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SPECIFICATION

MAGNETIC TAPE CASSETTE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a magnetic tape cassette having a friction reduction sheet provided with a rib-shaped projection between a case and hubs respectively components of the cassette.

2. Description of the Prior Art:

A prior magnetic tape cassette of this type will be described with reference to Figs. 8 and 9.

The prior magnetic tape cassette comprises a box type case composed of an upper shell 1 and a lower shell 2 laid over the upper shell 1, a pair of hubs 6, 6 around which a magnetic tape 5 is wound being rotatably supported in the case 1, and friction sheets 7, 7 being inserted between the upper shell 1 and the magnetic tape 5 or between the lower shell 2 and the magnetic tape 5.

The friction sheets 7, 7 are formed by materials which are processed to reduce a resistance value of the friction sheet relative to the magnetic tape so that the friction between the friction sheets 7, 7 and the magnetic tape 5 does not generate a static electricity. The friction sheets 7, 7 which are inserted at the side of the upper shell 1 having a transparent plate 3 are usually

transparent so that a winding operation of the magnetic tape 5 will be observed.

The friction sheets 7, 7 have respectively a pair of convexed ribs 8, 8 made by an embossed process and the ribs 8, 8 interpose therebetween hub holes 9, 9 in which the hubs 6, 6 are engaged. The friction sheets 7, 7 interpose therebetween the hubs 6, 6 and the magnetic tape 5 wound around the hubs 6, 6 at both insides thereof so that the magnetic tape 5 is wound in order, namely an order winding is increased and the magnetic tape 5 is travelling in smooth, namely a travelling characteristic is increased by reducing a contact friction between the friction sheets and the magnetic tape.

To achieve the effect just mentioned above, materials of the prior friction sheets 7, 7 and shapes of the ribs 8, 8 are improved in various manners. For example, there is a known cassette employing the friction sheets having elongate or round convexed ribs 8, 8 which are respectively placed in a predetermined positions. Although shapes of top portions of these convexed friction sheets are somewhat different, for example, round, flat, pointed with an acute angle, longitudinal cross sectional areas of these convexed ribs respectively have a single top portion, or a sole apex.

The convexed ribs 8, 8 of the prior friction sheets have respectively the single top portions each having the sole apex so that load of the magnetic tape 5 and hubs 6,

6 are concentrated to the sole apex which results in reducing elastic force of the ribs 8, 8 whereby the ribs 8, 8 can not elastically support the hubs 6, 6 and the magnetic tape 5. The ribs 8, 8 of the friction sheets 7, 7 contact with the hubs 6, 6 substantially at middle portions in the longitudinal directions of the ribs 8, 8. The ribs 8, 8 at the middle portions are easily bent and weak in the repulsive force. Provided that the ribs 8, 8 receive the load of the hubs 6, 6 the elastic force of the ribs 8, 8 at the portion receiving the load will be reduced at an early time so that the ribs 8, 8 of the friction sheets 7, 7 can not elastically support the hubs 6, 6. That is, the projections, namely the ribs 8, 8 lose their elasticity at the top portions thereof, and the top portion will be stretched and flat.

In any case, when the tape is continuously travelled or wound there occurs such phenomenon as edges of the magnetic tape 5 are not wound in order, so-called disorder winding or as the wound tape produces a stepped portion, so-called stepped drop. If such phenomena will occur the magnetic tape travels unstably and is dameged at the edges thereof to thereby obstruct a play and a record of the tape 5.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a magnetic tape cassette having a friction reduction sheet

to solve the problems of the prior magnetic tape cassette. It is another object of the present invention to provide a magnetic tape cassette having a friction reduction sheet enabling to hold stably the hubs at a normal position for a long period of time so that the resistance value is averaged.

It is still another object of the present invention to provide a magnetic tape having a characteristic of superior order winding and a superior travelling characteristic.

According to the present invention there is provided a friction reduction sheet for a magnetic tape cassette, which friction reduction sheet comprises at least one rib, positionable in contact with the magnetic tape of the cassette, the rib having two or more apexes.

The object of the present invention is achieved by providing a magnetic tape cassette provided with the friction reduction sheet.

The magnetic tape cassette of the present invention comprises a box type case composed of an upper shell 11 and a lower shell 12 laid over the upper shell 11, a pair of hubs 16, 16 around which a magnetic tape 15 is wound being accommodated in and rotatably supported by the case, friction reduction sheets 17, 17 having convexed ribs 18, 18 being provided at the side of the magnetic tape 15 and inserted between the magnetic tape 15 and the upper shell and between the magnetic tape 15 and the lower shell 12, characterized in that the convexed ribs 18, 18 have respectively a plurality of top portions or apexes.

