MAGNETIC DISC CASSETTES

This invention relates to magnetic disc cassettes capable of being used for the recording and/or reproducing of various analog and digital signals, and to recording and/or reproducing apparatus therefor. More particularly, the invention relates to disc cassettes having a cassette cover wherein is rotatably accommodated a flexible recording and reproducing disc such as a sheet-like magnetic disc.

Referring to Figure 1 of the accompanying drawings, there is shown a previously proposed recording and reproducing disc cassette 1 which comprises a flat cassette cover 4 in the form of a rectangular parallelepiped comprising upper and lower halves 2 and 3, and a sheet-like flexible magnetic disc (magnetic sheet) 5 accommodated rotatably within the cassette cover 4. The magnetic disc 5 has a respective magnetic layer formed on each surface thereof, and on the central part thereof there is stuck with an adhesive a centre core disc 6 formed by a circular plate. In the central part of the centre core disc 6 there is formed a rotary shaft insertion opening 7.

When the disc cassette 1 is installed or loaded on a magnetic recording and/or reproducing apparatus (not shown), a rotating carriage 8 enters a centre opening 3a of the lower half 3 and at the same time a rotary shaft 9 is inserted in the shaft insertion opening 7. In this state the centre core disc 6 is attracted to and secured on the rotating carriage 9 by a magnet (not shown). In this case, the magnetic disc 5 is disposed centrally in its thickness direction relative to the cassette cover 4. A magnetic head 11 is inserted into a head insertion opening 10 formed in the lower half 3, and is then brought into contact with the magnetic surface of the magnetic disc 5.

In such a loaded state, the centre core disc 6 is rotated together with the rotating carriage 9 by means of a driving unit such as a motor 12, whereupon the magnetic disc 5 is rotated within the disc cassette 1. In association therewith the magnetic head 11 is moved in a radial direction of the magnetic disc 5, thereby performing a desired recording or reproducing operation.

In the disc cassette 1 of this sort, in order to prevent the peripheral edge portion of the magnetic disc 5 from striking against the upper and

lower halves 2 and 3 and being bent thereby, a ring-like projection 13 is formed on the inner surface of the upper half 2 to restrict the displacement of the centre core disc 6 relative to the cassette cover 4.

Referring to Figure 2 of the accompanying drawings, the disc cassette 1 may, for example, have the following dimensional relationships between the cassette cover 4, the projection 13, the centre core disc 6 and the magnetic disc 5. The thickness l_1 of the cassette cover 4 is 3.4 mm, the plate thickness l_2 of the upper half 2 is 0.8 mm, the plate thickness l_3 of the centre opening portion 3a of the lower half 3 is 1.3 mm, the projecting length l_4 of the projection 13 is 0.5 mm, the spacing l_5 between the magnetic disc 5 and the projection 13 and the spacing l_5 between the magnetic disc 5 and a ring-like projection 14 of the lower half 3 are each 0.4 mm, the thickness l_6 of the centre core disc 6 is 0.5 mm, and the spacing l_7 between the inner surface of the upper half 2 and the centre core disc 6 is 0.4 mm. Thus, the magnetic disc 5 is disposed centrally in the thickness direction of the cassette cover 4.

However, when the disc cassette 1 is not installed on a magnetic recording and/or reproducing apparatus, that is, when the disc cassette 1 is not in use, if the magnetic disc 5 and the centre core disc 6 move towards the lower half 3 by virtue of their own weights as indicated by dot-dash lines in Figure 2, there is formed a gap of about 0.3 mm between the end of the projection 13 of the upper half 2 and the upper surface of the centre core disc 6. In the presence of this gap, the movement of the centre core disc 6 is no longer restricted by the projection 13, that is, the centre core disc 6 and the magnetic disc 5 move freely in the horizontal direction within the cassette cover 4, so that the peripheral edge portion of the magnetic disc 5 may strike against the side wall of the cassette cover 4 and be bent thereby. Once the peripheral edge portion of the magnetic disc 5 is bent, it is no longer possible to perform a good recording and reproducing operation in the vicinity of the bent peripheral edge portion.

This problem might be overcome by making the thickness l_5 of the centre core disc 6 larger and thereby making the overlapping length l_8 between the projection 13 and the centre core disc 6 larger at the time of installing the disc cassette 1. However, this is not very practical because of the resulting very narrow space (particularly in the thickness direction) within the cassette cover 4, and because of the requirement that the

magnetic disc 5 be disposed centrally in the thickness direction of the cassette cover 4.

According to the present invention there is provided a flexible magnetic disc cassette comprising:

a flexible magnetic disc;

a centre core disc formed from a flat disc by pressing so as to have a centre hollow and a raised flange, said centre core disc being attached to the centre of said flexible magnetic disc; and

a cover, having an upper half and a lower half, for containing said flexible magnetic disc with said centre core disc, said lower half having a driving hole which is larger in diameter than the outer diameter of said centre hollow of said centre core disc, so that said centre core disc engages loosely in said driving hole.

According to the present invention there is also provided a recording and/or reproducing apparatus in combination with a magnetic disc cassette of the type comprising:

a flexible magnetic disc;

a centre core disc formed from a flat disc by pressing so as to have a centre hollow and a raised flange, said centre core disc being attached to the centre of said flexible magnetic disc; and

a cover, having an upper half and a lower half, for containing said flexible magnetic disc with said centre core disc, said lower half having a driving hole which is larger in diameter than the outer diameter of said centre hollow of said centre core disc, so that said centre core disc engages loosely in said driving hole;

the apparatus comprising:

driving means to be coupled with said centre core disc for rotating said magnetic disc at a predetermined speed;

cassette supporting means mounted on a chassis for receiving and positioning said cassette;

cassette pressing means for depressing said cassette on said cassette supporting means; and

positioning means mounted on said driving means for positioning an inner surface of a wall of said cassette which wall is uppermost when said cassette is mounted on said driving apparatus.

