FLOPPY DISC CASSETTE LOADING APPARATUS

The invention relates to a floppy disc cassette having a shutter.

In such a floppy disc cassette, a head window is formed in a portion of the outer casing for exposing the disc to a magnetic head, the window being opened or closed by a shutter. Spring means may be provided in the outer casing for biasing the shutter at all times in the window closing direction to avoid risk of intrusion of dust and dirt into the cassette through the open window.

There is therefore a requirement for magnetic recording and/or reproducing apparatus in which means are provided in the cassette holder whereby the shutter is closed automatically and locking means are operated for locking the shutter in the closed state upon extraction of a cassette from the cassette holder, even in instances where the magnetic disc cassette is not provided with shutter closing spring means.

According to the invention there is provided a floppy disc cassette comprising an outer casing with a magnetic disc therein, the casing including a shutter mounted at one edge thereof for opening or closing a head access hole, the shutter comprising a pair of parallel shutter plates and a connecting web connecting together one edge of each of the shutter plates, a shutter lock provided inside the casing, a projection formed on the shutter to engage with the shutter lock thereby to retain the shutter in a position in which the head access hole is closed, and a recess in the connecting web of the shutter, said recess being provided only in the connecting web of the shutter and being so provided that when the cassette is inserted into a cassette player a member of the cassette player engages in the recess and upon extraction of the cassette from the cassette player the member engaged in the recess moves the shutter to the position in which the head access hole is closed and the projection on the shutter is engaged with the shutter lock.

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

Figure 1 is a perspective view showing one embodiment of a disc cassette according to the invention and a disc cassette loading apparatus for loading such a disc cassette;

Figure 2 is an enlarged front view, shown partially in section of the magnetic disc cassette of Figure 1;

Figure 3 is an enlarged plan view thereof;

Figure 4 is an enlarged partial front view of a locking member for the magnetic disc cassette;

Figure 5 is an exploded partial perspective view of a cassette holder;

Figure 6 is an enlarged plan view showing the main components of the cassette holder;

Figure 7 is a side elevation thereof;

Figure 8 is a diagrammatic plan view showing the cassette inserted halfway into the holder;

Figure 9 is an enlarged front view showing the locking member in the state shown in Figure 8;

Figure 10 is a diagrammatic plan view showing a shutter of the cassette in the opened state;

Figure 11 is a diagrammatic plan view showing the cassette inserted fully into the holder;

Figure 12 is a diagrammatic plan view showing the cassette extracted halfway from the holder;

Figure 13 shows a modified embodiment of a magnetic disc cassette according to the invention in end and plan views;

Figure 14 shows essential portions of the holder of the magnetic disc cassette in front, plan and side views;

Figure 15A shows in a diagrammatic plan view the magnetic disc cassette inserted halfway into a cassette holder;

Figure 15B is a diagrammatic plan view showing the horizontal extension resiliently engaging with a recess on one side of the cassette holder;

Figure 16 is a diagrammatic plan view showing the shutter of the magnetic disc cassette about to be opened;

Figure 17 is a diagrammatic plan view showing the shutter of the magnetic disc cassette in the course of closing the window;

Figure 18A is a diagrammatic plan view showing the state of closure of the window by the magnetic disc cassette shutter; and

Figure 18B is a diagrammatic plan view showing the magnetic disc cassette being extracted from the cassette holder.

Figure 1 shows a magnetic recording and/or reproducing apparatus and a magnetic disc cassette in perspective. The magnetic disc cassette is shown in a state ready to be loaded into the recording and/or reproducing apparatus. Figure 2 is an enlarged front view of the magnetic disc cassette with a portion thereof cut away. Figure 3 is an enlarged front view of the disc cassette. Before proceeding to the description of the magnetic recording and/or reproducing apparatus, description is first made of a magnetic disc cassette A to be loaded into the apparatus.

Referring to Figure 2, an outer casing 1 of the magnetic disc cassette A is formed of synthetic plastics material in the shape of a substantially square hollow plate of a size that can be held in a hand. A magnetic disc 2 is accommodated for rotation within the outer casing 1.

