

Description

This invention generally relates to a novel structure for the tape reels of a tape cassette to improve operation of the tape cassette and avoid damage of the tape.

A conventional tape cassette tape reel structure is described in US-A-4,560,117, issued to SHIMUZU, and shown in Figure 1 herein. This figure illustrates top and bottom cassette halves 10, 12, respectively, moulded of a clear synthetic resin, a tape guide 14, guide rollers 16 and guide pins 18 located at the front of the cassette half 12. The top and bottom cassette halves 10, 12, each include a pair of annular rings 20 and are connected via screws 22. A pair of tape reels 24 are mounted for centring and rotational support on the annular rings 20. The tape reels 24, which receive the tape 32 thereon, include a pair of planar, parallel and circular flanges 30. The flanges 30 are each stamped components made of metal, such as aluminium, and are attached to a synthetic resin hub 26 via a plurality of raised plastic fitting projections 40 with four circular resin washers 28 therebetween.

Metal is used to form these flanges because the required strength or structural integrity of the flange can be accomplished using a metal flange which is thinner than a comparable plastic flange. As a result, material costs and space usage can be minimised. However, when the flanges are stamped from metal, the edges are necessarily formed perpendicular to the flat, parallel tops and bottoms. In addition, the edges invariably develop burrs through the stamping process which abrade the edges of the tape travelling thereacross during operation. Further, during assembly and later handling, it is possible that one or both of these flanges could be permanently bent. Bending of the flanges occurs particularly when the related tape reel does not include any tape and the cassette halves are pinched in some manner. Once the flanges are bent, the edges of the travelling tape contact the edges of the bent flange or flanges, which also causes tape damage.

The hub 26 has an inner peripheral step 34 formed at a diameter slightly larger than the outside diameter of the corresponding annular ring 20. The ends of the annular rings 20 abut the hubs 26 only at the inner peripheral step 34, such that both sides of the tape reel 24 and the metal flanges 30 are separated from the cassette halves 10, 12 by a specific clearance. Spindles of a tape player recorder (not shown) are received by the centre holes 36 formed in the hubs 26, and radial projections 38 extending into the centre holes 36 engage the spindles to transfer torque from the rotating spindles to the tape reels 24 through the hub 26.

According to this conventional tape reel sup-

porting structure, the only area of contact between the tape reels and the tape cassette is between the pair of inwardly extending annular rings of relatively small diameter formed on each plastic tape cassette half, and the corresponding inner peripheral steps formed on each plastic tape reel hub for centring purposes. Support of the tape reels in this manner causes the abutting plastic inner peripheral steps and the plastic annular rings to wear due to friction, which in turn generates unwanted noise and debris. In addition, supporting via a relatively small diameter permits skewing of the tape reels relative to each other within the tape cassette, leading to possible edge damage of the tape moving between the skewed tape reels.

From the foregoing, it can be seen that an improved tape reel for a tape cassette is desired which minimises wear, maintains its intended position and prevents damage to the travelling tape.

GB 2029372 describes a cassette tape containing a pair of tape reels each including a tape reel hub with two substantially flat flanges connected at upper and lower positions on the outer sides of the hub. Each flange has a planar top and a planar bottom and the tape reel hub comprises a substantially tubular body with an annular surface disposed at either end of the body in a plane perpendicular to the axis of rotation.

In GB 2135653 a computer tape reel is described which has a hub and flanges in an arrangement similar to that of GB 2029372. The ends of the flanges furthest from the hub can be seen in the accompanying Figures to have slightly rounded edges. WO 85/04041 details a reel for open reel type cassettes comprising flanges which have chamfered outer circumferential edge parts.

