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"TAPE CASSETTE"

The invention relates to a tape cassette and more particularly to a tape cassette suitable for use for recording and reproducing digital signals, for example a PCM (pulse code modulated) signal.

5 In an ordinary tape cassette such as a standard type tape cassette now widely used in which no lid is provided at its front opening portion, the tape cassette is provided with a tape-end sensing mechanism for sensing the end of tape winding or tape rewinding.

10 In such a tape end sensing mechanisms, it is proposed electrically to sense a small piece of aluminum foil which is attached to, for example, the tape beginning or end, or optically to sense a transparent leader tape which is bonded to the tape beginning or end.

15 The conventional tape-end sensing means or mechanism to detect the tape beginning or end can easily be provided in such prior systems because the above tape cassette casing has no lid provided at its front opening portion.

20 However, in a tape cassette in which an analog signal is converted to a PCM signal and then recorded on a tape and in which when it is loaded onto a PCM signal recording and reproducing apparatus, the tape is usually extracted out of the tape cassette, the tape cassette is required to have a lid to prevent fingerprints, dust, or the like from adhering to the tape extending over the front opening portion of the cassette casing upon non-use. As a result, it is quite difficult to incorporate the tape-end sensing means of the non-lidded tape cassette to one having a lid at its front opening portion. However, it is desirable that the above lidded tape
25 cassette be provided with tape-end sensing means.

30 According to the invention there is provided a tape cassette comprising a casing and a lid with the lid having a front portion, for protecting a tape stretched and transported over a front opening portion of the cassette casing, and side portions extending from the front portion; the tape cassette further comprising means pivotally supporting the lid side portions on side portions of the cassette casing;



a first aperture formed in a pivoting side portion of the lid;
a second aperture formed in the cassette casing; and
a sensor chip provided within the cassette casing and forming an optical path in correspondence with the second aperture and which crosses the tape transport path, the first and second apertures being aligned when the tape cassette is in a condition of use in which the lid is in an open position and being non aligned when the tape cassette is in a storage condition in which the lid is closed, so that the second aperture is closed in the storage condition and the sensor chip disposed within the cassette casing is protected.

Advantageously a third aperture is formed in said side portion of the lid;
a fourth aperture is formed in the cassette casing; and
when said tape cassette is in the condition of use with the lid in the open position, the third and fourth apertures are aligned;
the arrangement being such that in the condition of use light from a light source in a tape cassette player can enter the cassette casing through the aligned first and second apertures, impinge on the tape, pass through the tape if the portion of the tape extending across the optical path is transparent, and exit from the cassette casing through the aligned third and fourth apertures to impinge on light sensitive means of the tape cassette player.

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

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

Figure 2 is an exploded perspective view of the tape cassette shown in Figure 1;

Figure 3 is a side view illustrating a main part of Figure 1;

Figure 4 is a cross-sectional side view taken on line IV-IV in Figure 3; and

Figure 5 is a partially cut-out perspective view illustrating a main part of the inside of the upper half in Figure 1.

Referring to the drawings and firstly to Figure 1, a tape cassette 1 can be loaded into and used by PCM signal recording and reproducing apparatus (not shown). The tape cassette 1 comprises an upper half 2, a

lower half 3, a front lid 4 and a back or inside lid 5 to protect a tape 6 stretched over a front opening portion of the cassette 1.

Further, in the tape cassette 1, as can be seen in Figure 2, a window 16 is formed through the upper half 2 and a window plate 16a of transparent synthetic resin closes the window 16. Between the upper half 2 and the lower half 3 are incorporated in turn a transparent sheet 21, a pair of hubs 22,22 around which the tape 6 is wound, and a transparent sheet 23. The front lid 4 and the inside lid 5, provided with a lid coil spring 20, are rotatably supported on the upper half 2 and the lower half 3 so as to be freely openable or closable. In the lower half 3, there are provided a pair of lubricant annular washers 24,24 and a brake device which is formed by a hub brake plate 25 and a brake leaf spring 26. Further, an unintentional-erase preventing member 17 and a lid lock 18 are provided on the lower half 3. Then, the upper half 2 and the lower half 3 are fastened integral by engaging projections 27 and screws 28.

When the tape cassette 1 thus constructed is used, the front lid 4 and the back lid 5 are opened to expose the tape 6 stretched over the front opening portion of the cassette casing as shown in Figure 1, while during non-use, the front lid 4 and the back lid 5 are closed to the dotted line position of Figure 3, to protect both the front and the back surfaces of the tape 6. It is possible to inspect the wound amount and the winding state of the tape 6 wound on the hubs 22 through the transparent window 16 and the transparent sheet 21.

Further in the tape cassette 1 according to this embodiment, as shown in Figure 3, two square apertures 10a, 10b are respectively formed through lid side portions 9 of the front lid 4, and two square apertures 13a, 13b are respectively formed through casing side portions 12 of the tape cassette 1 so as to communicate with the above two square apertures 10a, 10b when the front lid 4 is rotated around an axis pin 11 upwards to be in the open state.