At the centre of the magnetic disc 2, is a hub 4 having a drive shaft reception aperture 3, in which a rotary drive shaft 47 of the magnetic recording and/or reproducing apparatus is received. The hub 4 is mounted in an opening 5 formed in outer casing 1 so that the disc can be rotated.

Indicating means 6 are provided on a suitable portion of the casing 1 for indicating the number of annular magnetic tracks recorded on the disc 2. The indicating means 6 are made up of a dial indicating member 8 in the form of a disc having an indicating aperture 7 like a key slot, and a pawl 11 having an engaging portion 11a resiliently engaging with a serrated edge 10 of a rotary gear 9 integrally formed with the indicating member 8.

On both lateral sides of the outer casing 1, windows 12, 13 are formed for partially exposing the opposite sides of the disc 2. A magnetic head 39 of the magnetic recording and/or reproducing apparatus to be later described is introduced into one 12 of these windows in which one side, for instance, of the magnetic sheet 2 is exposed. The magnetic head 39 is designed to trace a magnetic track of image signals of plural still images concentrically formed on the magnetic sheet 2.

A shutter 14 of sheet metal is mounted on the outer casing 1 for opening or closing the windows 12, 13. The function of the shutter 14 is to protect the magnetic sheet 2 by preventing dust and dirt from intruding into the interior of the outer casing 1. The shutter 14 comprises a pair of parallel shutter plates 15, 16 having a sufficient size to cover the windows 12, 13 from outside and a connecting web 17 connecting one edge of each of the shutter plates 15, 16 to each other. The shutter 14 is movable transversely as viewed in Figure 2 with the shutter plates 15, 16 engaged in recesses 18, 18 formed in both sides of the outer casing 1. On the bottom surfaces of the recesses 18, 18, guide grooves 80 are formed extending in the sliding direction of the shutter 14 (i.e. left and right directions as viewed in Figure 2) for engagement by bosses 19, 19 formed on the inner sides of the shutter plates 15, 16. The function of the guide grooves 80 is to hold the shutter plate 14 from disengaging from the outer casing 1 during sliding of the shutter 14. The end of the closing stroke of the shutter 14 is determined by abutment of edges 15A, 16A of the shutter plates 15, 16 with left hand side steps 18A, 18A of the recesses 18, 18 as viewed in Figure 2, whereas the end of the opening stroke of the shutter 14 is determined by abutment of right hand side edges 15B, 16B of the shutter plates 15, 16 with right hand side steps 18B, 18B of the recesses 18, 18 as viewed in Figure 2.

The connecting web 17 of the shutter 14 is mounted for sliding along a cut-out or groove 20 in one lateral edge 1A of the outer casing 1. At one end of the connecting web 17 an L-shaped engaging member 21 is provided having a downwardly bent end 21a. When the shutter 14 is moved for closure, the bent end 21a is engaged by a locking member 22 secured in the interior of the outer casing 1.

The locking member 22 is made of a resilient material such as a synthetic plastics and, as also shown in Figure 4, comprises a supporting portion 23 secured to the inner faces of the outer casing 1 and a pawl portion 24 contiguous with the supporting portion 23 and having a free end 24a projecting towards the space between the shutter plates 15, 16 of the shutter 14 and an end 24b where the pawl portion is joined to the support portion 23. A first inclined surface 25 is formed at about the centre of an outer surface of the pawl portion 24 with a rising gradient towards the free end 24a of the pawl portion 24. A second inclined surface 26 on the outer surface has a rising gradient towards the end 24b. Intermediate the first and second inclined surfaces 25, 26, a cut-out or groove 27 is formed in the outer surface for engagement by the bent end 21a of the engaging member 21. A guide groove 28 contiguous to the cut-out 27 is formed in the edge 1A of the outer casing 1 where the locking member 22 is provided. The outer face 29 of the locking member 22 forms the bottom surface of the guide groove 28. A projecting portion 30 including the first inclined surface 25 of the pawl portion 24 is biased at all times to intrude into the guide groove 28 through the slot 29 by the resiliency of the pawl portion 24. It should be noted that the pawl portion 24 is formed with a vertically extending elongate slot 31 in which is engaged a pin 32 projecting from the inner faces of the outer casing 1 for limiting the elastic movement of the pawl portion 24.

