The present invention relates to a cassette having a locking means consisting of a swivel element which is rotatable about a bearing axis of a bearing means and of a locking apparatus arranged thereon below the bearing axis, the bearing means interacting with walls of the cassette housing and the swivel element consisting partially or completely of elastically deformable material and the locking apparatus being arranged so that it can be caused to rotate.

A locking means is known in which a rotatably mounted locking plate is supported against the cassette housing by means of a separate leg spring fastened to the said plate, in order to produce initial tension in the locking position. A directly locking projection on the locking plate engages a recess in a swivel flap of the cassette in the locking position, and another projection on the locking plate is actuated to trigger the locking plate from outside the housing, and the locking plate is thus rotated against the initial tension and releases the swivel flap to allow it to rotate upward and open the cassette (for this prior art, see Figure 1).

US-A-4,466,583 and DE-U-85 04 032 disclose a further cassette having a locking flap for the same purpose, the leg spring of the above prior art being replaced by an integral, molded plastic leg spring. This embodiment of an integral plastic spring is also disadvantageous owing to the complicated and expensive manufacture,which requires expensive molds, and because of the projecting plastic springs, which become caught up and thus hinder further processing and finishing (assembly) of the cassettes.

EP-A-191,387 discloses a cassette having a locking mechanism, a spring formed on the swivel plate being supported above the bearing axis on the inner surface of the cassette wall. However, this spring is not free from tension when the swivel plate is in the rest position.

It is an object of the present invention to avoid the disadvantages of the known cassettes having locking means, to make their production more economical and to extend their life.

We have found that this object is achieved by a cassette having a locking means consisting of a swivel element which is rotatable about a bearing axis of a bearing means and of a locking apparatus arranged thereon below the bearing axis, the bearing means interacting with walls of the cassette housing and the swivel element consisting partially or completely of elastically deformable material and the locking apparatus being arranged so that it can be caused to rotate, wherein the swivel element has a supporting extension above the bearing axis, and, in the rest position, the swivel element with the supporting extension and/or a part below the bearing axis is in contact, essentially without tension, with the inside of the outer wall, and, in the operating position, when the locking apparatus is actuated, the swivel element rotates and is thus converted into a state of tension, the supporting extension being in contact with the inside of the outer housing wall and the lower part of the swivel element not being in contact with the housing wall.

This ensures that the swivel element rests against the housing wall just without any, or with virtually minimal, play or contact pressure. In its rest position, in which the locking apparatus is not actuated, the swivel element is subjected to virtually no load and is completely free of tension in the cassette, which may be, for example, a VHS video cassette. Out of a storage time or useful life of about 5-10 years, such a cassette is in operation for scarcely more than 100-200 hours, ie. it is only during this relatively short time that this swivel element is subjected to a load against its supporting extension, which acts as an abutment. In contrast, the thin integrally molded plastic springs of the prior art are under load during the entire life of the

cassettes and will therefore eventually become weak, even in the case of very resilient, thin thermoplastic material, ie. the spring properties change since the thermoplastic flow of these plastic materials is load-dependent and time-dependent.

In the cassette having locking means of the present invention, it has been found, surprisingly, that, by arranging the supporting extension directly above the bearing axis, the internal resilience of the swivel element between the bearing points of the bearing means is sufficient to apply a spring force in the region of rotation of the swivel element, ie. during and after its actuation, in order to maintain the locking function in the rest position of the said element and to apply the necessary initial tension or spring force in the operating position.

In practice, every contact point between the swivel element and the housing wall is provided a distance away from the bearing axis. Advantageously, the one or more supporting extensions can be located essentially in the middle between bearing elements of the bearing means. This permits subsequent installation in existing VHS cassettes and furthermore an essentially symmetrical application of force is ensured.

In a practical embodiment, the distances of the contact points of the supporting extension and of the lower part of the swivel plate from the bearing axis should have a ratio of from 1:12 to 1:6, with the result that, for conventional dimensions of the swivel plate and known thermoplastic materials, forces of the desired magnitudes are achievable. In practice, the supporting extension may be thicker at the free end toward the outer housing wall, resulting in an angular position of the swivel plate.

In the rest position of the swivel plate, the angle between the said plate and the outer housing wall may be from about 0.5° to about 1.5°. In an advantageous embodiment, the swivel element is in the form of a swivel

plate. In another practical embodiment, the swivel plate can be provided with a frame-like reinforcement which extends as far as the bearing elements of the bearing means, and the swivel plate, between the bearing elements and including the supporting extension, can be thinner than the frame reinforcement and thus flexible.

