RAMP LOAD ASSEMBLY FOR A DISC DRIVE

Field of the Invention

This invention relates generally to the field of disc drive storage devices and more particularly, but not by way of limitation, to a rotary ramp load assembly for a hard disc drive assembly.

Background of the Invention

Hard disc drives enable users of computer systems to store and retrieve vast amounts of data in a fast and efficient manner. In a typical disc drive, data are magnetically stored on one or more discs which are rotated at a constant high speed and accessed by a rotary actuator assembly having a plurality of read/write heads that fly adjacent the surfaces of the discs.

The heads are suspended from gimbal assemblies extending from arms of the rotary actuator assembly and have aerodynamic features that enable the heads to fly upon an air bearing established by air currents set in motion by the rotation of the discs. Ramp load apparatuses are intended to allow a disc drive to spin down when the drive is powered down while preventing the read/write heads from coming into contact with the disc surfaces.

Previous ramp load apparatuses have been utilized that incorporate a stationary set of wedges positioned over the outer edges of the disc surfaces. When a typical drive incorporating this type of ramp load is powered off, a control torque is applied to the actuator arm assembly which rotates the heads toward the outer perimeters of the discs, forcing the gimbal assemblies up onto the ramps of the ramp load apparatus, thereby causing the heads to be lifted away from the disc surfaces. One of the main disadvantages of this ramp load apparatus is that the stationary ramps overlap the outer perimeters of the discs, rendering the disc surface areas below the ramps inaccessible and therefore

useless, and thus significantly reducing the amount of disc surface available for data storage.

Another problem with stationary ramp load apparatuses is that the ramps lift up only one side of the gimbal assemblies during the initial stage of engagement. This causes a roll to be induced to the heads, which are still flying in close proximity to the discs. The effect of this induced roll is that one side of the heads is flying closer to the discs than normal, greatly increasing the chance of head to disc interference, which can cause drive failure. Furthermore, stationary ramp load apparatuses rely on the actuator motor to push the heads up onto the ramps. A result of this design is that a force perpendicular to the centerline of the gimbal assembly is applied to the suspension every time a head is loaded onto one of the ramps. This force translates into a rotational moment about the swage joint of the gimbal assembly. The swage joint is a feature that attaches the gimbal assembly to the actuator arm. A rotational moment applied to the swage joint can cause the swage joint to slip during ramp loading, resulting in mis-registration of the heads relative to servo tracks, which can cause either a loss in drive performance or drive failure.

The slope of a stationary ramp affects the amount of disturbance that is induced to the fly height and attitude of a head during loading onto, and unloading from, the ramp. The steeper the slope, the more roll is induced during ramp loading and unloading. The steeper the ramp slope, the faster the head will unload off the ramp and onto the disc, generally causing overshoot and a lower fly height during the transition period as the head settles at its steady state fly height. Conversely, as the slope of a stationary ramp is reduced to minimize these effects, more surface area near the outer perimeter of the discs is lost for data storage.

Another concern in disc drive operation is the fact that non-operational mechanical shock applied to the disc drive while in a deactivated state can cause the heads to flex as a result of the relatively flexible gimbal assemblies to which the heads are attached. The heads can thus obtain significant velocities as they

accelerate away from and then back toward the discs. When such velocities are severe, damage can occur to the heads and the surfaces of the discs.

Accordingly there is a need for an improved approach to minimizing damage to the data surfaces of the discs of a disc drive when power down occurs, and further, to protect the discs from the effects of non-operational shock.

Summary of the Invention

The present invention provides an apparatus for minimizing damage to a disc drive during operational shutdown, while maximizing the recording capacity of the disc drive. The apparatus also protects the discs from the deleterious effects of a non-operational shock.

In a preferred embodiment, the disc drive comprises a plurality of rotatable discs, a plurality of controllably positionable heads, a spindle motor for rotating the associated discs and an actuator assembly supporting read/write heads adjacent the discs. A moveable ramp load assembly, disposed beyond the outer diameters of the discs, extends ramp members out over the discs toward the actuator assembly at a head park position to facilitate the ramp loading of the heads during an operational shutdown of the disc drive. The ramp load assembly further retracts from the head park position to a position outside the outer diameters of the discs during operation of the disc drive, thereby affording full access to the recording surfaces of the discs.

