Specification

1. Title of the Invention:

Suspension assembly

2. Detailed Description of the Invention:

[0001]

[Field of the invention]

The present invention relates to a disk storage device, and, more particularly, to a structure of a suspension assembly on one end of which a magnetic head is mounted.

[0002]

[Background art]

Recent magnetic disk drives are being reduced in size, more particularly, in thickness, so that various measures are being taken to accommodate such circumstances. They include, for example, the structure of a load beam, which is a support structure for the magnetic head, for mounting it on an actuator, and the mounting structure for the magnetic head. A typical structure for supporting the magnetic head comprises, as shown in Figure 1, a mount plate 10 connected to an actuator arm, a

load beam 12 coupled to the mount plate 10, and a flexure 14 coupled to the load beam 12, wherein the magnetic head is supported on the flexure 14 with a gimbal structure. A signal line 17 from the head is fixed on the side of the load beam 12.

[0003]

Figure 2 shows an exploded view of the mount plate 10, the load beam 12, and the flexure 14. Each component is worked into the predetermined shape, and then coupled and fixed to each other. The load beam 12 or the flexure 14 is manufactured under precise control on its material and thickness so as to provide predetermined mechanical characteristics such as natural frequency and stiffness. The load beam and the flexure are typically made of stainless steel. The mount plate 10 is coupled to the load beam 12 with welding at a plurality of welding points 18 shown in Figure 1. The load beam 12 and the flexure 14 are also coupled by welding at a plurality of welding points 19.

[0004]

[Problems to be solved by the invention]

As the disk drive is made smaller and smaller, the clearance between disks is narrowed down. Accordingly, the possibility is increased wherein a head assembly disposed between the disks collides with the surface of a disk due to some external impact or vibration. If the load beam or the flexure on the head mount contacts a disk surface, the disk surface may be damaged, leading

to damage or loss of data. It is believed that, since the load beam or flexure is generally made of stainless steel as described above, and a sharp edge is formed on such stainless steel member, when the edge hits the disk surface, it tends to be easily scratched.

[0005]

Figures 3 and 4 schematically show a variation of the load beam. The load beam is in the form of a thin plate, and is deformed as shown in Figure 3 or 4 under an external impact. Consequently, the edge of the load beam (31 in Figure 3, and 41 in Figure 4) collides the disk surface, so that the disk surface may be damaged, leading to damage or loss of data.

[0006]

The present invention is intended to provide a head support structure which can prevent damage on the disk surface which may be caused by contact between the disk surface and the head assembly.

[0007]

Furthermore, the present invention is intended to provide a disk drive with excellent impact resistance without impairing its low profile.

[0008]

[Summary of the invention]

To attain the above objects, a head support assembly for a disk drive according to the present invention is a head suspension assembly connected to an actuator arm at one end and supporting a head at the other end, wherein a projection is formed on a flexure closely fixed on a thin-plate load beam, said projection projecting toward a disk surface and having a smooth surface.

[0009]

According to one aspect of the present invention, the projection is formed at the vicinity of a hinge portion of the load beam, but at a position offset therefrom.

[0010]

[Preferred embodiment]

The suspension assembly according to the present invention is usually used for a storage disk drive known as a hard disk drive. The storage disk drive comprises a storage disk, a motor for rotating the storage disk, and a head stack assembly or actuator for reading or writing information from or to the storage disk. The head stack assembly comprises a head suspension assembly, and a carriage for supporting the head suspension assembly. The head suspension assembly comprises a head having a transducer, a suspension having a thin-plate load beam, and a flexure fixed on the load beam.

[0011]

Figures 5 and 7 show an embodiment of the present invention. Referring to Figure 5, there is shown a plan view of the head suspension assembly according to the present invention. It consists of a mount plate 10 to be coupled to the actuator arm, a load beam 12 coupled to the mount plate 10, and a flexure 14 coupled to the load beam 12. The magnetic head is supported on the flexure 14 with a gimbal support structure. A signal line 17 from the head is fixed on the side of the load beam 12. The mount plate 10 is coupled to the load beam 12 with welding at a plurality of welding points 18. The load beam 12 and the flexure 14 are also coupled by welding at a plurality of welding points 19.

[0012]

The following is materials and thickness of respective components of the head suspension assembly according to the present invention.

Mount plate: Stainless steel (SUS 304), 0.25 mm thick
Load beam: Stainless steel (SUS 304), 0.062 mm thick
Flexure: Stainless steel (SUS 304), 0.030 mm thick

[0013]

Figure 6 is a sectional view taken along line A-A' in Figure 5. It is an enlarged sectional view of the projection formed on the load beam. Referring to Figure 5, the load beam 12 is coupled

to the mount plate 10 at one end, and supports the head at the other end. The hinge portion 45 is located substantially at the center of these ends. When shock is exerted on the disk drive, bending as described with reference to Figure 3 or 4 occurs at the hinge portion 45 as the bending point.