At the centre of the connecting web 17 of the shutter 14, there is formed a recess 34 having an opening edge 34A flush with an outer surface 17A of the connecting web 17.

Next, the magnetic recording and/or reproducing apparatus will be described. A cassette holder 134 into which is inserted the aforementioned magnetic disc cassette A, is provided within a casing cover 35. The casing cover 35 and the cassette holder 134 are pivotally attached to a base plate 37 by a hinge 36.

On the base plate 37, there is provided a turntable 38, to which the centre hub 4 is held by magnetic attraction, the aforementioned magnetic head 39 for recording annular tracks on the disc 2 or reproducing the information such as still image recorded on these tracks, a magnetic head shifter 40 for intermittently and automatically shifting the magnetic head 39 in the radial direction of the disc 2, and a driving electric motor 41 for driving the turntable 38 and the associated components for rotation.

It should be noted that the motor 41 is subjected to servo control in such a manner that the disc 2 is rotated with a predetermined phase and at a constant speed.

The magnetic head 39 is provided intermediate the ends of a head shifting arm 44 of the head shifter 40 for confronting the recording surface, in this case the side 2A, of the disc 2, through a window 43 provided in a lower base plate 42 secured to the base plate 37.

A tension coil spring 45 has one end 45a engaged with the feed arm 44 so that the arm 44 is biased at all times to pivot in the direction of the arrow A' in Figure 1 about a pivot shaft 46.

A driving shaft 47 is mounted at approximately the centre of the base plate 37 for engaging in the hole 3 of the centre hub 4. The turntable 38 is mounted for rotation about the axis of the driving shaft 47, and a belt 49 connects the turntable 38 and a belt pulley 48 attached to a driving shaft of the driving electric motor 41.

On the base plate 37 is also mounted a counter driving unit 51 having a counter driving shaft 50 which is received in the aperture 7 of the dial indicating member 8 for driving the indicating member 8 for rotation. This counter driving unit 51 also drives the head shifting arm 44 so that driving of the indicating member 8 is operatively associated with the radial movement of the magnetic head 39. In other words, the indicating member 8 is rotated one pitch for one pitch travel of the magnetic head 39.

The cassette holder 134 is formed by a square frame 52, as also shown in Figure 5. The frame 52 is formed by guide frame sections 53 having a U-shaped cross-section for slidingly guiding the sides 1A, 1B of the outercasing 1 and connecting frame sections 55, 56 connect these guide frame sections. The guide frame sections 53, 54 are in facing relation to each other.

On the guide frame section 53 (that is, that guide frame section which guides the side 1A of the outer casing 1 along which the shutter 14 is guided) is mounted a slider 57 acting as shutter opening means, as also shown in Figure 6.

The slider 57 has an elongate horizontal portion 58 slidably disposed on an upper surface of the guide frame section 53. The upper end 58a of the portion 58 as viewed in Figure 6 is extended to an upper surface of the connecting frame section 55 by a bent portion 59. The end 58a has an elongate slot 60 therein in which is inserted a first pin 61 mounted upright on the connecting frame section 55. The horizontal portion 58 is bent at an outer edge 58c downwards to provide an upright extension 62 which is again bent at the lower edge to provide a horizontal extension 64 intruding into the interior of the guide frame section 53 through an elongate guide opening 63 in a side wall 53B of the guide frame section 53.

The extension 62 is held in abutting contact with the surface of the guide frame section 53 by a sliding support plate 66 secured by screws 65 to the guide frame section 53 to prevent accidental removal of the horizontal extension 64 out of the guide opening 63.

