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Specification

1. Title of the Invention:

Head supporting arm, method for manufacturing the same, and data recording apparatus

2 Detailed Description of the Invention:

[0001]

[Field of the invention]

The present invention relates to a head supporting arm comprising a load beam, a flexure including a connecting portion connected to said load beam and a bonding portion, and a slider having a head on its one end and bonded to the bonding portion by an adhesive agent, wherein the load beam has a dimple for generating a gimbal motion between the flexure and the slider, as well as a method for manufacturing the head supporting arm and a data recording apparatus.

[0002]

[Background art]

Conventionally, there have been various head supporting arms



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each of which is composed, as well known, of a load beam, a flexure including a connecting portion connected to the load beam and a bonding portion, and a slider having a head on its one end and bonded to the bonding portion by an adhesive agent, wherein the load beam has a dimple for generating a gimbal motion between the flexure and the slider. Those arms have been employed to support read/write heads in hard disk units, etc. In recent years, to cope with recording media whose recording density is improved significantly, those heads are being replaced with MR and GMR heads, which are more sensitive and easily affected by static electricity and heat. On the other hand, sliders are coming down almost to their limit in flying height. Thus, it is now at the final stage to be able to overlook the deformation of those flexures made of stainless steel and sliders made of ceramic due to a bimetal effect to be caused by thermal changes to occur between them.

[0003]

To avoid those problems, therefore, such an adhesive agent as thermosetting resin causing less thermal changes after being set is often used to fix the flexure and the slider together adhesively. And, when using such a thermosetting resin for fixing the flexure and the slider together adhesively, at first a laser beam is irradiated only on the flexure of those fixed via the thermosetting resin therebetween for a short time, thereby fixing it temporarily (laser tacking). This is to improve the efficiency of the object production process. After that, the whole head supporting arm to which both flexure and slider are fixed temporarily is heated in an oven, thereby setting the whole thermosetting resin.

[0004]

[Problems to be solved by the invention]

Although it is easy to bond a flexure and a slider together by means of such a laser tacking for the contact start stop (CSS)

type head supporting arms that do not require a merging lip for loading/unloading at the tip of the head supporting arm, the laser tacking process cannot be applied to the head supporting arms that require a merging lip for loading/unloading respectively, which are sued in many cases in recent years. This is because the flexure is almost covered by the load beam in each of those arms.

[0005]

In order to solve such a problem, Japanese Patent Application No. 10-370272 discloses a technique for enabling a laser tacking process even for the head supporting arm having a merging lip for loading/unloading by providing the load beam with an exposure opening for exposing the bonding portion of the flexure to which the slider is to be bonded and irradiating a laser beam at the bonding portion of the flexure through this exposure opening. However, the technique disclosed in Japanese Patent Application No. 10-370272 does not mention any head supporting arm, which is often employed and requires the load beam to have an opening used by a limiter that prevents the head, that is, the slider from going away too far from the load beam when the head is unloaded from a data recording medium.

[0006]

Under such circumstances, it is an object of the present invention to provide a head supporting arm provided with a merging lip and a limiter for loading/unloading the head so as to solve the above conventional problems and enables laser tacking, as well as a method for manufacturing the head supporting arm and a data recording apparatus.

[0007]

[Summary of the invention]

The head supporting arm of the present invention comprises a

load beam, a flexure including a connecting portion connected to the load beam and a bonding portion, and a slider having a head on its one end and bonded to the bonding portion by an adhesive agent, wherein the load beam has a dimple for generating a gimbal motion between the flexure and the slider. In this head supporting arm, (1) the load beam is provided with an exposure opening for exposing the bonding portion of the flexure bonded at the other end, which is opposite to the one end having the head of the slider, and (2) the limiter formed unitarily with the flexure is extended onto a surface of the exposure opening, which is at the opposite side of a surface where the flexure exists so that the limiter is hooked on the load beam.