In accordance with the present invention a tape cassette comprises first and second cassette halves, each half having interior and exterior surfaces, a pair of apertures extending from the exterior to interior surfaces and being surrounded by an inwardly extending annular projection formed in the interior surface which is aligned with an aperture and an annular projection on the other cassette half; a pair of tape reels, each including: a hub, first and second flanges, each having a planar top, a planar bottom and a curved circumferential edge joining the planar top and bottom, the bottoms being connected to the hub; openings formed centrally in the hub for receiving the annular projections; characterised in that the cassette halves each have an elliptical recessed area formed in the interior surface; a pair of low-friction, flat washers received by the recessed areas; the openings formed centrally in the hub receive the annular projections with a clearance therebetween along their entire surfaces; and an annular ring formed on the top of each flange to abut the respective wash-

ers, wherein the flanges are otherwise separated by a clearance from the two cassette halves.

The present invention provides a tape cassette with an economical, high quality tape reel assembly capable of being supported with low friction and of preventing damage to travelling tape.

The present invention also provides a tape cassette with a tape reel assembly capable of being easily formed and assembled by automation.

The tape reel assembly is capable of being rotatably supported farther out from its centre than prior art tape reels to improve stability and lessen friction at the area of support.

The present invention also provides a tape cassette with a tape reel assembly which efficiently and without damage dispenses tape across the magnetic head of a tape player/recorder.

Each flange has a raised, annular centring ring abutting and rotating only on the low-friction washers. These centring rings minimise friction, prevent skewing of the tape reels relative to each other and, along with the curved edges of the flanges, permit the tape to be wound without damage.

Preferred embodiments of the tape cassette and tape reel assembly of the present invention, in comparison with the prior art discussed above: (a) provide more efficient assembly and operation of a tape cassette; (b) require only two washers instead of four for ease and greater speed of assembly; (c) support the tape reels only via centring rings which have a sufficiently large diameter to minimise skewing of the tape reels relative to the ideal tape path, hence eliminating tape edge damage; (d) move the area of rotational support of the tape reels away from the relatively high friction tape cassette halves to the relative low friction washers to minimise wear, debris and noise; (e) prevent tape damage; and (f) due to the extensive use of plastic, provide a more efficiently manufactured tape cassette. In addition, the new tape cassette may be fabricated from different coloured plastics, ie. the top and bottom halves of the cassette may be of clear, styrene plastic, the washers made of a clear, anti-static-treated polyester film, the bridge made of a darker plastic such as "ABS" (acrylonitrile butadiene styrene) and the tape reels and rollers made of a darker plastic such as acetal. This contrasting colour combination provides an aesthetically pleasing tape cassette from a marketing standpoint, but, most importantly allows the manufacturer and user to view the operation of the cassette, which, of course, is a functional advantage.

An example of a tape cassette and tape reel assembly according to the present invention will now be described and contrasted with a known example with reference to the accompanying drawings, in which:-

Figure 1 is an exploded perspective view of conventional tape cassette, illustrating particularly the tape reels thereof;

Figure 2 is an exploded perspective view of the preferred embodiment of the tape cassette according to the present invention;

Figure 3 is a top plan view of one flange of the preferred embodiment of a tape reel assembly according to the present invention;

Figure 4 is a side, cross-sectional view of the preferred embodiment of the flange shown in Figure 3 according to the present invention, illustrating particularly the centring ring and the curved edges of flange;

Figure 5 is a bottom plan view of the preferred embodiment of the tape reel flange shown in Figures 3 and 4, illustrating the rib used to attach the flange to the hub;

Figure 6 is a side cross-sectional view of the rib shown in Figure 5;

Figure 7 is a left side, cross-sectional view of the tape cassette of Figure 2; and,

Figure 8 is a side, cross-sectional view of the curved edge of the flange shown in Figure 4.

The preferred embodiments of the present invention will now be described with reference to Figures 2-8.

For convenience of reference to the tape cassette shown in Figure 2, "front" indicates the area of the tape cassette exposed to the magnetic head of the tape player/recorder, "back" is the area opposite the front, "top" is the planar surface of the cassette facing up when the front of the cassette is inserted into the tape player/recorder, "bottom" is the opposite planar surface parallel to the top, and "sides" are the areas extending perpendicularly between and connecting the edges of the top and bottom.

Figure 2 illustrates a tape cassette 50 including a bottom cassette half 52 and a top cassette half 54 which are preferably made of a clear, hard plastic such as styrene. When assembled, the tape cassette 50 (and accordingly each cassette half 52 and 54) has a front 56, a back 58, a left side 60 and a right side 62.

