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CASSETTE REEL LOCK

The present invention relates to a cassette reel lock and, more particularly, to an improved reel lock and locking mechanism for locking the reels of a tape cassette.

Various locking mechanisms have been employed in the past for locking the reels of video tape cassettes when the cassettes are not installed in the recording or playback machines, for example, when the cassettes are being transported. Such locking mechanisms prevent the accidental unwinding and tangling of the tape when the cassettes are not in use.

Several prior reel locking mechanisms are disclosed, by way of example, in United States Letters Patent Nos. 4,195,797 and 4,232,840. These prior locking mechanisms employ locking members which are rotatable into and out of reel engagement and are urged into the reel engaging position by separately installed metal springs. Such separately installed springs have several disadvantages. They require increased inventory of parts and the manipulation and installation of both the separate reel locks and the springs require separate steps. In certain of these prior locking mechanisms, the springs are extremely tiny. Thus, the springs are difficult to manipulate by hand, and are virtually impossible to install by automated procedures. Moreover, the

presence of multiple, separate pieces result in increased material and installation costs and increases the possibility that the pieces may become separated after installation, either in transportation, in use, or if the cassette housing is taken apart for any reason after it has been assembled.

The aforementioned Letters Patent No. 4,232, 840 recognised the disadvantages of installation encountered in the prior locking mechanisms which utilises either tiny separate springs or large individual springs. In an attempt to overcome these installation problems occasioned by such separate elements, this Letters Patent disclosed locking mechanisms in which both of the reel locks were joined together by a single relatively large resilient element which was moulded integrally with and joined both of the reel locks so as to form a single element containing both of the reel locks and the resilient element. This interconnecting resilient element formed the spring for both reel locks.

However, this single, integral reel locking mechanism also suffers several disadvantages. One disadvantage occurs in the installation of the element in the cassette. Careful manipulation is required both to insure simultaneous positioning of both reel locks due to the fact that they are attached together, and also to insure that the resilient element which forms the spring and joins the reel locks is properly positioned and does not interfere with or disrupt the other locking mechanism elements. This is because the resilient spring element which couples both of the reel locks is of considerable size and occupies a substantial portion of the already restricted and compact area which is available for the locking mechanism. Another disadvantage is that a substantial force must be exerted on the locking mechanism to move the reel locks from the reel

engaging to the disengaging position. This is due to the simultaneous action of the single resilient spring on both of the locks, the location at which the spring is coupled to the locks, the direction in which the spring forces bear against the locks, and the size of the spring itself.

According to the present invention there is provided, in a tape cassette having a housing, a reel locking mechanism comprising a locking element provided with a bushing by which the locking element is mounted on the housing for rotation between reel engaging and disengaging positions about an axis which is stationary with respect to the housing, the locking element comprising reel engaging means which extends from the bushing at a first angular position about the bushing axis for engagement with a tape reel in the cassette to prevent rotation of the reel, and a resilient arm which extends from the bushing and is integrally connected at one end to the bushing at a second angular position about the bushing axis, the resilient arm slidably engaging an abutment which is stationary with respect to the housing thereby to bias the reel engaging means into engagement with the tape reel, movement of the locking element between the reel engaging and disengaging portions being accompanied by significant displacement of the region of contact between the resilient arm and the abutment lengthwise of the resilient arm due to the sliding movement therebetween.

An embodiment of a locking mechanism according to the present invention overcomes the afore-mentioned disadvantages. Thus, such a locking mechanism eliminates the need for separate reel locks and springs and, thus, reduces the number of parts. Such reduction in the number of parts in the present invention reduces both material and installation costs, reduces the amount of parts needed to be kept in inventory, and not only facilitates hand assembly

of these mechanisms, but also facilitates assembly of these mechanisms by automated procedures. Further, such a locking mechanism also reduces the likelihood of separation of parts, either in use, in transportation or upon disassembly of the casing; may be readily installed in previously configured cassette housings without the need for any redesign of such housings to accept the reel locks and mechanisms; is operable with a minimum of force and under the environmental conditions normally encountered by tape cassettes; and is spaced from and located relative to the locking mechanism elements so as not to interfere with their operation.

In one embodiment of the present invention, the aforementioned reel locking mechanism includes a pair of such reel locks for respectively engaging each of the reels in the cassette. Each of the reel locks includes one of the resilient arms and each of the resilient arms operates independently of the other to urge their respective reel locks toward the reel engaging positions of each reel.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is an overall perspective, exploded view of the bottom half of a video tape cassette showing a preferred embodiment of locking mechanism constructed in accordance with the principles of the present invention;

Figure 2 is a plan view of one of the reel locks incorporating the principles of the present invention and as shown on the left in Figure 1;

Figure 3 is a plan view of the other one of the reel locks incorporating the principles of the present invention and as shown on the right in Figure 1;

Figure 4 is a broken plan view of a portion of the bottom half of the video cassette housing as shown in Figure 1 with the several elements installed in the housing and showing the locking mechanism in its reel engaging and locking position; and

Figure 5 is a broken plan view, similar to the view shown in Figure 4, but showing the locking mechanism in its reel disengaged and unlocked position.