[0008]

The head supporting arm of the present invention, which comprises a slider having a head, a flexure, a load beam, etc. as described above, all being put together in a head gimbal assembly (HGA), enables the exposure opening to be used also as an opening of the limiter for loading/unloading the head, so that the limiter is hooked on the exposure opening. The exposure opening is originally used only for temporarily setting an adhesive made of a thermosetting resin for bonding the flexure and the slider together. Consequently, the laser beam can be irradiated for laser tacking while both merging lip and limiter for loading/unloading the head are kept functioning. In addition, because the laser beam irradiation point is positioned away from such elements as a GMR head, etc. to be easily affected by heat, those elements can be prevented from their temperature rises. The head supporting arm can thus be configured in simple configuration. In addition, such a configuration of the exposure opening of the present invention would make it possible to eliminate fragile parts from the load beam.

[0009]

In a preferred embodiment of the head supporting arm of the present invention, the exposure opening is shaped almost squarely and each side of the opening is set larger than the bonding portion of the flexure in the width direction, and the limiter is hooked on one side of the exposure opening, which is away further from the dimple of the opening than other sides. In any of the above cases, it is possible to realize a preferred exposure opening, which can be shared for both opening for irradiating the laser beam and opening of the limiter.

[0010]

The method for manufacturing the head supporting arm of the present invention is just the same as that of the head supporting arm composed as described above. At first, the slider, which is to be put together with the flexure via a thermosetting resin therebetween with respect to the load beam while the limiter of the flexure is hooked on the exposure opening of the load beam, is disposed on the bonding portion. Then, a laser beam is irradiated on part of the bonding portion from which the flexure is exposed through the exposure opening, thereby setting the adhesive with its heat so as to fix the flexure and the slider together temporarily. After that, the head supporting arm to which both flexure and slider are fixed temporarily is heated in an oven so as to further vulcanize the thermosetting resin. The flexure and the slider are thus bonded together adhesively. According to the manufacturing method described above, the head supporting arm provided with a merging lip and a limiter for loading/unloading respectively can be manufactured at a high yield.

[0011]

Furthermore, the data recording apparatus of the present invention comprises a data recording medium for recording data

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and a head supporting arm composed as described above and moved relatively to the data recording medium. The data recording apparatus composed as described above can thus be realized with preferable use of such a head supporting arm provided with a merging lip and a limiter for loading/unloading respectively.

[0012]

[Preferred embodiment]

Figure 1 is a block diagram of a hard disk drive (HDD) unit including a head supporting arm 31 manufactured according to the present invention. A spindle motor 11 for rotating a magnetic data recording hard disk 10 and a voice coil motor (VCM) are controlled by a VCM/spindle driver 12. A read/write circuit 14 is connected to a hard disk control circuit 15. The control circuit 15 is then connected to the VCM/spindle driver 12. A memory 16 for recording data and control data is connected to the control circuit 15 and the main control circuit, that is, an MPU 13. The MPU 13 controls the VCM/spindle driver 12, the hard disk control circuit 15, and the memory 16. The read/write head is attached to the slider (not illustrated). The slider is attached to the tip of the head supporting arm 31. The rear portion of the head supporting arm 31 is pivoted to the frame of the hard disk drive unit.

[0013]

An inner crush stopper 17 is mounted at the frame so as to be hooked on the head supporting arm 31 and used to position the read/write head on the innermost data recording track on the recording medium. A lamp element 18 is also mounted at the frame of the HDD unit. This HDD unit is loaded/unloaded in/from the data recording apparatus. While the HDD unit stands by, the merging lip 21 provided at the tip of the head supporting arm 31 rests on the lamp element 18. If a read/write operation is started, the head supporting arm 31 is

moved towards the center of the hard disk 10, thereby the merging lip 21 leaves the lamp element 18, thus the slider and the read/write head fly above the disk respectively. Herein, a feature of the HDD unit described above is the structure of the head supporting arm 31 to be described later. Other structural items are the same as those of the conventional HDD unit.

[0014]

Figure 2 shows a head supporting arm 31 of the present invention in an embodiment. Figure 2(a) is a top view and Figure 2(b) is a side view of the head supporting arm 31. In Figure 2(a) and (b), the head supporting arm 31 comprises an actuator arm 32, which is mounted on the frame of the HDD unit at the pivoting point 33, a load beam 34, a mount plate 35 for connecting the load beam 34 to the actuator arm 32, a flexure 36 attached to the load beam 34 at a connection point 45 (Figure 3), and a slider 37 attached to the bonding portion 36A of the flexure 36. Herein, the slider 37, the flexure 36, the load beam 34, and the mount plate 35 are assembled in the head gimbal assembly (HGA).