The invention will now be described by way of example with

reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a previously proposed disc cassette installed on a magnetic recording and/or reproducing apparatus;

Figure 2 is an enlarged sectional view taken on line II-II of Figure 1;

Figure 3 is an exploded perspective view of an embodiment of disc cassette according to the invention;

Figure 4 is a perspective view of an upper half of a cassette cover viewed from below;

Figure 5 is a plan view of a centre core disc viewed from a recessed side thereof;

Figure 6 is a perspective view of the disc cassette of Figure 3 viewed from below;

Figure 7 is a longitudinal sectional view of the disc cassette of Figure 3 showing its central portion;

Figure 8 is a longitudinal sectional view of part of the disc cassette of Figure 3 showing a guide means;

Figures 9 and 10 are longitudinal sectional views of parts of the disc cassette of Figure 3 showing a modification of the guide means;

Figure 11 is a longitudinal sectional view of part of the disc cassette of Figure 3 showing an erroneous erase preventing detent formed on the cassette cover;

Figure 12 is an exploded perspective view showing the disc cassette of Figure 3 and part of an embodiment of recording and/or reproducing apparatus according to the invention;

Figure 13 is a plan view of the apparatus of Figure 12 with a cassette presser member removed;

Figure 14 is a plan view of the apparatus of Figure 12 with the cassette presser member;

Figure 15 is a sectional view taken on line XV-XV of Figure 14;

Figure 16 is a sectional view taken on line XVI-XVI of Figure 14;

Figure 17 is a sectional view taken on line XVII-XVII of Figure 14;

Figure 18 is an exploded perspective view showing the mounting of a rotor of a motor, a spacer, a leaf spring to which is attached a spring-biased driving pin, a yoke and a motor cover;

Figure 19 is a sectional view taken on line XIX-XIX of Figure 13;

Figures 20 and 21 are sectional views similar to Figure 19 illustrating the operation of the spring-biased driving pin;

Figure 22 is an exploded perspective view of part of a head moving mechanism;

Figure 23 is a perspective view of a rotational position detecting mechanism for the motor shaft of a stepping motor;

Figure 24 is a sectional view taken on line XXIV-XXIV of Figure 22;

Figure 25 is a sectional view taken on line XXV-XXV of Figure 24;

Figure 26 is a longitudinal sectional view illustrating cooperation between the erroneous erase preventing detent of the disc cassette and an erroneous erase preventing detent detection member;

Figure 27 is a schematic side view illustrating the principle of a correcting operation against an inward warp of upper and lower plates of the cassette cover; and

Figure 28 is a plan view of the centre core disc in a positioned state with the motor shaft and the spring-biased driving pin respectively inserted.

The embodiment of flexible magnetic disc cassette to be described with reference to Figures 3 to 11 contains a sheet-like flexible magnetic disc and is installed on a recording and/or reproducing apparatus for recording and/or reproducing operation. First, an explanation will be given of a disc cassette 26 comprising a flexible magnetic disc 21 and a cassette cover 22. As shown in Figure 3, the magnetic disc 21 is formed of, for example, a thin disc-like high polymer film having a thickness of 0.4 mm, and a magnetic layer is uniformly formed on both surfaces to which a recording/reproducing magnetic head is to be brought into contact. At the centre of the magnetic

disc 21 there is formed a circular centre opening 21a (see Figure 7) at which there is attached a centre core disc 23 made of a ferromagnetic material such as iron. The centre core disc 23 is formed from a flat disc by pressing and, as shown in Figures 3 and 7, on one side thereof there is formed a centre hollow 23a and on the other side thereof there is formed a disc-like convex portion 23b, while at the peripheral edge portion of the centre core disc 23 there is formed a ring-like raised flange 23c. Thus the centre core disc 23 has the general shape of a pan.

As shown in Figure 7, a ring-like double-sided adhesive sheet 27 is bonded to the flange 23c, and the peripheral edge portion of the centre opening 21a of the magnetic disc 21 is bonded to the adhesive sheet 27, whereby the centre core disc 23 and the magnetic disc 21 are joined together securely.

At a nearly central part of the centre core disc 23, a square centre aperture 24 is formed as a motor shaft insertion aperture, and at a position which is distant by a predetermined distance from the centre aperture 24, a rectangular driving and positioning aperture 25 is formed as a positioning-pin insertion aperture. As clearly shown in Figure 5, the centre O_1 of the centre aperture 24 is slightly off the centre O_2 of the centre core disc 23 and of the magnetic disc 21, and is displaced by a predetermined distance towards the driving and positioning aperture 25. The centre aperture 24 and the driving and/positioning aperture 24 are formed so that a pair of diagonal lines d_1 and d_2 of the centre aperture 24 are each parallel with short and long side portions 25b and 25a of the driving and positioning aperture 25, respectively. Moreover, the length of one side of the centre aperture 24 is slightly larger than the diameter of the motor shaft, so that the motor shaft when fitted in the centre aperture 24 has slight play. The reason why the centre of the centre aperture 24 is off the centre of the centre core disc 23, as will be described in detail later, is that it is intended to bring the centre of the motor shaft fitted in the centre aperture 24 of the centre core disc 23 into coincidence with the centre of the magnetic disc 21 when the disc cassette 26 is installed on the recording and/or reproducing apparatus.

The cassette cover 22 for accommodating the magnetic disc 21, as shown in Figure 3, comprises an upper half 22a and a lower half 22b which are made of, for example, injection moulded ABS resin containing an antistatic agent. The outer peripheral portions of the upper and lower

halves 22a and 22b are welded to each other to form a flat rectangular cassette. At a nearly central part of the lower half 22b there is formed a circular centre opening as a driving hole 28, and at the peripheral edge portion of the driving hole 28 and on the inner surface of the lower half 22b there is integrally formed a ring-like projection 29. As shown in Figures 6 and 7, the convex portion 23b of the centre core disc 23 fits in the driving hole 28 with slight play. On the inner surface of the central part of the upper half 22a, as shown in Figures 4 and 7, there is integrally formed a ring-like projection 30, and also around the projection 30 there is integrally formed a ring-like projection 31 which is concentric with the projection 30. The projecting length of the projection 30 is longer than that of the projection 31 and hence, as shown in Figure 7, the projection 30 extends beyond the projection 31 and projects on the inner surface side of the lower half 22b. The projection 30 fits in the centre hollow 23a of the centre core disc 23 with slight play.

Referring to Figure 7, the cassette cover 22, the upper and lower halves 22a and 22b, the centre core disc 23 and the projection 30 of the upper half 22a are, for example, in the following dimensional relationships. The thickness L_1 of the cassette case 22 is 3.4 mm, the thickness L_2 of an upper plate 22c and that of a lower plate 22d of the upper and lower halves 22a and 22b are each 0.8 mm, the thickness L_3 of the portion of the upper plate 22c surrounded by the projection 30 is 1.0 mm, the projecting length L_4 of the projection 30 is 1.5 mm, the thickness L_5 of the centre core disc 23 is 0.3 mm, the thickness L_6 of the lower plate 22d adjacent to the centre opening 28 is 1.3 mm, and the height L_7 of the centre core disc 23 is 1.8 mm.

When the disc cassette 26 is installed on the recording and/or reproducing apparatus as will be described later, the magnetic disc 21 is disposed nearly centrally in the direction of the thickness of the cassette cover 22 as shown by solid lines in Figure 7 and is then rotated. In this case, the distance L_8 between the flange 23c and the centre core disc 23 and the inner surface of the upper half 22a, and the distance L_9 between the magnetic disc 21 and the projection 29 of the lower half 22b are each 0.4 mm. The distance L_{10} between the end of the projection 30 of the upper half 22a and a lower surface 23d of the centre core disc 23 is 0.4 mm, and the distance L_{11} between the outer surface of the lower half 22b and the

lower surface 23d of the centre core disc 23 is 0.2 mm.