A latch member, rigidly coupled to the ramp members, latches the actuator assembly when the ramp members are moved to the head ramp position. Snubber members, rigidly coupled with the ramp members, can further be provided to limit deflection of the discs due to mechanical shock during the non-operational mode.

These and various other features as well as advantages which characterize the present invention will be apparent from a reading of the following detailed description and a review of the associated drawings.

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Brief Description of the Drawings

FIG. 1 is a top plan view of a disc drive shown with its top cover removed and having a ramp load assembly constructed in accordance with a preferred embodiment of the present invention.

FIG. 2 is an enlarged top plan view of a portion of the disc drive of FIG. 1 with the ramp load assembly fully engaged, and with the latch extension of the ramp load assembly latching the actuator assembly during shutdown of the disc drive.

FIG. 3 is a partial cross-sectional view of the ramp load assembly of FIG. 1.

FIG. 4 is a top plan view of the ramp load apparatus of FIG. 3.

FIG. 5 is a view along 5-5 in FIG. 3.

FIG. 6 is a diagrammatical representation in elevation of the ramp load apparatus of FIG. 3.

Detailed Description

Referring to the drawings in general, and in particular to FIG. 1, shown therein is a top plan view of a disc drive 100 constructed in accordance with a preferred embodiment of the present invention. The disc drive 100 includes a basedeck 102 having a planar base surface 104 to which various components are mounted. A top cover (not shown) mates with the basedeck 102 to form an environmentally controlled internal environment for the disc drive 100.

Mounted to the surface 104 is a spindle motor 106 to which a plurality of discs 108 are mounted for rotation at a constant high speed when the disc drive 100 is in an operational mode. Adjacent the discs 108 is an actuator assembly 110 which pivots about a pivot shaft bearing assembly 112 in a rotary fashion. The actuator assembly 110 includes a plurality of stacked and spatially separated actuator arms 114 (only the top one of the actuator arms is viewable in FIGS. 1 and 2); connected to the ends of the actuator arms 114 are gimbal assemblies 116, sometimes herein also referred to as support flexures. Data read/write

heads 118 are suspended at the ends of the flexures 116 and are supported over the surfaces of the discs 108 by air bearings established by air currents set up by the rotation of the discs 108. As described above, the heads 118 are positionably located over data tracks (not shown) of the discs 108 in order to write and read data to and from the data tracks.

When the disc drive 100 is deactivated, it assumes a non-operational mode in which the rotation of the discs 108 is stopped (that is, the discs are stationary on the spindle motor 106). In transitioning to the non-operational mode, the actuator assembly 110 is rotated toward the outer perimeters of the discs 108.

Continuing with FIG. 1, the actuator assembly 110 is controllably positioned by a voice coil motor (VCM) 122. As is conventional, the VCM 122 includes a pair of permanent magnets (not visible in FIG. 1) which create magnetic flux paths disposed above and below an actuator coil (not designated) supported by the actuator assembly 110 opposite the actuator arms 114. Current applied to the actuator coil induces a magnetic field about the actuator coil which interacts with the permanent magnetic flux paths so that the VCM 122 causes relative movement of the actuator coil, thereby imparting controlled rotation of the actuator assembly 110 and thus the actuator arms 114.

To provide the requisite electrical conduction paths between the heads 118 and a disc drive read/write circuitry (not shown), head wires (not shown) are routed on the actuator assembly 110 from the heads 118, along the flexures 116 and the actuator arms 114 to a flex circuit 124. The head wires are secured by way of a suitable soldering process to corresponding pads of a printed circuit board (PCB) 126 of the flex circuit 124. A pair of spaced apart limit stops 128 are mounted to the surface 104 which interact with a limit stop arm 120 to limit the travel range of the actuator arm assembly 110.

Continuing with FIG. 1, a moveable ramp load assembly 130 is provided to prevent damage to the discs 108 during operational shutdown and to protect the discs 108 from non-operational mechanical shock. The ramp load assembly

130 includes a motor assembly 132 and a rotary ramp load apparatus 134 (hereinafter also referred to as "ramp portion 134"). Generally, the ramp portion 134 is supported on the surface 104 and rotates about a support post 135. As will be described more fully below, the ramp load assembly 130 is disposed beyond an outer diameter of the discs 108 in clearing relationship to all components of the disc drive 100 during the operational mode.