As shown in Figure 4, a sensor chip 14, which is preferably made of transparent synthetic resin and has an approximately L-shaped cross-section, is attached to the inside of each of the square apertures 13a of the lid side portions 12 of the tape cassette 1 to introduce a light therethrough.

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Each of the sensor chips 14, as shown in Figure 4 which is the front view of its attaching main part and in perspective view of Figure 5 which shows the same with the upper half 2 upside down, is attached such that a light incident surface end portion 14a of the sensor chip 14 is fitted into the square aperture 13a formed through the upper side of a casing side portion 12 or that the sensor chip 14 is fitted into the square aperture 13a formed through the chip 14 with its light incident surface end portion 14a being fitted into the square aperture 13a is bonded along its side surface 14b to the inside surface of the upper half 2. The sensor chip 14 is disposed such that the optical path passing through the square aperture crosses the tape transport path. In other words, each of the sensor chips 14 is disposed such that the tape 6 is transported in the space between a reflection end portion 14c of the sensor chip 14 and the square aperture 13b of the casing side portion 12.

When the above tape cassette 1 is loaded into a PCM signal recording and reproducing apparatus not shown and used for recording and reproducing the PCM signal, the front lid 4 and the back lid 5 of the tape cassette 1 are brought into the open state shown in Figure 1 and a light emitting element 7 and a light receiving element 8, which constitute a tape-end sensing apparatus to detect or sense the leader tape of the tape 6, are disposed at a predetermined position outside each of both side portions of the front opening portion of the tape cassette 1.

As shown by an optical path 15 in Figure 4, light emitted from the light emitting element 7, which is provided in the recording and reproducing apparatus, passes through the square apertures 10a and 13a, is introduced from the incident surface end portion 14a of the sensor chip 14 thereinto, reflected on the reflection surfaces formed on the angled reflection surface 14d and the reflection end portion 14c, passed through the tape 6 and the square apertures 13b, 10b and is incident on the light receiving element 8.

When the tape 6 intersecting the optical path 15 is a magnetic tape on which a magnetic recording and reproducing surface is formed, the light is interrupted thereby and does not reach the light receiving element 8, but when the tape 6 is the transparent leader tape, light is passed through the tape 6 and introduced into the light receiving element 8. Accordingly, the leader tape can be detected by whether or not the light is incident on the light receiving element 8. As a result, it becomes possible for the PCT

signal recording and reproducing apparatus to stop its recording operation or to perform its auto reverse operation by detecting the tape beginning and tape-end.

5 When the tape cassette 1 of this embodiment is in its non-use state, as shown in dotted lines in Figure 3, the front lid 4 is rotated around the pivot pin 11 and closed so that in association therewith, the two square apertures 10a, 10b of each of the lid side portions 9 are displaced from the two square apertures 13a, 13b of each of the casing side portions 12 of the tape cassette 1, with the square apertures 13a, 13b thus being covered by the lid side portion 9. Therefore, the incident surface end portion 14a of the sensor chip 14 can be prevented from being scratched or damaged from the outside.

10 Since the sensor chip 14 of this embodiment is disposed at the inside of the tape cassette 1, its reflection end portion 14c or the like is protected from being scratched or damaged from the outside. Thus the sensor chip 14 cannot be scratched or dirtied and hence the apparatus is reliable.

15 Furthermore, when the tape cassette 1 is in a non-used condition the two square apertures 10a, 10b of the lid side portions 9 are respectively displaced from the square apertures 13a, 13b of the casing side portions 12 of the tape cassette 1 and the square apertures 13a, 13b of the casing side portions 12 are covered by the lid side portions 9, whereby dust or the like is prevented from entering into the tape cassette 1.

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CLAIMS

1. A tape cassette comprising a casing and a lid with the lid having a front portion, for protecting a tape stretched and transported over a front opening portion of the cassette casing, and side portions extending from the front portion;

5 the tape cassette further comprising means pivotally supporting the lid side portions on side portions of the cassette casing;

a first aperture formed in a pivoting side portion of the lid;

a second aperture formed in the cassette casing; and

10 a sensor chip provided within the cassette casing and forming an optical path in correspondence with the second aperture and which crosses the tape transport path, the first and second apertures being aligned when the tape cassette is in a condition of use in which the lid is in an open position and being non aligned when the tape cassette is in a storage condition in which the lid is closed, so that the second aperture is closed in the storage condition and the sensor chip disposed within the cassette casing is
15 protected.

2. A tape cassette according to claim 1, in which a third aperture is formed in said side portion of the lid;

20 a fourth aperture is formed in the cassette casing; and

when said tape cassette is in the condition of use with the lid in the open position, the third and fourth apertures are aligned;

25 the arrangement being such that in the condition of use light from a light source in a tape cassette player can enter the cassette casing through the aligned first and second apertures, impinge on the tape, pass through the tape if the portion of the tape extending across the optical path is transparent, and exit from the cassette casing through the aligned third and fourth apertures to impinge on light sensitive means of the tape cassette player.

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