Elevated areas 82 and 84 are formed in the bottom half 52 and the top half 54 of the tape cassette 50, respectively, for receiving a tape guide 86, such as described in detail in US-A-4,506,846, introduced above.

As described above, when a conventional metal flange is used and inadvertently bent during assembly or handling, tape damage results during operation. In addition, as with all tape cassettes, the tape reels have a certain amount of play due to intentional clearances. During operation, this play causes the metal flange edges to deleteriously contact the sides of the tape.

With the present invention, however, the flanges are made of plastic instead of metal for two important reasons. First, plastic has "memory", so that when a plastic flange is squeezed or pinched during assembly or handling, it will remember or rebound to its original shape. Second, by using plastic, the edges of the flange can be moulded to include an exact curve or radius, which eliminates all burrs or roughness and facilitates tape transport.

As also stated above, metal was chosen for conventional flanges to allow a reduction in the thickness of the flange. Since the present invention uses plastic flanges, the tape cassette must be modified. This modification involves taking material out of the tape cassette, i.e. recesses are created in the tape cassette top and bottom halves for receiving the tape reels with the preferred clearance, the support area of the tape reels is moved from the hub to the flanges, and the tape cassette halves 52 and 54 are made out of a more rigid material.

More particularly, positioned within the tape cassette 50 are a first tape reel 64 and a second tape reel 66 for moving the tape 68 across the tape guide 86, and tape rollers 74, 76. Each tape reel 64 and 66 is preferably made of darker-coloured plastic such as acetal, than the tape cassette halves 52 and 54. The tape rollers 74 and 76, which are also preferably made of a darker-coloured, hard plastic, such as acetal, are rotatably received by columns 78 and 80.

The tape reels 64 and 66 with tape 68 extending therebetween are positioned between two washers or liners 88 and 90, which are preferably flat and made of a clear, low-friction, flexible plastic such as an anti-static-treated polyester film. Each of the washers 88 and 90 is substantially a thin, elongate ellipse having holes 92 and 94, respectively, formed therein.

The combination of reels 64 and 66 and washers 88 and 90 are positioned in recessed areas 100 and 101 formed in the bottom and top halves, 52, 54, respectively, of the tape cassette 50.

The openings 92 and 94 formed in each washer 88, 90, and the openings 118 formed in each flange 110 of the tape reels 64, 66 receive in spaced relation the circular projections 96, 98 formed in the cassette halves 52, 54.

There is also formed in the front 56 of both the bottom half 52 and the top half 54 of the tape cassette 50 a left aperture 102 and a right aperture 104 for receiving the tape player/recorder roller (not shown) to be used together with a drive pin (not shown), and a central aperture 106 for receiving the magnetic head of the tape player/recorder.

As described above, the structures of the top half 54 and bottom half 52 are substantially the same except for minor modifications, so a basic mould could be used to make either half and then

the minor modifications could be made. By having substantially similar halves 52 and 54, overall production costs are minimised.

Figures 3 and 4 are a top plan view and a side cross-sectional view, respectively, of the preferred embodiment of the flanges 110. The flanges 110 of the tape reels 64, 66, in contrast to the metal flanges 30 of the prior art tape cassette discussed above, are made of plastic, thus enhancing economics of fabrication and assembly.

Each flange 110 is a circular, relatively flat member having three equally spaced, annular openings 112, 114 and 116 formed therein. In addition, the central opening 118 is formed in the flange 110 for receiving projections 96, 98 therethrough in spaced relation, as discussed above. Further, each circumferential edge 111 of the flange 110 is curved on the inner side 113 thereof which greatly eliminates damage to the tape travelling across the flange edges 111 (see Figure 8). Finally, a projecting means 120 is formed on the flange 110 just outside of the central opening 118 for contacting the low-friction washers 88, 90 when assembled. In the preferred embodiment, the projecting means 120 is a centring ring formed on the flange 110.