With reference to FIGS. 2 through 5, a description of the ramp load assembly 130 will now be provided. FIG. 2 depicts the ramp portion 134 rotated about the support post 135 to assume a head park position so that the ramp portion 134 engages and latches the top actuator arm 114. That is, during shutdown of the disc drive 100, the ramp portion 134 is rotated to extend out over the discs 108. This rotation is achieved by the motor assembly 132 which is operably coupled to a drive gear 136 mounted to a motor shaft 138 of a motor 140.

FIG. 3 shows the ramp load assembly 130 in a partial cutaway, elevational view which shows the support post 135 mounted in an aperture in the surface 104 via a press fit or other bracketing securement (not shown). The ramp portion 134 has a central body portion 142 which has a generally semi-cylindrical shape except as further described herein, the body portion 142 having an upper rim extension which forms a driven gear 144, the driven gear 144 extending around a portion of the upper rim extension as shown.

As shown in FIGS. 3 and 4, the body portion has a support boss 146 (FIG. 4) which has a bore 148 (FIG. 3) therethrough. A pair of bearings 150 are disposed in counterbore portions of the bore 148 and are press fit onto opposite end portions of the support post 135 as shown. The drive gear 136 of the motor assembly 132 is coupled to the driven gear 144 to selectively dispose the ramp portion 134 in: (1) the retracted position shown in FIG. 1 wherein the ramp portion 134 is in clearing relationship to the discs 108 and the actuator assembly 110 (operational mode); or (2) the head park position shown in FIGS. 2 and 3 wherein the ramp portion 134 is rotated to engage and latch the actuator

assembly 110 (non-operational mode). The upper rim extension of the ramp portion 134 that forms the driven gear 144 also forms a latch arm 152 which generally is hook shaped and which extends from an opposing side from the driven gear 144 as shown. The latch arm 152 is disposed to engage the side portion of the top one of the plurality of actuator arms 114 when the actuator arms 114 are in the position depicted in FIG. 2. That is, the dimensional thickness of the support flexure 116 connected to the end of the top actuator arm 114 permits passage of the latch arm 152, and the dimensional thickness of the top actuator arm 114 is sufficient for the latch arm 152 to grasp the side thereof for latching engagement and securement thereof. In the latched position of the latch arm 152, the limit stop arm 120 of the actuator assembly 110 has been moved to engage one of the limit stops 128.

The motor 140 is of conventional design; that is, the motor 140 has the well known stepper detent characteristics such that the motor 140 assumes a rotational mode determined by the direction of current flow, and once the current flow has ceased, the motor 140 will remain at its last rotated position. The rotational position can be determined by current flow only, but it is common to provide rotational stops so that the motor can rotate only between two positions.

As is known, the spindle motor of a disc drive assembly is used to rotate the discs during the operational mode, and once power is removed, the spindle motor has a back electromotive force (emf) which is harnessed to generate a time limited shutdown current which is useful in downloading the various components of the disc drive which must be secured. It is this shutdown current from the spindle motor 106 which is used to actuate the motor 140, and via the drive gear 136 and driven gear 144, to rotate the ramp portion 134 to the engagement and latching position shown in FIG. 2. Conversely, when the disc drive 100 is powered up, current is directed to the motor 140 via a conventional driver circuit (not shown) to reverse rotate the motor 140 and the ramp portion 134 whereby the latch arm 152 is caused to be retracted, thereby releasing the top actuator arm 114.

With further reference to FIGS. 3 and 4, it will be noted that extending from one side of the central body portion 142 are a plurality of disc snubber members 154. The separation between snubber members 154 form clearance grooves 156 which receive the outer rim portions of the discs 108 when the ramp portion 134 is pivoted toward the discs 108 as shown in FIG. 2.

Extensive from, and connected to, each of the snubber members 154 is a ramp member 158. Preferably, the ramp members 158 have ramp surfaces 160 having a uniform slope, but the ramp surfaces 160 can be alternatively formed with several discreet sloped portions. Importantly, because the ramp portion 134 is completely clear of the discs 108 in the retracted mode (as shown in FIG. 1), the ramp members 158 can be extended as may be desired, permitting the employment of a gradual slope. Preferably, the slope of the ramp surfaces 160 will be about 2 degrees. Since this requires that the ramp members 158 be relatively thin and deep, it may be desirable for the ramp members 158 to be of metal construction, or alternatively, to be strengthened with internally disposed stiffeners. The latter can be accomplished by overmolding or by providing a coating selected from a range of polymeric materials such as Carilon®, a trademark of Shell Oil Company.