When the disc cassette 26 is not in use, the centre core disc 23 and the magnetic disc 21 rest on the lower half 22b by virtue of their own weights, for example, as shown by dot-dash lines in Figure 7. In this case, the end portion of the projection 30 of the upper half 22a and the projection 29 of the lower half 22b overlap with each other by 0.4 mm (distance L_{12}), so even if the centre core disc 23 is moved, a part of the centre hollow 23a of the centre core disc 23 is sure to engage the projection 30. Thereby the amount of play in a planar direction of the centre core disc 23 and hence the magnetic disc 21 is kept within a predetermined range, and therefore the projection 30 and the centre hollow 23a of the centre core disc 23 are not disengaged from each other along with the displacement of the centre core disc 23. If the disc cassette 26 is turned upside-down from the state shown in Figure 7 and consequently the centre core disc 23 rests on the upper half 22a by virtue of its own weight, the projection 30 comes into a completely fitted state within the centre hollow 23a of the centre core disc 23, so that, as in the aforesaid case, the amount of displacement of the centre core disc 23 and hence of the magnetic disc 21 is kept within a predetermined range.

In the disc cassette 26, the amount of displacement of the centre core disc 23 and of the magnetic disc 21 can be regulated exactly by the projection 30 until the gap between the upper and lower plates 22c and 22d becomes wider by 2.2 mm (the sum of the overlapping length of 0.4 mm and the centre core disc height of 1.8 mm) while the upper and lower halves 22a and 22b are moved from the state shown in Figure 7 towards the exterior, namely in the direction in which the upper plate 22c and the lower plate 22d move away from each other.

On the inside surfaces of the upper and lower halves 22a and 22b there are integrally formed, four arcuate ribs 33 and 34 respectively, extending concentrically with the driving hole 28 at regular intervals. When the cassette cover 22 is assembled, the ribs 33 of the upper half 22a and the ribs 34 of the lower half 22b are disposed on the same circumference, and at the same time the ribs 33 and 34 are positioned adjacent to each other at the four corners of the cassette cover 22 whereby there is effectively formed substantially one pair of ribs at each corner. The magnetic disc 21 is disposed so as to be surrounded with these ribs 33 and 34. The ribs 33 abut the inner surface of the lower plate 22d of the lower half 22b and the

ribs 34 abut the inner surface of the upper plate 22c of the upper half 22a. Thereby the cassette cover 22, which is flat and is easily deformed by even a small external force, is mechanically reinforced. Furthermore, in order to avoid possible damage or wear of the magnetic disc 21, a magnetic disc protecting non-woven fabric 35 is attached by heat-weld or a like means between the projection 31 and the ribs 33 and also between the projection 29 and the ribs 34 in the upper and lower halves 22a and 22b.

The distance from the centre of the driving hole 28 of the lower half 22b to the ribs 33 and 34 is somewhat longer than the radius of the flexible magnetic disc 21 so that even if the flexible magnetic disc 21 is displaced within the cassette cover 22 by the looseness of the centre core disc 23 in the driving hole 28, the peripheral edge portion of the flexible magnetic disc 21 does not abut the ribs 33 and 34.

In the upper and lower halves 22a and 22b of the cassette cover 22 and the non-woven fabric 35, there are respectively formed openings 36, 37 and 38 of the same shape extending in a radial direction of the magnetic disc 21, the openings 36, 37 and 38 being overlapped in opposed relation. As will be described later, a magnetic head is inserted from the opening 37 formed in the lower half 22b through the opening formed in the lower non-woven fabric 35, while a head pressing pad is inserted from the opening 36 formed in the upper half 22a through the opening 38 formed in the upper non-woven fabric 35. In Figure 3, positioning projections 39a and 39b are shown for mutual engagement when assembling the upper and lower halves 22a and 22b.

As shown in Figures 3 and 6, there is formed a recess 40 on each of the outer surfaces of the upper and lower halves 22a and 22b in the respective portions where there are formed the pad insertion opening 36 and the head insertion opening 37, and in the recess 40 there is mounted a shutter 41 having a U-shaped cross-section and made from aluminium, stainless steel or a synthetic resin, so as to be slidable in a predetermined direction. In the recess 40 of the lower half 22b, as shown in Figure 6, there is formed a rectilinear guide groove 42 extending along a side edge portion of the cassette cover 22, while in relation to the guide groove 42 there is formed in the shutter 41, as shown in Figure 8, a pawl-like projection 43, for example in three places, formed by inwardly bending a part of the shutter 41 by means of a press. The pawl-like projection 43 of the shutter 41 is

inserted in the guide groove 42 of the lower half 22b so that the shutter 41 is guided by the guide groove 42 slidably in the direction of arrows A and B in Figure 6. The shutter sliding mechanism is not limited to what has just been described. For example, as shown in Figure 9, a part of the shutter 41 may be subjected to half-blanking by means of a press to form a projection 44a which projects inwardly of the shutter 41, and the projection 44a is slidably fitted in the guide groove 42. Further, as shown in Figure 10, there may be formed a V-shaped projection 44b which projects inwardly of the shutter 41, and this projection 44b is slidably fitted in the guide groove 42.

In the side edge portion of the lower half 22b where the guide groove 42 is formed, as shown in Figure 6, there is formed a shutter mounting and demounting recess 56 communicating with the guide groove 42 in, for example, three places. When the shutter 41 is slid, for example, in the direction of the arrow B in Figure 6 to the position indicated by dot-dash lines, the recess 56 and the pawl-like projection 43 of the shutter 41 become opposed to each other. In this state, if a force is applied in a pulling direction of the shutter 41 from the cassette cover 22, the shutter 41 can easily be demounted from the cassette cover 22.

In each of opposed plate portions 41a and 41b of the shutter 41 there is formed an opening 45 having substantially the same shape as the pad and head insertion openings 36 and 37. By sliding the shutter 41 along the guide groove 42, the openings 36 and 37 can be selectively opened or closed. If the shutter 41 is disposed in a position as indicated by solid lines in Figure 6, the opening 45 in the shutter 41 and the openings 36 and 37 in the cassette cover 22 overlap with one another, that is, the openings 36 and 37 are opened. On the other hand, if the shutter 41 is slid to the position shown by dot-dash lines in Figure 6, the openings 36 and 37 are covered and closed with the shutter 41.

In the side portion of the cassette cover 22 where the shutter 41 is mounted, there is formed a cut-out portion 53 as shown in Figures 3 and 6, and the cut-out portion 53 is opened or closed along with the above-described sliding movement of the shutter 41. That is, when the opening 45 in the shutter 41, the openings 36 and 37 in the cassette cover 22 and the opening 38 of the fabric 35 overlap each other, the cut-out portion 53 is opened, while when the openings 36, 37 and 38 are covered with the shutter 41, the cut-out portion 53 is also closed. If the cut-out portion 53 is opened,

as will be described later, the cassette cover 22 can be installed in the right position on the recording and/or reproducing apparatus, and recording and reproducing can be performed. But, if the cut-out portion 53 is closed by the shutter 41, as will be described later, the disc cassette 26 cannot be installed in the normal operation position on the apparatus, and therefore misoperation is prevented.