[0015]

Figure 3 shows the load beam 34, the flexure 36, and the slider 37 of the head supporting arm 31 of the present invention in an embodiment. Figure 3(a) is a top view and Figure 3(b) is a side view of those items. In Figure 3(a) and (b), a head 43, which may be an MR head or a GMR head, is mounted on a thin film 44 provided at the tip of the slider 37. A protruded portion on the load beam 34, that is, a dimple 42 comes in contact with the bonding portion 36A of the flexure 36 supporting the slider 37 and the read/write head 43 so as to enable the slider 37 and the head 43 for a gimbal motion. And, an opening 51 is formed in the load beam 34 so as to control a bend 52 of the load beam 34. The load beam 34, as shown in Figure 2(b), is moved between two positions due to its bending at the bend 52. In addition, another opening 53 is formed in

the load beam 34 at a position corresponding to the head 43 provided at the tip of the slider 37, so that it is used to guide a connection wire, etc., for example, from the head 43 onto an opposite surface of the head 43 of the load beam 34.

[0016]

The most conspicuous feature of the head supporting arm 31 of the present invention is forming of an exposure opening 61 for exposing the bonding portion 36A of the flexure 36 bonded at the other end opposite to one end on which the head 43 of the slider 37 is provided, as well as extending the two limiters 62 formed unitarily with the flexure 36 onto a surface of the exposure opening 61, which is opposite to the surface on which the flexure 36 exists so that the tip of each of those limiters 62 is hooked on the load beam 34. With the configuration of the head supporting arm as described above, the exposure opening 61, it is possible to irradiate a laser beam on part A of the bonding portion 36A from the top as shown in Figure 3(a) for laser tacking. Without any dedicated opening 61, it is also possible to form each limiter 62 with use of the exposure opening 61 provided to enable laser tacking with respect to the load beam 34 so that the limiter 62 prevents the slider 37 from abnormal actions, for example, when in unloading the head.

[0017]

In the above embodiment, the exposure opening 61 is formed so as to be shaped almost squarely and larger in size of one side than the bonding portion 36A of the flexure 36 in the width direction. The exposure opening 61 is used to set the two limiters 62 provided at both ends of the bonding portion 36A of the flexure 36 in the width direction with respect to the load beam 34 through itself. Of course, according to the shape of those limiters 62, that is, if only one limiter 62 is provided, for example, at one place in the center of the width direction of the bonding portion 36A, one side of the exposure opening 61 may be formed more largely at least than the width of those

limiters 62. In addition, the shape of the exposure opening 61 is not necessarily limited only to square. And, the tip 62A of each limiter 62 is formed so as to be hooked on one side of the exposure opening 61, which is away further from the dimple 42. This is because the limiter 62 can function most effectively due to such a limiter 62 configured so that its tip 62A is hooked on the load beam 34. However, of course, the tip 62A of the limiter 62 may be hooked on the load beam 34 at another portion, for example, at a side surface of the exposure opening 61. The limiter 62 can also function satisfactorily in this case, although the effect may be lowered a little from that in the above case.

[0018]

To manufacture the head supporting arm 31 configured as described above, at first the slider 37 is disposed at the bonding portion 36A of the flexure 36 via a thermosetting resin with respect to the position of the load beam 34 while the limiter 62 of the flexure 36 is hooked on the exposure opening of the load beam 34. Then, a laser beam is irradiated on part of the bonding portion 36A from which the flexure 36 is exposed through the exposure opening 61, thereby setting the thermosetting adhesive with the heat of the laser beam so as to fix the flexure 36 and the slider 37 together temporarily. After that, the head supporting arm 31 to which both flexure 36 and slider 37 are fixed temporarily is heated in an oven so as to further vulcanize the thermosetting adhesive. The flexure 36 and the slider 37 can thus be fixed adhesively. The most important point in the method for manufacturing the above head supporting arm 31 is laser tacking through the exposure opening 61 used for hooking the limiters 62 on the load beam 34. Other processes may be the same as those of the conventional manufacturing method. According to the manufacturing method described above, therefore, it is possible to manufacture the head supporting arm 31 provided with both merging lip 21 and limiters 62 for loading/unloading at a high yield.