The invention is described below with reference to embodiments shown in the drawings.

Figure 1 shows the prior art, partially cut away,

Figure 2 shows the same front corner part with a locking means having a swivel plate with integral spring,

Figure 3 shows a second embodiment of the swivel plate having an integral spring,

Figure 3A shows a plan view of the swivel plate according to Fig. 3,

Figure 4 shows a side view of the locking means of Figure 1 in the rest position and operating position of the swivel plate and

Figure 5 shows a magnified section of Figure 4, partially in cross-section.

Figure 1 shows a front corner part 30 of a VHS cassette, consisting of upper and lower housing parts 31, 32, which are suitably connected to one another. The tape, which is not shown, is protected from the damage by means of a swivel flap 33 having side walls 34 whose inner surfaces are provided with injection molded pins 35, around which the swivel flap is rotatable. In the lower housing part 31, a rotatable locking plate 36 is provided, the said plate permitting locking by means of a projection 41 which engages a recess (not shown) in the side wall 34 of the flap. The swivel plate 33 having side walls 34 is held under initial tension against the housing parts 31, 32 in the closed position by means of a leg spring 37 which is provided on a peg 35 and whose leg 38 engages underneath the swivel flap 33. The locking plate 36 is held under initial tension in its locking position by means of a further leg spring 39 which is

arranged on a bearing journal 40 of the locking plate 36 and whose leg is supported against a rib of the bottom part 31 of the housing. The locking plate 36 is also provided with a relatively large actuating projection 42, which can be actuated from outside the cassette.

Figure 2 shows a locking means according to the present invention. For the sake of clarity, the leg springs 37 have been omitted. The swivel plate 10 is provided with a frame 11 and possesses at its foot, together with the locking apparatus 7, formed from projections 41 and 42, which are shown in Figure 4, means for locking or for actuating the locking means from outside the cassette. At the upper end of the swivel plate 10, cylindrical bearing elements 6A and 6B are provided on the right and left, as bearing means 6. It is also possible to use a common cylindrical axis as a bearing means. The cylindrical bearing elements 6A and 6B are parts of the bearing means 6, for which purpose bearing apertures 8A and 8B are provided in the outer cassette wall 9 or in the inner wall 12. The bearing axis, which is simultaneously the axis of rotation of the swivel plate 10, is denoted by B. One or more supporting extensions 13, which in this case are in the form of a nose and have a cam 14 on the free end, as a thickening of the material, to maintain the distance from the outer side wall 15, are provided roughly in the middle between the bearing elements 6A and 6B. The contact point between the cam 14 and the inside of the outer side wall 15 is denoted by F.

Figure 3 shows the swivel plate 10 with a uniform thickness e (without frame 11). The supporting extension 16 in this case is wedge-shaped, with the major part of the material being at the free end. Figure 3A shows a plan view of the swivel plate 10 in its embodiment and arrangement from Figure 2. The bending lines 18' drawn in show the flexible part 18 when the force K is applied at the actuating projection 42, and the effect obtained when the cam 14 on the supporting extension 13 rests against

the inside of the outer wall 15 at the contact point F.

As most clearly shown in Figure 5, it is necessary for the contact point S of the cylindrical bearing element 6A, 6B to be provided at a distance b from that side of the swivel plate 10 which faces the outer wall 9, the distance a of the outer wall itself being equal to or slightly larger than b. In practice, a-b should be about 0-0.2 mm. This defines the angular position of the swivel plate 10 in the rest position and the extent of deflection in the operating position.

It is also necessary to dimension the lateral play c of the cylindrical element 6A, 6B in the bearing apertures 8A and 8B so that $c-d \geq 0.2$ mm, where d is the cylinder diameter. This makes it possible to ensure that, with the usual tolerances and normal flexibility of the swivel plate 10, there is no jamming of the bearing means 6.

Figure 5 shows that contact points are present at S and T. In addition, however, it is also possible for a contact point T to be present, in addition to the contact point F, on the lower edge 19 of the swivel plate 10, for example as shown in Figure 4, where only a cam 14 and the lower edge 19 are used as contact parts themselves. Where spacing cams are used, the distance b to the front contact end of the cam must be calculated, and the above dimensioned specifications should be observed.