FIG. 6 is a diagrammatical representation of the rotary ramp portion 134 and is provided for describing the operation and certain other properties and benefits of the present invention. The ramp portion 134 is depicted in FIG. 6 during shutdown of the disc drive 100. That is, the motor 140, which is operably coupled to the ramp members 158 via the ramp portion 134, causes the ramp members 158 to be moved in the arrow direction 162 when the disc drive 100 transitions between the operational and non-operational modes. This rotation of the ramp portion 134 places the ramp members 158 in the head park position so that the support flexures 116 can be pushed up onto the ramp surfaces 160 as the actuator arms 114 are moved toward the perimeters of the discs 108 during shutdown of the disc drive 100.

Further movement of the ramp portion 134 in the arrow direction 162 will cause the perimeter portions of the discs 108 to be nested within the clearance grooves 156 (as represented by dash line extensions of the discs 108.) The disc snubber members 154 are purposely provided a dimensional thickness greater than that of the ramp members 158 at the point of joinder thereof so that any deflection of the discs 108, such as from a mechanical shock, will cause the discs 108 to contact only the disc snubber members 154, minimizing undesirable disc-arm contact.

The cross dimension of the clearance grooves 156 (that is, the spatial dimension between disc snubber members 154) is not critical, but at a minimum, the discs 108 must clear the disc snubber members as they nest in the clearance grooves 156. Also, the cross dimension of the clearance grooves 156, at a maximum, should be established in consideration of the amplitude of disc deflection that can be tolerated during the occurrence of mechanical shock.

As the support flexures 116 make contact with the ramp members 158, the contacted edges are lifted first, and as mentioned above, this initial contact induces a roll to the fly attitude of the heads 118; that is, the heads 118, lifted along one side edge, will have a roll or twist about their center lines. This roll deflection will be minimized due to the gradual slope of the ramp surfaces 160 as compared to previously known stationary ramp load apparatuses. Accordingly, it is believed that, in most instances, the amount of roll deflection induced by the ramp portion 134 will not cause head-disc contact. However, there are instances where this induced roll deflection to the flight attitude of the heads cannot be tolerated because the flight distance between the heads 118 and the surfaces of the discs 108 is so small that any differential in deflection between sides of the heads 118 will result in deleterious contact with the discs 108.

Induced roll deflection of the heads 118 can be prevented by the use of modified support flexures such as those shown at 164 in FIG. 6; that is, the lower half of the support flexures depicted in FIG. 6 are of a modified construction. Each of the support flexures 164 is shown with its corresponding

head 118 removed for the purpose of displaying a lift button 166 which is disposed along the longitudinal centerline of the support flexure 164. The lift buttons 166 are dimensioned to extend beneath the support flexures 164 to provide a single point of lift as the lift buttons 166 are caused to bear against, and are lifted by, the ramp members 158. This eliminates any roll deflection inducement in the heads 118 supported by the support flexures 164. Thus, the modified support flexures 164, or gimbal assemblies, minimize the roll induced to the heads 118 during the transition time when the support flexures 164 are being lifted and the heads 118 are still flying close to the discs 108.

The lift buttons 166 are generally convex shaped to have a lowest tangential contact, and the lift buttons 166 can simply be stamped or embossed into the under surfaces of the support flexures 164, or the lift buttons 166 can be made separately and connected to the undersides of the support flexures 164 by welding or adhesive bonding. To reduce friction, the lift buttons 166 can be coated with a hard, slick material such as a polyimide.

It will be appreciated that, because the heads 118 are caused to slide along the ramp surfaces 160, it is preferable that the ramp portion 134 be constructed from an material displaying a low coefficient of friction, an example being a polymeric material such as Carilon® or the like. Of course, the purpose is that the ramp surfaces 160 should be sufficiently slick to permit the ramp members 158 to lift the support flexures 116 or 164 with a low amount of sliding friction.