The outer side of the section 53 is formed with a step 67 for abutment by an upper end 62a of the extension 62 as viewed in Figure 6. The forward stroke end of the slider 57 is determined by abutment of the upper end 62a of the vertical extension 62 on the step 67, whereas the reverse stroke end of the slider 57 is determined by abutment of the pin 61 on the upper end 60a of the elongated slot 60 as viewed in Figure 6. It should be noted that the distance l between the upper end 62a of the vertical extension 62 as viewed in Figure 6 and the step 67 is selected to be the same as the distance between the pin 61 and the other end 60b of the slot 60 and thus the slider 57 has a travel stroke equal to the distance l.

A rotary pawl piece 68 acting as a shutter closing means is provided on the guide section 53 at a position ahead of or below the slider 57 as viewed in Figure 6.

The pawl piece 68 has a horizontal portion 69 engaging the upper surface of the frame section 53. The lower end 69a as seen in Figure 6 of the horizontal portion 69 engages the upper surface of the connecting frame section 56. An elongate slot 70 is formed at an end 69a of the horizontal portion 69. A second pin 71 mounted upright on the connecting frame

section 56 engages in the slot 70. The horizontal portion 69 is bent at an outer edge 69A downwards to provide an upright extension 72 which is again bent along the lower edge thereof to provide a horizontal extension 73 intruding through the slot 63.

The other end of the horizontal portion 69 has a beak-like end 74 protruding inwardly of the square frame 52. This beak-like end 74 is normally engaged and held by a pin 75 mounted upright on the upper surface of the guide frame section 53. In this manner, the pawl piece 68 may be pivoted about the second pin 71 and, when the pawl piece 68 is turned clockwise as viewed in Figure 6 about the pin 71, the extension 73 is extricated from the guide frame section 53 through the elongate slot 63.

A tension coil spring 77 is mounted between an inner projection of the horizontal portion 69 and an end 76a of a tongue 76 formed integral with the lower end 57a of the slider 57 as viewed in Figure 6. The spring 77 operates to hold the slider 57 at the reverse stroke end position during normal operation, that is, when the cassette is not introduced into the cassette holder, said pawl piece 68 being kept at this time in a position such that the beak-like end 74 is engaged with the upright pin 75.

In Figure 6, the arrow B indicates the cassette inserting direction.

Referring now to Figures 8 to 12, the operation of the slider 57 and the pawl piece 68 will be described. It should be noted that, in the magnetic disc cassette A, the bent end 21a of the member 21 and the pawl portion 24 are engaged with each other in advance and the windows 12, 13 are closed by the shutter plates 15, 16.

Referring to Figure 8, when the cassette A is inserted along and between the guide frame sections 53, 54 of the square frame 52, the horizontal extension 64 projecting through the guide frame section 53 intrudes into the guide groove 28, as shown in Figure 9. A leading edge or corner 64a of the extension 64 acts on the projecting portion 30 and presses the portion 30 into the interior of the outer casing 1, the resiliency of the pawl portion 24 allowing this, whilst the extension 64 is moved along the first inclined surface 25 of the locking member 22. The engagement between the pawl portion 24 and the bent end 21a of the member 21 is broken by the inward movement of the projecting portion 30. A leading edge 64A of the extension 64 abuts on the bent end 21a of the member 21.

It should be noted that, upon insertion of the cassette A, the horizontal extension 73 projecting through the guide frame section 53 is rotated clockwise about the second pin 71. The foremost part of the extension 73 rides on the upper surface of the connecting web 17 of the shutter 14 and abuts on the surface at a position spaced apart by l ahead of the recess 34 or above the recess 34 as viewed in Figure 8.

When the cassette A is inserted further along the guide frame sections 53, 54, the windows 12, 13 are opened gradually by the shutter 14.

The extreme opening position of the shutter 14 is reached when the side 1C of the outer casing 1 has reached a position spaced a distance l from the connecting frame section 55 (Figure 10).

When the cassette A is pushed further until the side 1C of the outer casing 1 contacts the connecting frame section 55, as shown in Figure 11, the extension 64 is pushed upwards when viewed in Figure 11 by the engaging member 21 of the shutter 14. With the extension 64 thus pushed upwards, the slider 57 is pushed in its entirety in the direction of the arrow C against the resilience of the coil spring 77. The end 62a of the vertical extension 62 of the slider 57 abuts at this time on the step 67 of the guide frame section 53, while the end 60b of the slot 60 in the horizontal portion 58 of the slider 57 abuts on the first pin 61.

