an open position exposing the opening; and an inner cover coupled to and movable in conjunction with the front cover between said closed position wherein the inner cover is positioned behind the front cover and said open position wherein the inner cover is moved away from the rear side of the tape so that said run of the tape can be engaged through the second cut-out for withdrawal of the tape through the opening, the inner cover having an integrally formed top portion which closes the first cut-out in said closed position and said run of the tape being enclosed by the front cover and the inner cover in said closed position.

2. A tape cassette according to claim 1, in which the inner cover is hinged on the front cover, whereby the inner cover is moved from said closed position to said open position by movement of the front cover from said closed position to said open position.

3. A tape cassette according to claim 2, in which the inner cover has a guide pin, at least at one end thereof, engaging in a guide groove which is formed at a portion of the peripheral edge wall of the housing so that the inner cover is moved along the guide groove as the inner cover is moved between said closed position and said open position.

4. A tape cassette according to claim 3, in which the housing comprises an upper half forming the top wall and an upper part of the peripheral edge wall and a lower half forming the bottom wall and a lower part of the

peripheral edge wall, and in which the inner cover extends along the length of the cut-outs, the housing having an inner peripheral edge wall along said cut-outs, and said guide groove being formed on an end portion of said inner peripheral edge wall.

5. A tape cassette according to claim 4, in which said end portion of the inner peripheral edge wall comprises a front part wall and rear part wall which are respectively formed integral with the top wall and the bottom wall with the guide groove formed between the front part wall and the rear part wall.

6. A tape cassette according to claim 5, in which said front part wall has a tape guiding surface at its front edge to guide said run of the tape.

7. A tape cassette substantially as hereinbefore described and illustrated with reference to the accompanying drawings.