[0019]

[Advantages of the invention]

As described above clearly, according to the present invention, the exposure opening used for temporarily fixing an adhesive made of a thermosetting resin for bonding the flexure and the slider together can also be used as an opening of the limiters for loading/unloading and those limiters are hooked on the exposure opening. It is thus possible to irradiate a laser beam used for laser tacking while both of the merging lip and the limiters for loading/unloading respectively are kept functioning. In addition, because the laser beam irradiation point is away from such elements as a GMR head, etc. that are easily affected by heat, those elements can be protected from temperature rises. Consequently, the head supporting arm can be formed in a simple and compact configuration. In addition, such a configuration of the exposure opening of the present invention makes it possible to eliminate fragile portions from the load beam.

4. Brief Description of the Drawings:

Figure 1 is a circuit block diagram of an HDD unit including a head supporting arm manufactured according to the present invention;

Figure 2(a) and (b) are top and side views of the head supporting arm in an embodiment of the present invention; and

Figure 3(a) and (b) are top and side views of an embodiment of a load beam, a flexure, and a slider assembled in the head supporting arm of the present invention.

[Description of symbols]

10 ... Hard Disk

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21 ... Merging Lip
31 ... Head Supporting Arm
34 ... Load Beam
36 ... Flexure
36A ... Bonding Portion
37 ... Slider
42 ... Dimple
43 ... Head
51, 53 ... Opening
61 ... Exposure Opening
62 ... Limiter
62A ... Tip

Claims:

1. A head supporting arm, comprising:
 - a load beam;
 - a flexure including a connecting portion connected to said load beam and a bonding portion; and
 - a slider having a head on its one end and bonded to said bonding portion by an adhesive agent, wherein
 - said load beam has a dimple for generating a gimbal motion between said flexure and said slider and an exposure opening for exposing said bonding portion of said flexure bonded at the other end, which is opposite to said one end having said head of said slider, and
 - a limiter formed unitarily with said flexure is extended onto a surface of said exposure opening, which is at the opposite side of a surface where said flexure exists so that said limiter is hooked on said load beam.
2. The head supporting arm according to Claim 1;
 - wherein said exposure opening is shaped almost squarely and its one side is wider than said bonding portion of said flexure in the width direction.
3. The head supporting arm according to Claim 1;
 - wherein said limiter is hooked on one side of said exposure opening, said one side being away farther from said dimple than other sides.

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4. A method for manufacturing a head supporting arm according to any of Claims 1 to 3, comprising the steps of:

disposing said slider at said bonding portion of said flexure via a thermosetting resin therebetween with respect to said load beam while said limiter of said flexure is hooked on said exposure opening of said load beam;

irradiating a laser beam at part of said bonding portion from which said flexure is exposed through said exposure opening;

fixing both flexure and slider together temporarily by setting a thermosetting adhesive with the heat of said laser beam; and

heating said head supporting arm to which both flexure and slider are fixed temporarily in an oven, thereby further vulcanizing said thermosetting resin so as to fix said flexure and said slider together adhesively.

5 A data recording apparatus, including

a data recording medium for recording data; and

a head supporting arm that moves relatively to said data recording medium;

wherein said head supporting arm includes;

a load beam;

a flexure including a connecting portion connected to said load beam and a bonding portion; and

a slider having a head on its one end and bonded to said bonding portion by an adhesive agent;

wherein said load beam has a dimple for generating a gimbal motion between said flexure and said slider and an exposure opening for exposing said bonding

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portion of said flexure bonded at the other end, which is opposite to said one end where said head of said slider is provided, and

a limiter formed unitarily with said flexure is extended onto a surface of said exposure opening, which is at the opposite side of a surface where said flexure exists so that said limiter is hooked on said load beam.