Moreover, in order to prevent the cassette cover 22 from being installed in an erroneous direction, there is formed a triangular cut-out portion 52 at one predetermined corner of the cassette cover 22.

In this embodiment, moreover, there is provided an erroneous erase preventing mechanism at one corner of the cassette cover 22, so that the information recorded on the magnetic disc 21 will not be erased by mistake. That is, as shown in Figures 3 and 11, a channel-shaped cut-out portion 46 is provided at a predetermined corner of the lower half 22b of the cassette 22, and within the cut-out portion 46 an erroneous erase preventing detent 47 is connected integrally with the lower half 22b by a thin portion 49 formed by a V-shaped groove 48. On the inner surface on the free end side of the detent 47 there is integrally formed an abutment 50 extending towards the upper plate 22c of the upper half 22a and the free end of the abutment 50 is in contact with the inner surface of the upper plate 22c. Accordingly, even when a force is exerted in the direction of an arrow C in Figure 11, the erroneous erase preventing detent 47 is not separated from the lower half 22b. If it is desired to separate the detent 47 from the lower half 22b for the prevention of an erroneous erase, a pivotal force may be applied in the direction of an arrow D in Figure 11 to the free end of the detent 47 whereby the thin portion 49 can easily be cut to remove the dent 47 by folding. The reason for such a construction is that in the thin cassette cover 22 there is a thickness restriction on pushing and folding off the detent 47 inwardly. The construction of the embodiment permits the detent 47 to be folded off surely and easily.

At the two corner portions on the side of the opening 37 of the lower half 22b and in positions outwardly displaced from the ribs 34, there are formed a pair of positioning holes 51 for positioning the cassette cover 22 when the disc cassette 26 is installed on the recording and/or reproducing apparatus. In this embodiment, moreover, auto loading cut-out portions 54 and 55 having a semicircular section are formed in both side portions of the

cassette cover 22. Within the cut-out portions 54 and 55 there are inserted a pair of supporting rods (not shown) of a moving mechanism for holding the cassette cover 22 and moving it automatically to a predetermined position as necessary. Consequently, by utilizing the auto loading cut-out portions 54 and 55 it is possible to form the apparatus so that an auto change of the disc cassette 26 can be performed, and an automatic cassette take-out operation is possible at the time of quality inspection.

The recording and/or reproducting apparatus will now be described with reference to Figures 12 to 28.

As shown in Figures 12 to 14, on a chassis 61 of a recording and/or reproducing apparatus (hereinafter referred to simply as the "apparatus") 60 there are mounted four cassette receiving pins 63, 64, 65 and 66 for receiving the disc cassette 26. On the upper ends of the pins 63 and 64 there are integrally formed cassette positioning projections 67 and 68 respectively arranged to fit in the pair of positioning holes 51 formed in the cassette cover 22. The cassette receiving pins 63, 64, 65 and 66 are respectively provided at their upper ends with receiving surfaces 63a, 64a, 65a and 66a, which are equal in height with respect to the chassis 61.

On the chassis 61 there are fixed a pair of L-shaped supporting members 69 and 70, to which a cassette presser member 72 is attached by pivots 73 and 74 respectively. The cassette presser member 72 has a plate body 72a, and four cassette pressing pins 75, 76, 77 and 78 are mounted on the lower surface of the plate body 72a. That is, as shown in Figures 15 to 17, the pins 75 to 78 are slidably supported in the vertical direction by a sleeve 79 provided in the plate body 72a and at the same time are normally resiliently biased downwards by a compression coiled spring 81 interposed between the sleeve 79 and a spring shoe 80. Accordingly, the disc cassette 26 is pressed for holding towards the cassette receiving pins 63, 64, 65 and 66 by the cassette pressing pins 75, 76, 77 and 78.

In this case, as is apparent from Figure 14, the disc cassette 26 is received at its four corners by the cassette receiving pins 63, 64, 65 and 66. On the other hand, the positions wherein the cassette pressing pins 75, 76, 77 and 78 of the cassette presser member 72 hold down the disc cassette 26 are each offset by a predetermined distance from the positions of the pins 63, 64, 65 and 66 towards the central side of the disc cassette 26. That is, the cassette pressing pins 75 and 77 are disposed nearly on a line

joining the cassette receiving pins 63 and 65 and are disposed between the pins 63 and 65, and are so constructed as to be in corresponding relation to the ribs 33 and 34 of the disc cassette 26. The cassette pressing pins 76 and 78 and the cassette receiving pins 64 and 66 are also disposed in the same relation as above.

On the chassis 61 there is also mounted a driving mechanism 82 for rotating the magnetic disc 21 on the disc cassette 26. At a nearly central position of the portion surrounded with the cassette receiving pins 63, 64, 65 and 66, there is mounted a flat-type brushless motor 83 for rotating the magnetic disc 21 in the disc cassette 26. As shown in Figure 18, on the upper surface of a rotor 83a of the motor 83, a spacer 84 in the form of a partially cut-out ring-like disc, a leaf spring member 86 to which a spring-biased driving pin 85 is fixed for centring the magnetic disc 21 in the cassette cover 22, and a disc-like yoke 90 having a ring-like recess 88 formed in the upper surface thereof are tightened together with a pair of set-screws 91. The leaf spring member 86 is interposed between the spacer 84 and the yoke 90, and the spacer 84, the leaf spring member 86 and the yoke 90 are further tightened together with a set-screw 92, so that these components are rotated together with a motor shaft 83b of the motor 83.

In a nearly central part of the leaf spring member 86, as shown in Figure 18, there is formed a generally horseshoe-shaped opening 94. A pin mounting portion 96 is also integrally formed with a pair of narrowly formed L-shaped arm portions 95, the pin mounting portion 96 being supported from both sides by the pair of arm portions 95. The driving pin 85 is fixed to the pin mounting portion 96. The spring-biased driving pin 85, as shown in Figures 19 to 21, is formed of a stem portion 98 having a nearly centrally located flange 98a, a bearing portion 99 fitted and fixed over the upper end portion of the stem portion 98, and a cylindrical portion 101 mounted rotatably with respect to the stem portion 98 by means of a ball bearing 100 disposed between the bearing portion 99 and the cylindrical portion 101. The stem portion 98 extends through the pin mounting portion 96, and onto the lower end portion of the extending portion of the stem portion 98 there is fixed a cylindrical mounting member 102. By the flange 98a of the stem portion 98 and the mounting member 102, the pin mounting portion 96 of the leaf spring member 86 is held in place whereby the spring-biased driving pin 85 is secured to the pin mounting portion 96. The pin 85 is disposed such

that the cylindrical portion 101 of the pin 85 has passed through an aperture 89 formed in the recess 88 of the yoke 90. Consequently, within the aperture 89, the pin 85 is capable of being moved in the direction of an arrow E in Figure 19 by the resilience of the leaf spring member 86, and particularly it is pivotable in the direction of arrows F and G, centred on the arm portion 95 in Figure 19 (in other words, it is movable in the radial direction of the yoke 90). The pin 85 is mounted in such a position that the distance S_1 shown in Figure 19 is slightly longer than the distance S_2 shown in Figure 28.