A preferred embodiment of the present invention is shown generally in Figure 1. Referring to Figure 1, the video cassette generally includes a housing bottom half 10, a left reel 12 having a video tape 14 stored thereon in readiness for play, a right pickup reel 16, a housing top half (not shown), and a plurality of screws 18 for attaching the bottom and top halves to the housing together. The interior of the housing includes a number of features which are common generally to video tape cassettes and which will not be described herein in detail because they do not constitute important features of the present invention.

The present invention resides in the reel locking mechanism which is generally indicated in the area denoted by 20 in the drawings. This locking mechanism automatically locks the reel when the cassette is out of the recording or playback machine to prevent accidental unwinding and tangling of the tape, but automatically unlocks the reels when the cassette is placed in the machine. The locking mechanism is preferably contained in an area of the bottom half 10 of the housing defined by the rear wall 22 of the bottom half of the housing and curved interior partitions 24 in the housing.

The locking mechanism includes a lock retractor 26 which is pivotally mounted for rotation by pins 28 in notches 30 in upright, spaced, parallel walls 32 in the housing, as best seen in Figures 1, 4 and

5. The lock retractor 26 also includes a generally horizontally extending arm 34 and a pair of spaced, upwardly extending actuating arms 36, as best seen in Figures 1, 4 and 5. The horizontally extending arm 34 overlies an opening (not shown) in the bottom half of the housing 10 through which an actuating pin or other element (not shown) in the recording and playback machine extends when the cassette is installed in the machine to bear upwardly against the horizontally extending arm 34. The pin causes the lock retractor 26 to rotate about pins 28 to unlock the locking mechanism as shown in Figure 5 when the cassette is positioned in the machine.

The reel locks of the present invention include both left and right reel locks as shown in Figures 2 and 3, respectively. Each of these reel locks are substantially identical in construction, but are substantially mirror images of each other. Accordingly, the left reel lock 37 only will be described and the reference numerals employed in the description of the left reel lock shown in Figure 2 will also be employed to designate like elements in the right reel lock 37' in Figure 3, except that the numerals in the right reel lock are primed.

The reel lock 37 includes a generally cylindrical, vertical bushing 38 which is adapted to be slipped over a pin 40. The pin 40 is stationarily mounted to the bottom wall of the bottom half of the housing 10 and extends upwardly from the bottom wall, as best shown in Figures 1, 4 and 5. Thus, the pin 40 stationarily mounts the reel lock 37 to the housing half 10, but the bushing 38 permits rotation of the reel lock about an axis defined by the pin 40.

The reel lock 37 also includes a reel engaging arm 42 which extends outwardly from the bushing 38 and includes a reel engaging hooked tip 44 which

is adapted to engage teeth 46 on the respective reel 12, as best shown in Figure 4. The hooked tip 44 of the reel engaging arm 42 is shaped to provide a ratchet action, i.e. when engaged with the reel it will allow the reel to rotate in the direction indicated by the single headed arrow in Figure 4, but will prevent rotation in the opposite tape unwinding direction. The lower end of the hooked tip 44 preferably extends at 48 slightly beneath the average height of the arm 42 as shown in Figure 1 and this extension projects into a shallow recess 50 in the bottom wall of the bottom half 10 as best shown in Figures 4 and 5. The recess 50 insures engagement of hooked tip 44 with the teeth 46 on the reel 12.

The reel lock 37 also includes an actuating arm 52 which extends from the bushing 38 in angularly spaced relationship to the reel engaging arm 42. Actuating arm 52 includes a vertically extending bearing surface 54 at its outer end which is positioned to be engaged by one of the actuating arms 36 of the lock retractor 26, as shown in Figure 5, to rotate the reel lock from its reel engaging and locking position, as shown in Figure 4, to its disengaging and unlocking position, as shown in Figure 5.

The bushing 38, reel engaging arm 42 and actuating arm 52 are preferably all formed in integral, one-piece construction with each other by suitable means, such as injection moulding or the like.

The locking mechanism and reel lock which have thus far been described are essentially conventional in the art. The improvement in the present invention is in the spring mechanism for automatically urging the reel locks to the reel engaging and locking position when they have been rotated from this position.

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Such spring mechanism in the preferred form of the present invention comprises a resilient arm 56 which at one end is also formed in integral, one-piece relationship to the bushing 38 and extends outwardly from the bushing in angular and spaced relationship to the arms 42 and 52. The opposite end of the resilient arm 56 is suspended free and unattached as shown. The resilient arm 56 extends in a direction so as to slidably engage a spring engaging pin 58 formed stationarily on the cassette housing and extending upwardly from the bottom housing half 10 as shown in Figures 1, 4 and 5. In the reel engaging position, the arm 56 is preloaded against pin 58. However, when the reel lock 37 is rotated about pin 40 to the reel disengaging position, as shown in Figure 5, the outer surface of the resilient arm 56 bears slidably against pin 58 and is placed under further tension in readiness to return the reel lock 37 to the reel engaging and locking position. Because both of the resilient arms 56 and 56' are free and unattached to each other or to the respective reel locks 37 and 37', they urge their respective reel locks toward the reel engaging position independently of each other. Such independent operation assists in reducing the amount of force needed to move the reel locks out of the reel engaging position, yet they produce ample force to return the respective reel locks 37 and 37' to their reel engaging positions.