Figure 5 is a bottom plan view of the preferred embodiment of the flange 110 shown in Figures 3 and 4. This figure illustrates an annular projection 122 formed on the bottom of the flange 110, which is attached via ultrasonic welding to a corresponding annular recess 123 formed in each hub 124 (see Figures 2 and 7). An energy director 136 (Figure 6) is formed from the annular projection 122 to facilitate ultrasonic welding and may be interrupted to allow for knockouts, which are known in the art and result from the moulding process.

Again referring to Figure 2, during assembly, the hub 124 is assembled with a leader tape 126 via a staking rod 128 into a hole 130 formed in the hub 124. Then, the flanges 110 are centred on the hub 124 and ultrasonically welded thereto at the interface of the respective projections 122 and recesses 123. The assembled tape reels 64, 66 are then placed between the washers 88 and 90 and the cassette halves 52, 54, as described above.

As opposed to the prior art discussed above, the only area of rotatable support for the tape reels 64, 66, is the interface of the centring rings 120 and the washers 88 and 90. This tape reel support structure results in quiet, debris-free and low-friction operation.

The recessed areas 100, 101, provide adequate clearance for the tape reels 64, 66, thus allowing efficient rotation without contacting the tape cassette halves 52, 54 except at the centring rings 120. On the other hand, the areas 103, 105 of relative elevation around the perimeter of the tape

cassette halves 52 and 54 maintain proper orientation of the tape 68 relative to the tape reels 64, 66.

The foregoing is considered as illustrative only. For example, the above-described tape cassette has been shown to be of the type intended for use in analogue and digital audio tape player/recorder. However, the invention can be similarly applied to tape cassettes for use in video or other playing and/or recording apparatus. In addition, although a three-piece tape reel 62, 64 is described, a one-piece, integrally moulded, tape reel could be substituted.

Claims

1. A tape cassette comprising:

first and second cassette halves (52,54), each half having interior and exterior surfaces, a pair of apertures (96,98) extending from the exterior to interior surfaces and being surrounded by an inwardly extending annular projection formed in the interior surface which is aligned with an aperture (96,98) and an annular projection on the other cassette half; a pair of tape reels (64,66), each including: a hub (124), first and second flanges (110), each having a planar top, a planar bottom and a curved circumferential edge joining the planar top and bottom, the bottoms being connected to the hub; openings (118) formed centrally in the hub (124) for receiving the annular projections; characterised in that the cassette halves (52,54) each have an elliptical recessed area (100,101) formed in the interior surface; a pair of low-friction, flat washers (88,90) received by the recessed areas (100,101); the openings (118) formed centrally in the hub (124) receive the annular projections with a clearance therebetween along their entire surfaces; and an annular ring (120) formed on the top of each flange to abut the respective washers, wherein the flanges are otherwise separated by a clearance from the two cassette halves.

2. A tape cassette according to claim 1, wherein the first and second cassette halves (52,54) and the first and second washers (88,90) are formed of a clear material, and a tape guide (86) and the tape reels (64,66) and the first and second tape rollers (74,76) are formed of a relatively darker material.

3. A tape cassette according to claim 1 or claim 2, wherein the hub (124) and the first and second flanges (110) are plastic moulded and are connected via ultrasonic welding.