Returning to the disc drive 100, it will be appreciated that, during its non-operational modes, the support flexures 116 (or 164) will be at rest on the ramp members 158, and the outer perimeters of the discs 108 will be nested in the clearance grooves 156 between the disc snubber members 154. When the disc drive 100 is energized to become operational, the discs 108 will again be rotated by the spindle motor 106. As sufficient rotational speed is achieved by the discs 108, the ramp portion 134 is reverse rotated to move in the arrow direction 168. This reversal in direction withdraws the latch arm 152 from latching engagement with the top one of the actuator arms 114. Simultaneously, the ramp members

158 are caused to be withdrawn from beneath the support flexures 116 (or 164), and as the support flexures 116 (164) are slidingly lowered along the retracting ramp surfaces 160, the heads 118 are finally lowered to within flying distance above the surfaces of the discs 108, and with complete withdrawal of the ramp members 108, the heads 118 are positioned on the air bearing in their flying attitude.

The reverse rotation of the ramp portion 134 in the arrow direction 168 is effected by energizing the motor 140 to reverse rotate the drive gear 136, thereby driving the driven gear 144. Operational power is available during startup of the disc drive 100 for the purpose of driving the motor 140, and in most cases, sufficient power to operate the motor 140 is available during power shutdown from the back emf generation effected by the decaying rotational speed of the spindle motor 106. Should sufficient shutdown power not be available for a particular application of the present invention, it is known to incorporate spring energy to store potential energy during startup to effect rotation of the ramp load assembly 130 during power down. As such devices and the required control mechanisms are well known and are considered an equivalent to powering the motor 140 for reverse rotation such have not been disclosed herein.

Furthermore, the torque to control the rotation of the ramp portion 134 can be provided a number of equivalent ways. One plausible system would incorporate a torsional spring and a gear into the shaft. The torsional spring would be designed to provide sufficient torque to engage the ramp load apparatus during the power down cycle, and to provide sufficient latching torque to hold the ramp members and actuator arms in place during shipping and handling. An electro-magnetic motor could then be used to provide torque via a gear system to counteract the spring and disengage the ramp members. Another approach would be to incorporate wind vanes onto the shaft and utilize the windage from the spinning discs to counteract the torsional spring and disengage the ramp members.

It will be recognized that present invention can be practiced in a variety of modified forms. For example, since the ramp members are not functionally affected by the snubber members, there may be applications in which the snubber members can be eliminated. Furthermore, a version of the ramp load assembly can be constructed without the ramp members for those applications where disc snubbing alone is required. In each case, the present invention provides a ramp load apparatus, a snubber apparatus or a combination of both, and a novel latching feature, wherein the apparatus sets outboard to the perimeters of the discs and does not overlap the disc except during periods when the disc drive is non-operational.

The present invention further provides a latching feature without increasing the cost or dimensional complexity of the actuator arm. The latch arm of the present invention is independent to the structure of the actuator assembly, which is advantageous in that symmetry of the actuator assembly can be retained. That is, the latch arm does not change the dimensional characteristics of the actuator arm, and with the removal of a crash arm extending from one side of the actuator assembly, as is present in prior art disc drives, a source of potential unsymmetrical vibration is prevented. Non-symmetrical features such as crash arms can cause vibration of the arms during seeks which can make it difficult, if not impossible, to seek and stay on track. Finally, because the ramps are moved beyond the outer diameters of the discs during operation of the drive, the ramps can be advantageously provided with more gradual slope then stationary ramps of the prior art which permanently extrude over the discs and prevent utilization of the full recording capacities of the discs.

In view of the foregoing discussion, it will be clearly understood that the present invention is directed to an apparatus for parking read/write heads (118) of a disc drive (102) through the use of a controllably positionable ramp load assembly (130) adjacent the discs (108) of the disc drive. The ramp load assembly comprises ramp members (158) which support the heads when the disc drive is in a non-operational mode by rotating to a head park position, and the

ramp load assembly retracts from the head park position when the disc drive is in an operational mode. Further, snubber members (154), coupled to the ramp members, limit disc deflection when a mechanical shock is applied to the disc drive during the non-operational mode.

It will be clear that the present invention is well adapted to attain the ends and advantages mentioned as well as those inherent therein. While a presently preferred embodiment has been described for purposes of this disclosure, numerous changes may be made which will readily suggest themselves to those skilled in the art and which are encompassed in the spirit of the invention disclosed and as defined in the appended claims.

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Claims:

1. A ramp load assembly for use in a disc drive having a rotatable disc and an actuator assembly arm supporting a head adjacent the disc, the disc being rotated during an operational mode of the disc drive and the disc being stationary during a non-operational mode of the disc drive, the ramp load assembly comprising:

a controllably positionable ramp member which moves to a head park position over the disc to support the head during the non-operational mode, and which moves away from the head park position during the operational mode.