In this manner, the side 34A of the recess 34 in the shutter 14 is shifted, by the movement of the cassette A over the distance l, to a position occupied by the foremost part of the horizontal extension 73. The pawl piece 68 is now rotated counterclockwise as viewed in Figure 11 under the resiliency of the coil spring 77 increased by the aforementioned movement of the slider 57, so that the extension 73 is engaged by snap action into the recess 34. With the extension 73 thus snapping into the recess 34, the shutter 14 is held between the slider 57 and the pawl piece 68 in the window open state, thus preventing inadvertent sliding of the shutter 14 during recording or reproduction and the resulting closure of the windows 12, 13.

When the cassette A is extracted gradually from the frame 52, in an attempt to withdraw the cassette A from the magnetic recording and reproducing apparatus, the windows 12, 13 are closed gradually by the shutter 14 as the shutter is held between the slider 57 and the pawl piece 68.

When the cassette A is extracted further after the shutter 14 has reached the window fully closed position shown in Figure 12, the extension

73 of the pawl piece 68 is disengaged from the side 34A of the recess 34 against the force of the coil spring 77, and the slider 57 is extracted out of the guide groove 28 so that the pressure exerted on the projecting portion 30 of the pawl portion 24 of the locking member 22 is removed. Since the projecting portion 30 is no longer pressured, the pawl portion 24 is moved by its resiliency in a direction such that the projecting portion 30 intrudes into the guide groove 28, the bent end 21a of the engaging member 21 again engaging with the pawl portion 24 for holding the shutter 14 in the window closed state.

In the embodiment of Figures 13 through to 18, parts or components similar to those of the preceding embodiment are designated by the same numerals. It should be noted that, in the magnetic disc cassette A, the bent end 21a of the member 21 and the pawl portion 24 are engaged with each other in advance and the windows 12, 13 are closed by the shutter plates 15, 16, as in the preceding embodiment.

In the cassette A, a pawl piece 210 is provided on the connecting web portion 17 of the shutter 14, as shown in Figure 13.

The pawl piece 210 of the shutter 14 is engaged in the cut-out 27 in the locking member 22 when the shutter 14 is in the window closed position.

As shown in Figure 14, a slider 78 is secured by screws 79a, 79b to the guide frame section 53 of the frame 52. The slider 78 has a horizontal extension 64 having an inclined surface 64B with a downward gradient towards the leading edge so that a difference in level is caused to exist between the leading edge 64a and the rear portion 64b of the extension 64. By providing this inclined surface, the pawl portion 24 does not remain in the flexed state when the cassette A is introduced into the magnetic recording and/or reproducing apparatus. In this matter, the elastic limit of the pawl portion 24 is not exceeded in a shorter operating time. Since the slider 78 is fixed and the resiliency of the coil spring 77 is not increased due to movement of the slider 78 as in the preceding embodiment, a sufficient elastic force need be stored in the coil spring 77 to engage the foremost part of the extension 73 of the pawl piece 68 by snap action into the recess 34.

Referring to Figure 15A, when the cassette A is inserted along the respective guide frame sections 53, 54 of the square frame 52, the foremost

part of the horizontal extension 73 of the resiliently biased pawl piece 68 rides on the upper surface 17A of the connecting web 17 of the shutter 14 and is kept in pressure sliding contact therewith by the force of the coil spring 77. When the cassette A is inserted to a position shown in Figure 15B, the rotary pawl piece 68 is turned counterclockwise about the pin 71 so that the extension 73 is engaged by snap action into the recess 34. The leading edge 64a of the extension 64 projecting through the guide frame section 53 is moved along the first inclined surface 25 of the locking member 22 and the projecting portion 30 is pushed into the inside of the outer casing 1 against the resiliency of the pawl portion 30. The pawl piece 210 is now disengaged from the pawl portion 24 and the leading edge 64A of the horizontal extension 64 abuts the end 14a of the shutter 14.