Another magnetic tape cassette not according to the present invention comprises a box type case composed of an upper shell and a lower shell 32 laid over the upper shell, a pair of hubs 34, 35 around which a magnetic tape 36 is wound being accommodated in and

rotatably supported by the case, and friction reduction sheets 33, 33 having convexed ribs 43, 43 being provided at the side of the magnetic tape 36 and inserted between the magnetic tape 36 and the upper shell and between the magnetic tape 36 and the lower shell 32, characterized in that end portions 44, 44 of the convexed rib 43, 43 are respectively brought into contact with the hubs 34, 35.

The above and other objects, features and advantages of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view of a magnetic tape cassette shown from the bottom side thereof according to a first embodiment of the present invention;

Fig. 2 is a cross-sectional view taken along II-II of Fig. 1;

Fig. 3 is a plan view of a magnetic tape cassette omitting an upper shell thereof not according to the present invention;

Fig. 4 is a perspective view of a friction reduction sheet employed in the magnetic tape cassette not according to the present invention;

Fig. 5 is a cross-sectional view taken along V-V of Fig. 4;

Fig. 6 is a perspective view of a friction reduction sheet employed in a magnetic tape cassette not according to the present invention;

Fig. 7(a), and 7(c) are respectively illustrating cross-sectional views of various ribs of the friction reduction sheets not according to the present invention;

Fig. 7(b) illustrates a cross-sectional view of a rib of a friction reduction sheet according to the present invention;

Fig. 8 is an exploded perspective view of a prior magnetic tape cassette shown from the bottom side thereof; and

Fig. 9 is a cross-sectional view taken along IV-IV of Fig. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A magnetic tape cassette of the present invention will be described with reference to Figs. 1, 2 and 7b.

First Embodiment (Figs. 1 and 2)

A magnetic tape cassette of a first embodiment as illustrated in Figs. 1 and 2 is employed in a digital record/play audio magnetic tape cassette.

The magnetic tape cassette comprises a box type case composed of an upper shell 11 and a lower shell 12 laid over the upper shell 11, hub holes 14, 14 and hub stoppers 13, 13 respectively provided on the upper and lower shells 11, 12, hubs 16, 16 around which a magnetic tape 15 is wound being accommodated in the case and rotatably

supported by the hub holes 14, 14, and friction reduction sheets 17, 17 being inserted between the magnetic tape 15 and the upper shell 11 and between the magnetic tape 15 and the lower shell 12.

The friction reduction sheets 17, 17 respectively have ribs 18, 18 each formed by an embossed process. A pair of ribs 18, 18 interpose therebetween ventilators 19, 19 in which the hubs 16, 16 are engaged and have respectively convexed portions at the inside thereof faced the magnetic tape 15 and the hubs 16, 16. The convexed portions of the ribs are brought into contact with the side surfaces of the hubs 16, 16, when the magnetic tape cassette is assembled. The ribs 18, 18 have respectively a plurality of top portions or apexes which extend along the longitudinal direction of the friction reduction sheets 17, 17.

In the audio magnetic tape cassette, when the two ribs 18, 18 are formed in the friction reduction sheets 17, 17, a gap between two apexes is preferable to have an interval of 1 through 3 mm, particularly of 1.5 through 2 mm. Furthermore, a hight of a depth formed between two apexes is preferable to be one third or two thirds of that of the apexes respectively from the surface of the friction reduction sheets 17, 17.

The ribs 18, 18 of the friction reduction sheets extend in the entire length of the ribs 18, 18 but may be broken at the middle of the entire length provided that

the ribs 18, 18 are brought into contact with the hubs 16, 16.

Comparative Example (Figs. 3 through 5)

An embodiment not according to the present invention will be described with reference to Figs. 3 and 4 which is employed in a linear trucking analog record/play audio magnetic tape cassette. The magnetic tape cassette of this type has a case formed by laying an upper shell (which is omitted in Fig. 3) over a lower shell 32. A record/play head a inserted from an opening provided at the front side of the case is brought into contact with a magnetic tape 36 to record magnetically a signal and reproduce the signal.