A end portion 83c of the motor shaft 83b of the motor 83 is generally hemispherical, and the height of the end portion 83c of the motor shaft 83b is set to a predetermined level. As will be described in detail later, if the upper plate 22c of the cassette cover 22 warps towards the lower plate 22d when installing the disc cassette 26 onto the apparatus 60, the end portion 83c engages the inner surface of the upper plate 22c to correct the inward warp of the latter.

On the other hand, in the recess 88 of the yoke 90 four pairs of magnets 104 are fixed with an adhesive at nearly equal intervals in the circumferential direction. On the upper surfaces of inner and outer flanges 90a and 90b of the yoke 90 there are respective stuck lubricant sheets 105 and 106 comprising a polytetrafluoroethylene sheet or the like incorporating carbon. As shown in Figures 19 to 21, the upper surfaces of the lubricant sheets 105 and 106 (that is, the receiving surfaces for the centre core disc 23) are disposed so as to be flush with each other and above the upper surfaces of the magnets 104. The cylindrical portion 101 of the pins 85 projects upwardly from the upper surfaces of the lubricant sheets 105 and 106.

In Figures 12 and 13 is shown a motor cover 107 having an opening 107a formed in the upper surface thereof. Within the opening 107a the yoke 90 is rotatably disposed, and the lubricant sheets 105 and 106 stuck on the yoke 90 projects upwards from the upper surface of the motor cover 107.

Next, an explanation will be given of a head moving unit in the apparatus 60.

The head moving unit includes a head support 110 onto which a magnetic head 108 is secured on a mounting plate 109, and a feed screw 112 which is driven by a stepping motor 111 about the axis thereof. As shown in

Figures 12 to 14, the stepping motor 111 is screwed to a vertical piece 113 of the chassis 61, and a motor shaft 111a of the stepping motor 111 is directly connected to the feed screw 112. The other end of the feed screw 112 is rotatably attached to a cut-up piece 117 of the chassis 61, and the feed screw 112 is disposed horizontally with respect to the chassis 61.

In this case, the head support 110 is so constructed as to be movable along the axis of the feed screw 112. That is, a pair of guide shaft mounting portions 114 and 115 are provided on the chassis 61, and both end portions of a guide shaft 116 having a circular section are fixed to the mounting portions 114 and 115. The guide shaft 116, which is disposed parallel with the feed screw 112, extends through the head support 110 and in this state it is borne by a sleeve 118 fixed to the head support 110. Consequently, the head support 110 is slidable while being guided by the guide shaft 116 in the direction of arrows S and T in Figures 12 and 24.

With the head support 110, as shown in Figures 12 and 22, there is integrally formed a pair of needle-like member mounting portions 120 which are opposed to each other in spaced relation. The feed screw 112 extends through an opening 121 formed in the vertical piece 113 of the head support 110, and is disposed between the pair of needle-like mounting portions 120. In the upper surfaces of the pair of mounting portions 120 there are formed V-shaped grooves 122a and 122b respectively, the V-shaped grooves 122a and 122b having an inclination corresponding to the pitch angle of the threaded portion of the feed screw 112 in the direction orthogonal to the axis of the feed screw 112 and extending on the same straight line. A needle-like member 124 spans between the pair of mounting portions 120 with its end portion inserted in the V-shaped grooves 122a and 122b. Furthermore, as shown in Figure 24, it is inserted without play, between and along adjacent threads (that is, at the root) of the feed screw 112. Above the needle-like member 124 there is disposed a keep plate 125 which is fixed onto the upper surfaces of the mounting portions 120 with a pair of set-screws 126 whereby the needle-like member 124 is secured to the mounting portions 120 in the aforesaid arrangement. Furthermore, as shown in Figure 25, a leaf spring 127 is fixed to the lower surface of one mounting portion 120 with the set-screw 126, and by virtue of a resilient restoring force of the free end of the leaf spring 127 the feed screw 112 is normally urged towards the needle-like member 124 and the keep plate 125. Consequently,

the needle-like member 124 and the threaded portion of the feed screw 112 never become disengaged from each other, and the needle-like member 124 is kept engaged without play between adjacent threads.

On the head support 110, as shown in Figures 12 and 24 there is pivotably mounted a pad supporting member 129 which holds a pad 128 formed of felt or the like. In more particular terms, on the head support 110 there are mounted a pair of opposed vertical pieces 130 extending in the direction perpendicular to the chassis 61, and a bearing 131 is fixed to each of the vertical pieces 130 (see Figures 12 and 13). Furthermore, pivots 132 fixed to the pad supporting member 129 are borne by the bearings 131, while between one vertical piece 130 and the head support 110 there is stretched a compression coiled spring 133. Thereby, the head support 110 is normally urged round the pivots 132 in the direction of an arrow H in Figures 12 and 24, namely in the direction in which the pad 128 comes into pressure contact with the magnetic head 108. When the disc cassette 26 is not installed on the apparatus 60, the head support 110 is urged in the direction of an arrow I in Figure 12 against the force of the compression coiled spring 133 by means of a predetermined urging mechanism such as a plunger solenoid (not shown), so that the pad 128 is spaced from the magnetic head 108. That is, the state of the apparatus 60 shown in Figure 12 is the state in the case that the disc cassette 26 is not installed or not in operation. When the disc cassette 26 has been installed or in operation, the head support 110 is pivotally moved in the direction of the arrow H by virtue of the urging force of the coiled spring 133. As a result, as shown in Figure 24, the magnetic disc 21 exposed to the openings 36 and 37 in the cassette cover 22 is held between the pad 128 and the magnetic head 108.

Referring now to Figure 23, a disc 135 made of a synthetic resin is coaxially fixed onto the other end of the motor shaft 11a of the stepping motor 111, and a reflector 136 is mounted on a part of the peripheral surface of the disc 135. A detector 137 comprising a light emitting element and a light receiving element (photo-sensor) is disposed in opposed relation to the outer peripheral surface of the disc 135. A rotational position of the motor shaft 11a of the stepping motor 111 is detected by the cooperation of the detector 137 and the reflector 136. A detection mechanism 137a for detecting a movement position of the head support 110 with respect to the feed screw 112 is mounted near both ends of the feed screw 112. On the

basis of detection signals from the detection mechanism 137a and the detector 137, there are decided rotation start and stop positions of the motor shaft 11a as will be described later. As a result, the magnetic head 108 can be moved by only an amount required for the magnetic disc 21 to be recorded or reproduced by the magnetic head 108 (namely within a predetermined range of movement). An optical pulse generator 138 (Figure 12) detects a rotational phase of the flat brushless motor 83.