2. The ramp load assembly of claim 1, further comprising:

a latch member, rigidly coupled to the ramp member, which latches the actuator arm when the ramp member is moved to the head park position.

3. The ramp load assembly of claim 1, further comprising:

a motor operably coupled to the ramp member and which moves the ramp member as the disc drive transitions between the operational and non-operational modes.

4. The ramp load assembly of claim 1, further comprising:

a snubber member, rigidly coupled to the ramp member, which limits deflection of the disc in response to application of a non-operational shock to the disc drive.

5. A disc drive, comprising:

a rotatable disc;

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an actuator assembly adjacent the disc having a head supportable over the disc during operation of the disc drive; and

a ramp load assembly adjacent the disc having a moveable ramp extendable over the disc to support the head during non-operation of the disc drive, wherein the moveable ramp is retractable to a position beyond an outer diameter of the disc during operation of the disc drive.

6. The disc drive of claim 5, wherein the ramp load assembly further comprises a latch arm which secures the actuatory assembly during non-operation of the disc drive.

7. The disc drive of claim 5, wherein the moveable ramp is characterized as comprising a continuously extending, inclined surface having a slope of about two degrees with respect to the disc.

8. The disc drive of claim 5, wherein the ramp load assembly further comprises a motor, operably coupled to the moveable ramp, which rotates the ramp member to extend the ramp member over the disc during non-operation of the disc drive and retracts the moveable ramp during operation of the disc drive.

9. The disc drive of claim 5, further comprising a snubber member, coupled to the ramp member, which limits deflection of the disc in response to application of a mechanical shock to the disc drive to minimize contact between the disc and the actuator assembly.

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AMENDED CLAIMS

[received by the International Bureau on 21 December 1998 (21.12.98);
original claims 1,4 and 5-9 amended;
remaining claims unchanged
(2 pages)]



1. A ramp load assembly for use in a disc drive having a rotatable disc and an actuator arm supporting a head adjacent the disc, the disc being rotated during an operational mode of the disc drive and the disc being stationary during a non-operational mode of the disc drive, the ramp load assembly comprising:

a controllably positionable ramp member which rotates to a head park position over the disc to support the head during the non-operational mode, and which rotates away from the head park position to a retracted position beyond an outermost diameter of the disc during the operational mode.

2. The ramp load assembly of claim 1, further comprising:

a latch member, rigidly coupled to the ramp member, which latches the actuator arm when the ramp member is moved to the head park position.

3. The ramp load assembly of claim 1, further comprising:

a motor operably coupled to the ramp member and which moves the ramp member as the disc drive transitions between the operational and non-operational modes.

4. The ramp load assembly of claim 1, further comprising:

a snubber member, rigidly coupled to the ramp member, which limits deflection of the disc in response to application of a non-operational shock to the disc drive, the snubber member rotating over the disc drive during non-operation of the disc drive and rotating beyond the outermost diameter of the disc during operation of the disc drive.

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5. A disc drive, comprising:

a rotatable disc;

an actuator assembly adjacent the disc having a head supportable over the disc during operation of the disc drive; and

a ramp load assembly adjacent the disc having a moveable ramp member rotatable over the disc to support the head during non-operation of the disc drive, wherein the ramp member is retractable to a position beyond an outermost diameter of the disc during operation of the disc drive.

6. The disc drive of claim 5, wherein the ramp load assembly further comprises a latch arm which secures the actuator assembly during non-operation of the disc drive.

7. The disc drive of claim 5, wherein the ramp member is characterized as comprising a continuously extending, inclined surface having a slope of about two degrees with respect to the disc.

8. The disc drive of claim 5, wherein the ramp load assembly further comprises a motor, operably coupled to the ramp member, which rotates the ramp member to extend the ramp member over the disc during non-operation of the disc drive and retracts the ramp member during operation of the disc drive.

9. The disc drive of claim 5, further comprising a snubber member, coupled to the ramp member, which limits deflection of the disc in response to application of a mechanical shock to the disc drive to minimize contact between the disc and the actuator assembly, the snubber member extendable over the disc during non-operation of the drive and retractable beyond the outermost diameter of the disc during operation of the disc drive.

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