When the cassette A is pushed further into the holder 34, the windows 12, 13, not shown in Figure 16, are opened gradually by the shutter 14. It should be noted that, for reliable opening operation of the shutter 14, the end of the extension 73 need be engaged with the recess 34 before the pawl portion 24 is disengaged from the shutter 14.

When the cassette A is gradually extracted from the frame 52, in an attempt to withdraw the cassette A from the recording and/or reproducing apparatus, the shutter 14 acts to gradually close the windows 12, 13 as the shutter is held between the slider 78 and the rotary pawl piece 68 (Figure 17). When the cassette A has been extracted to the point that the slider 78 is disengaged from the guide groove 28, the pressuring state of the projecting portion 30 of the locking member 22 is cancelled. The pawl piece 210 of the shutter 14 is engaged into the cut-out 27 through the second inclined surface 26 of the pawl portion 24 so that the shutter 14 is again kept in the closed state (Figure 18A). When the shutter 14 has reached the window fully closed position, and the cassette A is further extracted, the horizontal extension 73 of the pawl piece 68 is disengaged from the recess 34 against the resiliency of the coil spring 77 to permit the cassette A to be withdrawn from the recording and/or reproducing apparatus (Figure 18B).

In the present embodiment, when the magnetic disc cassette A is inserted into the holder 34, the locking member 22 by which the shutter 14 closed the windows 12, 13 of the outer casing 1 is maintained in the window closed state may be released automatically, while the shutter 14 is opened. In addition, when the cassette A is withdrawn out of the holder 134, the

shutter 14 opening the windows 12, 13 may be closed automatically, while the locking member 22 is brought again to its shutter locking position.

It is seen from the foregoing that the locking member 22 by which the shutter 14 closing the windows 12, 13 in the outer casing 1 is locked in the closed state is released automatically upon insertion of the magnetic disc cassette A into the holder 134, the shutter 14 being then opened. Likewise, the shutter 14 opening the windows 12, 13 is closed automatically upon extraction of the cassette A from the holder 134, and the locking member 22 is brought again to its shutter locking position.

Thus, even though the outer casing 1 is not provided with shutter closing spring means, the shutter 14 will be closed automatically and thus without resorting to manual operation when the cassette A is withdrawn from the recording and/or reproducing apparatus.

From the foregoing it is seen that it is possible to release the locked state of the shutter to open and maintain the opened state of the shutter upon insertion of the magnetic disc cassette into the holder of the magnetic recording and/or reproducing apparatus, and to close and maintain the closed state of the shutter automatically upon extraction of the cassette from the holder, even in instances where the cassette is not provided with shutter closing spring means.

Attention is directed to our co-pending application No. 8319405 (Publication No. GB 2124012A) from which this application was divided out.



CLAIMS

1. A floppy disc cassette comprising an outer casing with a magnetic disc therein, the casing including a shutter mounted at one edge thereof for opening or closing a head access hole, the shutter comprising a pair of parallel shutter plates and a connecting web connecting together one edge of each of the shutter plates, a shutter lock provided inside the casing, a projection formed on the shutter to engage with the shutter lock thereby to retain the shutter in a position in which the head access hole is closed, and a recess in the connecting web of the shutter, said recess being provided only in the connecting web of the shutter and being so provided that when the cassette is inserted into a cassette player a member of the cassette player engages in the recess and upon extraction of the cassette from the cassette player the member engaged in the recess moves the shutter to the position in which the head access hole is closed and the projection on the shutter is engaged with the shutter lock.

2. A floppy disc cassette according to claim 1, wherein the shutter lock is biased towards the outside of the casing and, when the shutter is to be opened, the shutter lock is pushed to the inside of the casing and is thereby disengaged from the shutter.

3. A floppy disc cassette according to claim 2, wherein the shutter lock has a projecting portion and the projecting portion is externally exposed for unloeking the shutter lock.

4. A floppy disc cassette substantially as hereinbefore described and illustrated with reference to the accompanying drawings.