On the cassette receiving pin 65, as shown in Figures 12 and 26, there is mounted an erroneous erase preventing detent detecting member 140 so as to be movable along the axis of the pin 65, the detecting member 140 being provided at one end thereof with an upwardly projecting detector portion 143. The detecting member 140 is normally urged upwards by a compression coiled spring 141 and is retained by a stop 142 mounted on the upper end portion of the pin 65. On the other hand, a detector 144 incorporating therein a light emitting element and a light receiving element (neither shown) disposed in opposed relation to each other, is attached to the chassis 61. The detector 144 is constructed so that the other end portion of the detecting member 140 can get between the light emitting and receiving element along with a downward movement of the detecting member 140. That is, while the detecting member 140 is retained against the stop 142 by the compression coiled spring 141, the other end portion of the detecting member 140 is spaced upwards from between the light emitting and receiving element. When the detector portion 143 of the detecting member 140 has been forced down by the erroneous erase preventing detent 47 of the cassette cover 22, the other end portion of the detecting member 140 gets between the light emitting and receiving elements against the force of the compression coiled spring 141, whereby the recording operation is performed in the above case. Otherwise the recording operation is prevented.

In this case, in order to prevent erroneous installation (loading) of the disc cassette 26 on the apparatus 60, there are formed erroneous installation preventing projections 146 and 147 on the chassis 61 side in opposed relation to the channel-shaped cut-out portion 53 and the triangular cut-out portion 52 both formed in the disc cassette 26.

Next, the operation of the apparatus 60 will be described.

First, the shutter 41 of the disc cassette 26 to be installed on the appartus 60 is slid in the direction of the arrow A in Figure 6 until the

openings 36 and 37 of the disc cassette 26 and the opening 45 of the shutter 41 overlap with each other, whereby the openings 36 and 37 are opened and at the same time the channel-shaped cut-out portion 53 of the disc cassette 26 is opened. Thereafter, the disc cassette 26 is installed on the apparatus 60 by means of a cassette loading mechanism (not shown). As shown in Figure 14, the erroneous installation preventing projection 146 and 147 of the chassis 61 can get in the channel-shaped cut-out portion 53 and the triangular cut-out portion 52 of the disc cassette 26, respectively, so that the cassette cover 22 can be disposed in the normal loading position, and the disc cassette 26 is placed on the cassette receiving pins 63, 64, 65 and 66 by means of the cassette loading mechanism. The projections 67 and 68 of the cassette receiving pins 63 and 64 are respectively fitted into the positioning holes 51 and 52 formed in the cassette cover 22, whereby the positioning of the disc cassette 26 is effected in its planar direction, that is the longitudinal and the transverse direction. At the same time, the cassette presser member 72 moves pivotally about the pivots 73 and 74 in interlock with the cassette loading mechanism, thus allowing the pins 75, 76, 77 and 78 of the cassette presser member 72 to force the disc cassette 26 elastically downwards by virtue of the forces of the compression coiled springs 81. Accordingly, the disc cassette 26 is resiliently held between the pins 63, 64, 65 and 66 and the pins 75, 76, 77 and 78 of the presser member 72 whereby the positioning of the disc cassette 26 in the height direction is effected.

When installing the disc cassette 26, if the cut-out portion 53 is covered with the shutter 41, or if the triangular cut-out portion 52 is not disposed in the normal position (that is, if the loading direction of the disc cassette 26 is not correct), since corner portions of the shutter 41 and the disc cassette 26 will strike against the projections 146 and 147, the disc cassette 26 is not disposed in the foregoing normal loading position. Consequently, the loading operation is not performed and hence recording and reproducing operation are not carried out. It is therefore not possible for the magnetic head 108 to be damaged by abutment with the shutter 41 which covers the opening 37 of the disc cassette 26.

On the other hand, the portion of the disc cassette 26 where the openings 36 and 37 are formed is inserted between the magnetic head 108 and the pad 128. In interlock with the loading operation of the disc cassette

26 by means of the loading mechanism (not shown), the pad supporting member 129 is pivotally moved in the direction of the arrow H in Figures 12 and 24 by the force of the coiled spring 133, thus resulting in a part of the magnetic disc 21 exposed through the opening 45 in the shutter 41, the openings 36 and 37 in the cassette cover 22 and the opening 38 in the non-woven fabrics 35 being held between the magnetic head 108 and the pad 128.

In this case, if the erroneous erase preventing detent 47 of the disc cassette 26 has not been folded off, the detector portion 143 of the detecting member 140, as indicated with dot-dash lines in Figure 26, is forced down against the force of the coiled spring 141 by the detent 47, thereby allowing the gap between the light emitting and receiving elements of the detector 144 to be interrupted. As a result, the apparatus 60 is ready to perform recording and reproducing operation on the basis of a predetermined signal from the detector 144. On the other hand, if the detent 47 has been folded off, the end of the detector portion 143 of the detecting member 140 can get into the cut-out portion 46 of the cassette cover 22. Therefore, the detecting member 140 is left disposed in the upper position by virtue of the coiled spring 141, so that the gap between the light emitting and receiving elements of the detector 144 is not interrupted and hence the apparatus 60 is maintained in a state not performing a reproducing operation, on the basis of a predetermined signal from the detector 144.

Along with such a loading operation of the disc cassette 26, the motor shaft 83b is inserted in the centre aperture 24 of the centre core disc 23 fitted in the driving hole 28 of the lower half 22b of the disc cassette 26. In this case, if the upper plate 22c of the loaded disc cassette 26 is warped towards the lower plate 22d, as indicated by dot-dash lines in Figure 27, the hemispherical top 83c of the motor shaft 83b comes into contact with the nearly central part of the inner surface of the upper plate 22c. Consequently, a force in the direction of arrows J and K in Figure 27 is exerted on the upper plate 22c by the pins 75, 76, 77 and 78. As a result, when the loading of the disc cassette 26 is over, the deformation (inward warp) of the upper plate 22a is already corrected and the upper plate 22a is flat as indicated by solid lines in Figure 27.