Patentansprüche

1. Eine Bandkassette, umfassend erste und zweite Kassettenhälften (52, 54), die jeweils innere und äußere Oberflächen aufweisen, wobei sich ein Paar Öffnungen (96, 98) von den äußeren zu den inneren Oberflächen erstreckt und von einem nach innen sich erstreckenden, an der inneren Oberfläche ausgebildeten ringförmigen Ansatz umgeben ist, der mit einer Öffnung (96, 98) und einem ringförmigen Ansatz an der anderen Kassettenhälfte ausgerichtet ist; ein Paar Bandspulen (64, 66), die jede eine Nabe (124) sowie erste und zweite Flansche (110), die jeder eine ebene Oberseite, eine ebene Unterseite und eine gekrümmte, an die ebene Ober- und Unterseite anschließende Umfangskante aufweisen, wobei die Unterseiten mit der Nabe verbunden sind; zentrisch in der Nabe (124) ausgebildete Öffnungen (118) zur Aufnahme der ringförmigen Ansätze; dadurch gekennzeichnet, daß die Kassettenhälften (52, 54) jeweils einen in der inneren Oberfläche gebildeten, elliptischen, zurückspringenden Bereich (100, 101) aufweisen; ein Paar in den zurückspringenden Bereichen (100, 101) aufgenommener, reibungsarmer flacher Scheiben (88, 90) vorgesehen ist; die zentrisch in der Nabe (124) ausgebildeten Öffnungen (118) die ringförmigen Ansätze mit einem Spiel dazwischen entlang ihrer gesamten Oberflächen aufnehmen; und ein an der Oberseite jedes Flansches gebildeter ringförmiger Rand (120) vorgesehen ist, um gegen die jeweiligen Scheiben anzuliegen, wobei die Flansche im übrigen durch Spiel von den beiden Kassettenhälften getrennt sind.

2. Eine Bandkassette nach Anspruch 1, bei der die ersten und zweiten Kassettenhälften (52, 54) sowie die ersten und zweiten Scheiben (88, 90) aus durchsichtigem Material und eine Bandführung (86) sowie die Bandspulen (64, 66) und die ersten und zweiten Bandrollen (74, 76) aus verhältnismäßig dunklerem Material gebildet sind.

3. Eine Bandkassette nach Anspruch 1 oder 2, bei der die Nabe (124) und die ersten und zweiten Flansche (110) aus Kunststoff geformt und durch Ultraschallschweißen verbunden sind.

Revendications

1. Cassette à bande comportant :

des première et deuxième moitié de cassette (52, 54), chaque moitié ayant des surfaces intérieures et extérieures, une paire d'ou-

cassette halves 52 and 54 maintain proper orientation of the tape 68 relative to the tape reels 64, 66.

The foregoing is considered as illustrative only. For example, the above-described tape cassette has been shown to be of the type intended for use in analogue and digital audio tape player/recorder. However, the invention can be similarly applied to tape cassettes for use in video or other playing and/or recording apparatus. In addition, although a three-piece tape reel 62, 64 is described, a one-piece, integrally moulded, tape reel could be substituted.

Claims

1. A tape cassette comprising:

first and second cassette halves (52,54), each half having interior and exterior surfaces, a pair of apertures (96,98) extending from the exterior to interior surfaces and being surrounded by an inwardly extending annular projection formed in the interior surface which is aligned with an aperture (96,98) and an annular projection on the other cassette half; a pair of tape reels (64,66), each including: a hub (124), first and second flanges (110), each having a planar top, a planar bottom and a curved circumferential edge joining the planar top and bottom, the bottoms being connected to the hub; openings (118) formed centrally in the hub (124) for receiving the annular projections; characterised in that the cassette halves (52,54) each have an elliptical recessed area (100,101) formed in the interior surface; a pair of low-friction, flat washers (88,90) received by the recessed areas (100,101); the openings (118) formed centrally in the hub (124) receive the annular projections with a clearance therebetween along their entire surfaces; and an annular ring (120) formed on the top of each flange to abut the respective washers, wherein the flanges are otherwise separated by a clearance from the two cassette halves.

2. A tape cassette according to claim 1, wherein the first and second cassette halves (52,54) and the first and second washers (88,90) are formed of a clear material, and a tape guide (86) and the tape reels (64,66) and the first and second tape rollers (74,76) are formed of a relatively darker material.

3. A tape cassette according to claim 1 or claim 2, wherein the hub (124) and the first and second flanges (110) are plastic moulded and are connected via ultrasonic welding.