The magnetic tape cassette further include hubs 34, 35 around which the magnetic tape 36 is wound, and a friction reduction sheet 33 which is inserted between the hubs 34, 35 and the lower shell 32. The friction reduction sheet 33 is formed by a rectangular thin synthetic resin such as, for example, polyethylene terephthalate plate, and has a pair of hub holes 42, 42 penetrating bosses of a pair of hubs 34, 35. The friction reduction sheet 33 has a plurality of ribs 43 each formed by an emboss process and being substantially semicircular in the cross section thereof and elongate in the long side thereof. The ribs 43 interpose therebetween the hub holes 42, 42, namely four ribs 43 are oppositely arranged relative to the hub holes 42, 42 and two ribs 43 are arranged between the hub holes and both ends of the friction reduction sheets 33. Each end 44 of the ribs 43 arranged at both ends of the friction reduction sheet 33 are disposed at a position inside the outer peripheries of the hubs 34, 35 so that only each end 44 of the ribs 43, 43 are brought into contact with the hubs 34, 35 when the magnetic tape cassette is assembled.

The rib 43 keeps its elastic force with ease at the end 44 thereof compared with that at the middle portion thereof so that the ribs 43, 43 can support stably the hubs 34, 35 for a long period of time without losing the elastic force at the early time and without being stretched.

This is caused by the fact that the ribs 43 form three walls projected from the friction reduction sheet 33 with the end 44 being a veltex of the triangle composed of the three walls to thereby increase a rigidity of the ribs 43 compared with the rigidity of the ribs provided at the central portion of the friction reduction sheet and obtain a high repulsive force.

Second Comparative Example (Fig. 6)

A further magnetic tape cassette not according to the present invention employs another type of friction reduction sheet 33. The friction reduction sheet 33 has one elongate rib 43 provided between hub holes 42, 42 and a pair of elongate ribs 43, 43 provided between ends of the friction reduction sheet 33 the hub holes 42, 42.

Each end 44 of the ribs 43, 43 is disposed at the inside of the outer peripheries of the hubs 34, 35 so that only the end portions 44 of the ribs 43 can be brought into contact with the hubs 34, 35 when the magnetic tape cassette is assembled. The end portions 44 of the ribs 43 keeps their elastic force compared with the ribs 43 provided at the middle portion of the friction reduction sheet 33 so that the ribs 43 can stably support the hubs 34, 35 for a long period of time without losing their elastic force at the early time and without being stretched.

MODIFIED EMBODIMENT (Fig. 7b)

A friction reduction sheet 33 employed in the present invention will be described with reference to Fig. 7 (b). The friction reduction sheet 33 have various type of ribs in cross sections thereof.

In Fig. 7 (a), the friction reduction sheet 33 not according to the present invention has a rib 43 formed substantially in trapezoid in cross section, in Fig. 7 (b), the friction reduction sheet 33 has a rib 43 having two apexes at the top thereof which is substantially same as that disclosed in Fig. 2, and in Fig. 7 (c), the friction reduction sheet 33 not according to the present invention has a rib formed substantially in triangle.

Although the invention has been described in its preferred form with a certain degree of particularity, it is to be understood that many variations and changes are possible in the invention without departing from the scope thereof.

Reference is hereby made to co-pending U.K. Patent Application No. 8906595.7 (published as GB-A-2212783), the matter for which protection is claimed being a friction reduction sheet for a magnetic tape cassette, which friction reduction sheet comprises a hub hole, within which hub hole, a hub of the magnetic tape cassette is positionable, first and second ribs, the respective, substantially parallel, longitudinal axes of which ribs extend on opposite sides of the hub hole and a third rib, the longitudinal axis of which extends across the hub hole, one end of the third rib being positioned adjacent the hub hole.

CLAIMS

1. A friction reduction sheet for a magnetic tape cassette, which friction reduction sheet comprises at least one rib, positionable in contact with the magnetic tape of the cassette, the rib having two or more apexes.

2. A friction reduction sheet according to Claim 1, wherein the ribs of the friction sheet extend longitudinally for the entire length of the friction sheet.

3. A friction reduction sheet according to Claim 1 or 2, wherein the depth of valley between apexes of a rib is one third of a height of the apexes.

4. A magnetic tape cassette comprising a friction reduction sheet according to Claim 1.

5. A magnetic tape cassette comprising:

a box type case composed of an upper shell and a lower shell laid over the upper shell;

a pair of hubs around which a magnetic tape is wound being accommodated in the case and rotatably supported by hub holes defined respectively in the upper and lower shells; and

a friction reduction sheet according to Claim 1, 2 or 3, the friction reduction sheet being inserted between the magnetic tape and the upper and lower shells.

6. A friction reduction sheet substantially as hereinbefore described with reference to and as shown in, Figures 1, 2 and 7(b) of the accompanying drawings.

7. A magnetic tape cassette substantially as hereinbefore described with reference to, and as shown in, Figure 1 of the accompanying drawings.

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