On the other hand, when the disc cassette 26 has been installed, the pressing position of the pins 75, 76, 77 and 78 of the presser member 72 are

on the diagonal lines of the pins 63, 64, 65 and 66 as previously noted and they are the positions corresponding to the ribs 33 and 34 of the disc cassette 26. Therefore, if the lower plate 22d of the disc cassette 26 to be installed is deformed inwards, namely towards the upper plate 22c as indicated by dot-dash lines in Figure 27, the lower plate 22d undergoes a force in the direction of arrows L and M through the ribs 33 of the upper half 22a and the ribs 34 of the lower half 22b, thus resulting in the deformation of the lower plate 22d being corrected and the lower plate 22d becoming flat as indicated by solid lines in Figure 27.

Thus, as set forth above, even if the upper and lower plates 22c and 22d are both warped inwards, this warp can be corrected to a satisfactory extent. As a result, the space within the cassette cover 22 when installed can always be maintained constant, there is no fear of obstruction of the rotation of the magnetic disc 21, and the magnetic disc 21 can be rotated by a relatively small driving torque.

Along with the aforesaid installation of the disc cassette 26, the centre core disc 23 is attracted by the magnets 104 of the yoke 90 and is disposed on the lubricant sheets 105 and 106 stuck on the upper surfaces of the flanges 90a and 90b of the yoke 90. If the position of the driving and positioning aperture 25 in the centre core disc 23 and that of the spring-biased pin 85 are shifted from each other, the pin 85 is forced down by the centre core disc 23 by virtue of the attrative force exerted between the centre core disc 23 and the magnets 104. As a result, as shown by solid lines in Figure 20, the pin 85 is forced down against the resilient restoring force of the leaf spring 86, particularly the arm portion 95. In such a state, when the apparatus 60 is changed to the recording or reproducing mode and the motor shaft 83b of the motor 83 is rotated, the pin 85 rotates together with the leaf spring 86 and the yoke 90 with respect to the centre core disc 23.

At this time the magnetic disc 21 is held between the magnetic head 108 and the pad 128 whereby load torque is exerted on the magnetic disc 21. Consequently, even if a frictional force is exerted between the lubricant sheets 105 and 106 stuck on the yoke 90 and the centre core disc 23, and between the latter and the pin 85, the centre core disc 23 is not rotated and the pin 85 moves round relative to the stationary centre core disc 23. Thereafter, when the driving and positioning aperture 25 in the centre core disc 23 is reached as indicated by dot-dash lines in Figure 28, the cylindrical

portion 101 of the pin 85 gets in the aperture 25 by virtue of the resilient restoring force of the leaf spring 86.

Then, as the motor shaft 83b rotates in the direction of arrow N, the pin 85 is moved further round and the cylindrical portion 101 of the pin 85 first comes into engagement with a positioning edge 2a located further from the motor shaft 83b out of a pair of longer edges of the aperture 25. Then the pin 85 is moved further round and comes into engagement with a driving edge 25b of the aperture 25, while the cylindrical portion 101 of the pin 85 is rotated with the ball bearing 100 since a holding force induced by the magnetic head 108 and the pad 128 and an inertia force caused by the difference in revolution between the yoke 90 and the centre core disc 23 are exerted as a load torque on the magnetic disc 21 and the centre core disc 23. In this case, as previously noted, since the distance S1 shown in Figure 19 is set slightly longer than the distance S2 shown in Figure 28, the pin 85 is brought into an inclined state by a torsional deformation of the arm portion 95 of the leaf spring 86 as illustrated in Figure 21. As a result, the axis of the pin 85 now has a slight inclination with respect to the vertical direction in Figure 21, so that on the centre core disc 23 there is normally exerted an urging force in the direction of arrow P in Figures 21 and 28 through the cylindrical portion 101 of the pin 85, by virtue of the resilient restoring force of the arm portion of the leaf spring 86.

Although the load torque applied to the magnetic disc 21 by the magnetic head 108 and the pad 128 is small, the provision in this embodiment of the ball bearing 100 between the stem portion 98 and the cylindrical portion 101 allows the pin 85 to be sure to move to the predetermined position indicated by solid lines in Figure 28, even if the forming accuracy of the insertion apertures 24 and 25 in the centre core disc 23 is not good.

As the centre core disc 23 is moved in the direction of the arrow P, two sides 24a and 24b of a V-shaped corner located farther from the driving and positioning aperture 25 out of the four sides of the motor shaft insertion centre aperture 24 are brought into pressure contact at two points with the motor shaft 83b, and the centre core disc 23 is positioned. Accordingly, the centre of the magnetic disc 21 stuck on the centre core disc 23 is disposed nearly on the axis of the motor shaft 83b. In this state, as the motor shaft 83b rotates and the pin 85 is moved round in the direction of the arrow N in

Figure 28, the cylindrical portion 101 of the pin 85 pushes the driving edge 25b of the aperture 25, so that the centre core disc 23 and hence the magnetic disc 21 is rotated in the direction of the arrow N. Since the magnetic disc 21 is disposed concentrically with the motor shaft 83b, it is rotated in an almost centred state.

Next, an explanation will be given of the operation of the head moving mechanism. First, when the apparatus 60 is changed, for example, to the reproducing mode in a load state of the disc cassette 26 in the manner as set forth hereinbefore, the magnetic disc 21 rotates in the previously described manner. Along with this rotation, recorded information is read-out by the magnetic head 108 which is in sliding contact with the recording surface of the magnetic disc 21, and a synchronizing signal contained in the read-out information is supplied to a stepping motor driving circuit (not shown).

Every time such a synchronizing signal is supplied, a predetermined driving current is provided from the above driving circuit to the stepping motor 111 whereby the motor shaft 111a is rotated in the direction of an arrow Q in Figures 12 and 24 in steps by a predetermined rotational angle (for example, 15 degrees). Along with this rotation of the motor shaft 111a, the needle-like member 124 inserted without play between adjacent threads of the feed screw 112 is moved in the direction the arrow S by the feed screw 112. Thereby the head support 110, together with the needle-like member 124, is guided by the guide shaft 116 and moves stepwise to the next circular recording track intermittently, namely at every rotation of the magnetic disc 21, in the direction of the arrow S. Consequently, the magnetic head 108 and the pad supporting member 129 both mounted on the head support 110 slide together with each other and with the magnetic disc 21 held therebetween, and move intermittently in the longitudinal direction within the head and pad insertion openings 36 and 37 in the disc cassette, namely along a radial direction of the magnetic disc 21.

As the pitch of the feed screw 112 is relatively small and the stepping motor 111 has a relatively large rotational angle (for example, about 15 degrees) per step, even if the recording track pitch on the magnetic disc 21 is small, it is possible to effect positioning of the magnetic head 108 with high accuracy with respect to the recording track to be reproduced. This is because even if stepping motors have the same

mechanical accuracy in a single step rotation, the ratio of this mechanical accuracy to the one step rotational angle is smaller in a stepping motor having a larger rotational angle, and therefore the magnetic head 108 can be moved with high accuracy.