[0014]

The flexure of the present invention is formed with two projections 47 at regions somewhat close to the head supporting end from the hinge portion 45. It is Figure 6 that shows section A-A' where the projections are formed. As shown in Figure 6, the projection 47 has a smooth round surface. By making a portion of the load beam to contact the disk surface when the load beam is deformed by external shock the region where this projection is formed, the edge of the load beam can be prevented from colliding with the disk surface.

[0015]

Figure 6 shows an enlarged sectional view of the projection 47. In this embodiment, the projection 47 is formed to have a radius 1.35 mm, and a height 0.06 mm from the load beam. Such shape and size of the projection is determined by taking into account the spacing between disks, stiffness of the load beam, and the location where the projection is formed.

[0016]

The projections 47 formed on the flexure 14 is arranged to become the region contacting the disk due to deformation of the load beam when the disk drive is subjected to external shock or the like. Since the projection 47 has a gradual round surface, it does not scratch the disk surface even if it contacts the disk surface. In addition, contacting of the projection can prevent the edge of the load beam from contacting the disk surface.

[0017]

While damage on the disk surface can be avoided because the projection has a round surface, it may be possible to form a coating consisting of elastic material such as resin or plastics on the surface of the projection to reduce shock on the disk.

[0018]

In addition, as can be seen from the comparison between Figure 5 showing the embodiment of the present invention and Figure 1 showing a prior art, in the embodiment of the present invention provided with the projection 47, a welding point for the load beam 12 and the flexure 14 is not formed on the region where the projection 47 is formed. Accordingly, the flexure 14 is in a free state from the load beam 12 to the region where the projection 47 is provided. With such free arrangement, the projection 47 is designed to be more easily close to the disk surface than the edge of the load beam when the load beam is deformed, whereby the edge is prevented from collision.

[0019]

[Advantages of the invention]

In the head suspension assembly according to the present invention, even if the load beam collides the disk surface when it is deformed by external shock, the projection with smooth round surface formed on the flexure contacts the disk surface, whereby it can prevent the edge of the load beam from colliding the disk, and effectively prevent data recorded on the disk surface from being lost.

4. Brief Description of the Drawings:

Figure 1 is a schematic view showing the arrangement of a typical head suspension assembly;

Figure 2 is an exploded view of the typical head suspension assembly;

Figure 3 is a view showing deformation of the typical load beam;

Figure 4 is a view showing deformation of the typical head suspension assembly;

Figure 5 is a schematic view showing the arrangement of a head suspension assembly according to the present invention;

Figure 6 is a sectional view of the load beam of the present invention at a region where projections are formed; and

Figure 7 is an enlarged sectional view of the load beam at a region where the projection is formed.

[Description of symbols]

10 ... Mount plate
12 ... Load beam
14 ... Flexure
16 ... Signal line
45 ... Hinge portion
47 ... Projection

3. Claims:

(1) A suspension assembly comprising:

a suspension having a thin-plate load beam; and

a flexure fixed on said load beam; wherein

said flexure contains a projection having a round surface and projecting toward a disk surface.

(2) A suspension assembly as set forth in Claim 1, wherein said projection is formed at the vicinity of a hinge portion of said load beam.

(3) A suspension assembly as set forth in Claim 1 or 2, wherein said projection is formed by plasticly deforming the flexure.

(4) A suspension assembly as set forth in any one of Claims 1 through 3, wherein a coating with elasticity is formed on the surface of said projection facing to a disk surface.

(5) A head suspension assembly comprising:

a head having a transducer;

a suspension having a thin-plate load beam; and

a flexure fixed on said load beam; wherein

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said flexure contains a projection having a round surface and projecting toward a disk surface.



(6) A head stack assembly comprising:

a head suspension assembly comprising a head having a transducer; a suspension having a thin-plate load beam; and a flexure fixed on said load beam; wherein said flexure contains a projection having a round surface and projecting toward a disk surface; and

a carriage for supporting said head suspension assembly.

(7) A storage disk drive comprising;

a head suspension assembly comprising a head having a transducer; a suspension having a thin-plate load beam; and a flexure fixed on said load beam; wherein said flexure contains a projection having a round surface and projecting toward a disk surface;

a carriage for supporting said head suspension assembly;

a storage disk from or on which data is read or written by said transducer; and

a motor for rotating said storage disk.

[Document type] Abstract

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