The resilient arm 56 preferably includes a somewhat enlarged portion 60 adjacent its tip. The size of the enlarged portion need not be particularly critical. Its principal purpose is to provide a bearing surface during moulding of the reel lock 37 to assist in ejection of the reel lock and its arm 56 from the mould. However, if it is desired to restrict the degree of rotation of the reel lock in the cassette in its reel disengaging position

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by utilising the enlarged portion 60, rather than by contact of the back side of the tip 44 of the reel engaging arm 42 with wall 32 as shown in Figure 5, the size of the enlarged portion 60 may be selected to be at least as large as the distance between spring engaging pin 58 and the adjacent outer surface of the bushing 38 of the reel lock. In such case, the degree of rotation of the reel lock 37 will be limited by the enlarged portion 60 moving between pin 58 and bushing 38 to prevent further rotation.

Although the reel lock of the preferred embodiment of the present invention may be formed of any one of a wide range of materials, including metals, thermoplastic polymers are preferred and, of such polymers, acetal resins, such as Delrin (Registered Trade Mark), are particularly preferred. It has been found that these polymers are of sufficient strength, yet also exhibit excellent resiliency to allow operation of the reel lock with minimum forces and at the temperatures typically encountered by the cassettes in environments both in and out of the recording and playback machines.

It will be seen that the locking mechanism of the present invention realises a substantial reduction in the number of pieces needed relative to the locks and mechanisms of the prior art. Thus, material and installation costs are reduced and the likelihood of separation of additional pieces in use, transportation or disassembly of the cassette is minimised. Such reduction in the number of pieces not only facilitates hand assembly of the cassettes, but also makes possible the use of automated procedures in the assembly of the cassettes. Automated procedures either could not previously be utilised where separate metal springs were employed or could be accomplished only with difficulty and care. Moreover, the reel locks and locking mechanism incor-

porating the principles of the invention are fully acceptable for installation in the cassette housing previously in use without the need to modify these housings. Moreover, because the resilient arm 56 is short and unobtrusive, it will not interfere with the other elements of the locking mechanism, either during installation or use.

It will be understood that although the present invention has been described in terms of a video tape cassette, the principles of the present invention are equally applicable to other forms of cassettes, such as audio tape cassettes.

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CLAIMS

1. In a tape cassette having a housing, a reel locking mechanism comprising a locking element provided with a bushing by which the locking element is mounted
5 on the housing for rotation between reel engaging and disengaging positions about an axis which is stationary with respect to the housing, the locking element comprising reel engaging means which extends from the bushing at a first angular position about the bushing
10 axis for engagement with a tape reel in the cassette to prevent rotation of the reel, and a resilient arm which extends from the bushing and is integrally connected at one end to the bushing at a second angular position about the bushing axis, the resilient arm slidably
15 engaging an abutment which is stationary with respect to the housing thereby to bias the reel engaging means into engagement with the tape reel, movement of the locking element between the reel engaging and disengaging portions being accompanied by significant
20 displacement of the region of contact between the resilient arm and the abutment lengthwise of the resilient arm due to the sliding movement therebetween.

2. A locking mechanism in a tape cassette according to claim 1, wherein the bushing and the one
25 end of the resilient arm are formed integrally by moulding.

3. A locking mechanism in a tape cassette according to claim 1 or 2, wherein the locking element and the biasing means are formed of a thermoplastic
30 polyer.

4. A locking mechanism in a tape cassette according to claim 3, wherein the polymer is an acetal resin.

5. A locking mechanism in a tape cassette
35 according to any preceding claim, wherein the resilient arm includes an enlarged portion adjacent the other end



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of the resilient arm.

5 6. A locking mechanism in a tape cassette according to claim 5, wherein the abutment is spaced from the bushings by a predetermined distance, the enlarged portion being at least as large as the predetermined distance to restrict rotation of the locking element.

10 7. A locking mechanism in a tape cassette according to any preceding claim, wherein the locking element is one of a pair of locking elements for respectively engaging each of the reels in the cassette, each of the locking elements including a resilient arm, each of the resilient arms operating independently of the other to urge their respective
15 reel locks toward the reel engaging positions of each reel.

20 8. A locking mechanism in a tape cassette as claimed in any one of the preceding claims, wherein the cooperation between the resilient arm and the abutment is such that the effective length of the resilient arm increases during rotation of the locking element towards the reel disengaging position.

25 9. A locking mechanism in a tape cassette as claimed in any one of the preceding claims, in which the abutment comprises a pin which extends parallel to the axis of the locking element.

30 10. A reel locking mechanism, for a tape cassette, substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.