It is advantageous in practice if the distances of the first contact point F or T between the supporting extension 16 or 13 of the swivel element 10 and the housing wall 15 of the cassette and the second contact point T between the lower part 19 of the swivel element 10 and the housing wall 15 from the bearing axis B have a ratio of from 1:6 to 1:12.

Figure 4 shows the swivel plate 10 having the spacing cam 14 on the supporting extension 13 in the rest position 10' and operating position 10". While in the rest position 10' (Figures 2 and 3) the deflection angle α from the vertical is about 0.5-1.5°, which is also

determined by the cam dimensions, in the operating position the deflection angle β is about 10°. In general, β must be 5-20°, which of course depends on the form and actuation path W of the locking apparatus, in particular of the actuating projection 42 due to the actuating peg 17.

In the position 10" of the swivel plate 10, deflected by the angle β of, for example, 10°, the position of the peg 6A has changed slightly (displacement of the contact points S' to S"), and consequently the contact point of the cam 14 has also shifted from T to T'. In this position 10" of the swivel plate 10, it displays its full resilience and flexibility, which are determined in the embodiment of Figure 2 by the region of reduced thickness m, 18 between frame 11 and bearings 6A, 6B, and by the supporting extension 13. The thickness of the frame part 11 is denoted by r. In the VHS system, the deflection force is specified as being smaller than 15 pond $\hat{=}$ 15 cN. For actuation, the embodiment shown in Figures 3 and 3A requires a relatively small deflection force K of about 8-12 cN for one of the following materials: polyoxymethylene (POM), polystyrene (PS), polypropylene (PP) or ABS, and, in the case of POM, with a swivel plate thickness e of 1-2 mm. Because of the required flexible properties, the stated materials must have a modulus of elasticity of from 2,500 to 3,500, preferably about 3,000, N/mm^2. The forces which have been applied over the swivel plate 10 are predominantly bending forces. Of course, reaction forces of such swivel plates or similar locking or braking elements can also be in the region of about 1 cN to 30 cN or more, particularly in the case of different dimensions and space conditions.

The invention is described for video cassettes. However, the locking means can also advantageously be used for any type of cassettes having an automatic unlocking means in the recorder. Cassettes of this type include audio, data, film and disc cassettes.

Claims

1. A cassette, having a locking means consisting of a swivel element (10) which is rotatable about a bearing axis (B) of a bearing means (b) and of a locking apparatus (41, 42) arranged thereon below the bearing axis, the bearing means interacting with walls of the cassette housing and the swivel element consisting partially or completely of elastically deformable material and the locking apparatus being arranged so that it can be caused to rotate, wherein the swivel element (10) has a supporting extension (13) above the bearing axis (B), and, in the rest position, the swivel element (10) with the supporting extension (13) and/or a part (19) below the bearing axis (B) is in contact, essentially without tension, with the inside of the outer wall (15), and, in the operating position, when the locking apparatus (42) is actuated, the swivel element (10) rotates and is thus converted into a state of tension, the supporting extension (13) being in contact with the inside of the housing wall (15) and the lower part (19) of the swivel element (10) not being in contact with the housing wall (15).

2. A cassette as claimed in claim 1, wherein each contact point (F, T) between the swivel element (10) and the housing wall (15) is provided at a distance from the bearing axis (B).

3. A cassette as claimed in claim 1 or 2, wherein the one or more supporting extensions (13, 16) are arranged essentially in the middle between the bearing elements (6A, 6B) of the bearing means (6).

4. A cassette as claimed in claim 2, wherein the distances of the contact points (F, T) of the supporting extension (13, 16) and of the lower part (19) of the swivel element (10) from the bearing axis (B) have a ratio of about 1 : 6 to 1 : 12.

5. A cassette as claimed in any of claims 1 to 4, wherein the supporting extension (13, 16) is designed with a material thickening (14) at the free end toward

* C L M S *

the outer housing wall (15).

6. A cassette as claimed in any of claims 1 to 5, wherein, in the rest position of the swivel element (10), the angle between the swivel plate and the outer wall (15) is from about $0.5° \leq 1.5°$.

7. A cassette as claimed in any of claims 1 to 6, wherein the swivel element (10) is in the form of a swivel plate.

8. A cassette as claimed in claim 7, wherein the swivel plate (10) is provided with a frame-like reinforcement (11) which extends as far as the bearing elements (6A, 6B) of the bearing means, and the region (19) of the swivel plate (10) between the bearing elements (6A and 6B), including the supporting extension (13, 16), has a reduced thickness (m) compared with the frame reinforcement (11) and is thus flexible.