During the above movement, the feed screw 112 undergoes a downward force in Figures 24 and 25 through the needle-like member 124. But since force towards the needle-like member 124 is exerted at all times on the feed screw 112 by means of the leaf spring 127, the threads of the feed screw 112 and the needle-like member 124 will never become disengaged.

In this way, the magnetic head 108 in sliding contact with the magnetic disc 21 moves stepwise and radially from the outer periphery towards the centre of the magnetic disc 21 at every rotation of the motor shaft 83b, namely on each circular recording track. When the head support 110 has been moved to a predetermined position and the magnetic head 108 is near the inside terminal edge portion of the magnetic surface of the magnetic disc 21, the position of the head support 110 is detected by a detection mechanism 137a. Then, when the detector 137 and the reflector 136 become opposed to each other along with the rotation of the motor shaft 111a of the stepping motor 111, the rotation of the motor shaft 111a in the direction of the arrow N is stopped on the basis of detection signals from the detection mechanism 137a and the detector 137. Conversely, if the feed screw 112 has been rotated in the direction of an arrow R in Figures 12 and 24 by means of the stepping motor 111, the magnetic head 108 is moved from the radial centre of the magnetic disc 21 towards the outer periphery (in the direction of the arrow T in Figures 12 and 24). When it has reached the outside terminal edge portion of the magnetic surface, the rotation of the motor shaft 111a in the direction opposite to the arrow N direction is stopped.

With the above operation the information recorded on the recording surface of the magnetic disc 21 is reproduced. Also, in the recording operation, the same operation is performed as set forth hereinbefore.

In the disc cassette 26 described above, the centre core disc 23 is formed in the shape of a pan, and the centre hollow 23a of the centre core disc 23 and the projection 30 of the upper half 22a are held in a fitted state, so that even if the magnetic disc 21 is displaced towards the lower half 22b

due to its own weight while the disc cassette 26 is not in use, the movement of the centre core disc 23 and hence of the magnetic disc 21 in their planar direction is surely restricted within a predetermined range by the engagement between the centre core disc 23 and the projection 30. Consequently, it is possible to eliminate the risk of the peripheral edge portion of the magnetic disc 21 coming into contact with the ribs 33 and 34 and being damaged thereby. Particularly in the case of a flat-type disc cassette, it is preferable that the range of movement in the vertical direction of the centre core disc 23 is as large as possible having regard to the dimensional variations of the various components. In this connection, by forming the centre core disc 23 in the shape of a pan, it becomes possible to have a larger range of movement than in the case of a plate-like centre core disc 6 as shown in Figure 27.

Moreover, as previously noted, even if the upper plate 22c and the lower plate 22d of the cassette cover 22 are deformed to a certain extent in the direction away from each other because of a low mechanical strength of the cassette cover 22, the range of movement of the centre core disc 23 can be surely restricted. Moreover, since the centre core disc 23 is formed of a thin plate, it is possible to reduce its weight as compared with a conventional plate-like centre core disc, and this in turn permits the use of a small-sized low torque motor as the driving source for the magnetic disc 21.

Also, when joining together the magnetic disc 21 and the centre core disc 23, the convexed portion 23b of the centre core disc 23 serves as a guide allowing the magnetic disc 21 to be mounted with very high accuracy with respect to the centre core disc 23. Consequently, the vibration of the outer part of the magnetic disc 21 during rotation can be kept to a minimum.

Moreover, the distance from the yoke 90 to the inner surface of the upper plate 22c of the upper half 22d at the time of installation of the disc cassette 26 can be relatively large, which permits the formation of a hemispherical tapered portion at the end portion 83c of the motor shaft 83b, as a result, even without forming an opening in the upper plate 22c in corresponding relation to the motor shaft 83b, the centre core disc 23 can be fully guided by the tapered portion.

Various modifications are of course possible, for example, the

material of the centre core disc 23 is not limited to iron, and any suitable magnetic material may be used, and further the centre core disc 23 may be formed of a hard material incorporating a magnetic powder.

Regarding the dimensional relationship between the upper and lower halves 22a and 22b of the cassette cover 22 and the centre core disc 23, the values of L_1 to L_{12} previously shown are merely examples, which may be changed if there exists an overlapping portion between the projection 30 of the upper half 22a and the lower half 22b. It is also possible to form the projection 30 on the lower half 22b so as to project towards the upper half 22a, and to insert it in the centre hollow 23a of the centre core disc 23.

CLAIMS

1. A flexible magnetic disc cassette comprising:
a flexible magnetic disc;
a centre core disc formed from a flat disc by pressing so as to have a centre hollow and a raised flange, said centre core disc being attached to the centre of said flexible magnetic disc; and
a cover, having an upper half and a lower half, for containing said flexible magnetic disc with said centre core disc, said lower half having a driving hole which is larger in diameter than the outer diameter of said centre hollow of said centre core disc, so that said centre core disc engages loosely in said driving hole.

2. A cassette according to claim 1 wherein the inner surface of said upper half of said cover is provided with a ring-shaped projection having a diameter which is smaller than the inner diameter of said centre hollow of said centre core disc, so that said projection engages loosely in said centre hollow of said centre core disc.

3. A cassette according to claim 2 wherein said raised flange and said ring-shaped projection are arranged to prevent said flexible magnetic disc from undue movement within said cover when said flexible magnetic disc is not ready for use.

4. A recording and/or reproducing apparatus in combination with a magnetic disc cassette of the type comprising:
a flexible magnetic disc;
a centre core disc formed from a flat disc by pressing so as to have a centre hollow and a raised flange, said centre core disc being attached to the centre of said flexible magnetic disc; and
a cover, having an upper half and a lower half, for containing said flexible magnetic disc with said centre core disc, said lower half having a driving hole which is larger in diameter than the outer diameter of said centre hollow of said centre core disc, so that said centre core disc engages loosely in said driving hole;
the apparatus comprising:

driving means to be coupled with said centre core disc for rotating said magnetic disc at a predetermined speed;

cassette supporting means mounted on a chassis for receiving and positioning said cassette;

cassette pressing means for depressing said cassette on said cassette supporting means; and

positioning means mounted on said driving means for positioning an inner surface of a wall of said cassette which wall is uppermost when said cassette is mounted on said driving apparatus.

5. Apparatus according to claim 4 wherein said cassette pressing means comprises a plurality of spring biased members for pressing down on said wall of said cassette at outer regions of said wall.

6. Apparatus according to claim 5 wherein said positioning means for positioning said inner surface of said wall of said cassette comprises an end of a centre positioning pin to be positioned in a central aperture of said centre core disc.

7. Apparatus according to claim 6 wherein said centre positioning pin has a hemispherical end surface.

8. A flexible magnetic disc cassette substantially as any embodiment or modified embodiment hereinbefore described with reference to Figures 3 to 11 of the accompanying drawings.

9. Apparatus according to claim 4 and substantially as hereinbefore described with reference to Figures 12 to 28 of the accompanying drawings.