Patentansprüche

1. Eine Bandkassette, umfassend erste und zweite Kassettenhälften (52, 54), die jeweils innere und äußere Oberflächen aufweisen, wobei sich ein Paar Öffnungen (96, 98) von den äußeren zu den inneren Oberflächen erstreckt und von einem nach innen sich erstreckenden, an der inneren Oberfläche ausgebildeten ringförmigen Ansatz umgeben ist, der mit einer Öffnung (96, 98) und einem ringförmigen Ansatz an der anderen Kassettenhälfte ausgerichtet ist; ein Paar Bandspulen (64, 66), die jede eine Nabe (124) sowie erste und zweite Flansche (110), die jeder eine ebene Oberseite, eine ebene Unterseite und eine gekrümmte, an die ebene Ober- und Unterseite anschließende Umfangskante aufweisen, wobei die Unterseiten mit der Nabe verbunden sind; zentrisch in der Nabe (124) ausgebildete Öffnungen (118) zur Aufnahme der ringförmigen Ansätze; dadurch gekennzeichnet, daß die Kassettenhälften (52, 54) jeweils einen in der inneren Oberfläche gebildeten, elliptischen, zurückspringenden Bereich (100, 101) aufweisen; ein Paar in den zurückspringenden Bereichen (100, 101) aufgenommener, reibungsarmer flacher Scheiben (88, 90) vorgesehen ist; die zentrisch in der Nabe (124) ausgebildeten Öffnungen (118) die ringförmigen Ansätze mit einem Spiel dazwischen entlang ihrer gesamten Oberflächen aufnehmen; und ein an der Oberseite jedes Flansches gebildeter ringförmiger Rand (120) vorgesehen ist, um gegen die jeweiligen Scheiben anzuliegen, wobei die Flansche im übrigen durch Spiel von den beiden Kassettenhälften getrennt sind.

2. Eine Bandkassette nach Anspruch 1, bei der die ersten und zweiten Kassettenhälften (52, 54) sowie die ersten und zweiten Scheiben (88, 90) aus durchsichtigem Material und eine Bandführung (86) sowie die Bandspulen (64, 66) und die ersten und zweiten Bandrollen (74, 76) aus verhältnismäßig dunklerem Material gebildet sind.

3. Eine Bandkassette nach Anspruch 1 oder 2, bei der die Nabe (124) und die ersten und zweiten Flansche (110) aus Kunststoff geformt und durch Ultraschallschweißen verbunden sind.

Revendications

1. Cassette à bande comportant :
des première et deuxième moitié de cassette (52, 54), chaque moitié ayant des surfaces intérieures et extérieures, une paire d'ou-



vertures (96, 98) s'étendant depuis les surfaces extérieures jusqu'aux surfaces intérieures et étant entourées par une saillie annulaire s'étendant vers l'intérieur formée dans la surface intérieure qui est alignée avec une ouverture (96, 98) et une saillie annulaire sur l'autre moitié de cassette; une paire de bobines de bande (64, 66), comprenant chacune : un moyeu (124), des premier et deuxième flasques (110), ayant chacun un sommet plan, un fond plan et un bord circonférentiel courbe reliant les sommets et fonds plans, les fonds étant reliés aux moyeux; des ouvertures (118) formées de manière centrale dans le moyeu (124) afin de recevoir les saillies annulaires; caractérisée en ce que les moitiés de cassette (52, 54) ont chacune une zone renfoncée elliptique (100, 101) réalisée dans la surface intérieure; une paire de rondelles plates à faible friction (88, 90) reçues dans les zones renfoncées (100, 101); les ouvertures (118) formées de manière centrale dans le moyeu (124) reçoivent les saillies annulaires avec un jeu entre elles le long de leurs surfaces totales; et une bague annulaire (120) formée sur le sommet de chaque flasque afin de buter contre les rondelles respectives, les flasques étant par ailleurs séparés par un jeu des deux moitiés de cassette.

2. Cassette à bande selon la revendication 1, dans laquelle les première et deuxième moitiés de cassette (52, 54) et les première et deuxième rondelles (88, 90) sont réalisées en matière transparente, et un guide de bande (86) et les bobines de bande (64, 66) et les premier et deuxième galets de bande (74, 76) sont réalisés dans une matière relativement plus sombre.
3. Cassette à bande selon la revendication 1 ou la revendication 2, dans laquelle le moyeu (124) et les premier et deuxième flasques (110) sont moulés en matière plastique et sont reliés par soudage aux ultrasons.

