

SWING ARM DRIVING TYPE OPTICAL RECORDING/REPRODUCING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an optical recording/reproducing apparatus for recording information and reproducing information from an optical recording medium, and more particularly, to a swing arm driving type optical recording/reproducing apparatus.

2. Description of the Related Art

In general, an optical recording/reproducing apparatus employs an optical disk on both sides of which information can be recorded or a plurality of optical disks separated from each other and having respective centers of rotation located on the same axis as an optical recording medium, in order to increase the storage capacity thereof. Information is recorded and reproduced using an optical pickup. The optical recording/reproducing apparatus is divided into a carrier driving type and a swing arm driving type depending on the driving type.

In the carrier driving type, the optical pickup is installed on a base to be capable of directly transmitting an optical beam. The optical pickup is moved along a radial direction of the optical disk by a predetermined driving means.

In the swing arm driving type, an optical spot formed on the optical disk is transmitted by the optical pickup using the rotation of the swing arm installed on the base to be rotatable. The swing arm driving type has an advantage over the carrier driving type of reducing the access time by determining the position of the optical spot focused on the optical disk by the rotation of the swing arm centering around one hinge point. Meanwhile, in the swing arm driving type, most optical elements of the optical pickup are fixedly arranged on the base and optical elements such as the objective lens for condensing light on the information recording surface are arranged in the swing arm. Accordingly, the structure and assembly of the optical recording/reproducing apparatus is complicated and the optical path is designed to be

long. Therefore, the swing arm driving type has a problem in that optical loss increases.

SUMMARY OF THE INVENTION

To solve the above problem, it is an objective of the present invention to provide a swing arm driving type optical recording/reproducing apparatus in which the number of optical parts is reduced by installing all optical elements of an optical pickup in a swing member and a supporting structure is improved so that the swing member easily locks to and releases from a base.

Accordingly, to achieve the above objective, there is provided an optical recording/reproducing apparatus, comprising a base, at least one optical disk rotatably installed on the base, both sides of which are information recording surfaces, a plurality of optical pickups, each including a light source for irradiating light, an optical path changing means arranged on an optical path between the light source and each information recording surface for changing the traveling path of light, an objective lens arranged between the optical path changing means and the information recording surface for condensing incident light on the information recording surface, and a photodetector for receiving the light reflected from the information recording surface and incident via the objective lens and the optical path changing means, a swing member including a mount on which the light source, the optical path changing means, and the photodetector are installed, a plurality of swing arms extended from the mount, a suspension one end of which is installed on a surface which faces the information recording surface of each swing arm for elastically biasing the other end, and a slider which is installed at the other end of the suspension, which contacts the information recording surface by the elastic bias of the suspension, and into which the objective lens is loaded, a supporting means interposed between the base and the mount for supporting the swing member to be reciprocally rotatable centering around one hinge point on the base, and a magnetic driving means for reciprocally rotating the swing member.

BRIEF DESCRIPTION OF THE DRAWING(S)

The above objective and advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. 1 is a vertical sectional view partially showing a swing arm driving type optical recording/reproducing apparatus according to a first embodiment of the present invention;

FIG. 2 is a plan view partially showing the swing arm driving type optical recording/reproducing apparatus according the first embodiment of the present invention;

FIG. 3 is a perspective view showing the optical arrangement of an optical pickup of the swing arm driving type optical recording/reproducing apparatus according to the first embodiment of the present invention;

FIG. 4 is a sectional view partially showing a swing arm driving type optical recording/reproducing apparatus according to a second embodiment of the present invention; and

FIG. 5 is a sectional view partially showing a swing arm driving type optical recording/reproducing apparatus according to a third embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGs. 1 through 3, an optical recording/reproducing apparatus according to a first embodiment of the present invention includes a base 10, an optical disk 20 rotatably installed on the base 10 and having information recording surfaces 20a and 20b at either side thereof, optical pickups for recording information on and reproducing information by irradiating light onto the information recording surfaces 20a and 20b, a swing member 50 on which the optical pickups are mounted, a supporting unit 60 for supporting the swing member 50 to be reciprocally rotatable, and a magnetic driver 70 for driving the swing member 50.

The optical disk 20 is mounted onto a spindle motor 11 installed in the base 10, and rotates on the base 10.

The optical pickup includes first and second optical pickups 30 and 40 for recording information on and reproducing information from the information recording surfaces 20a and 20b, respectively.

The first optical pickup 30 includes a first light source 31 for irradiating first light L1, a first optical path changing unit 33 arranged on an optical path between the first light source 31 and the optical disk 20, for changing the traveling path of an incident light, a first objective lens 37 for condensing the first light L1 to form a light spot on the information recording surface 20a, and a first photodetector 39 for receiving the first light L1 incident via the first objective lens 37 and the first optical path changing unit 33 after reflected by the information recording surface 20a. The first optical path changing unit 33 makes the first light L1 incident from the first light source 31 face the first objective lens 37, and the first light L1 incident from the first objective lens 37 face the first photodetector 39.

Preferably, the first optical pickup 30 further includes a first collimating lens 32 arranged on the optical path between the first light source 31 and the first optical path changing unit 33, for condensing and collimating a divergent light irradiated from the first light source 31 and a first condensing lens 38 arranged on an optical path between the first optical path changing unit 33 and the first photodetector 39, for condensing the incident light. Also, the first optical pickup 20 includes a first reflective mirror 34 arranged on an optical path between the first optical path changing means 33 and the first objective lens 37, for changing the traveling path of the first light L1 so as to be vertically irradiated onto the information recording surface 20a.

The second optical pickup 40 includes a second light source 41 for irradiating second light L2, a second optical path changing unit 43 arranged on an optical path between the second light source 41 and the optical disk 20, for changing the traveling path of the incident light, a second objective lens 47 for condensing the second light L2 so as to form a light spot on the information recording surface 20b of the optical disk 20, and a second photodetector 49 for receiving the second light L2 incident via the second objective lens 47 and the second optical path changing unit 43 after being reflected by the information recording surface 20b.

Preferably, the second optical pickup 40 further includes a second collimating lens 42 arranged on the optical path between the second light source 41 and the second optical path changing unit 43, for condensing and collimating the divergent light irradiated from the second light source 41 and a second condensing lens 48 arranged on an optical path between the second optical path changing unit 43 and the second photodetector 49, for condensing the incident light.

Here, the first and second light sources 31 and 41, the first and second optical path changing units 33 and 43, and the first and second photodetectors 39 and 49 are installed on the same plane. The first and second objective lenses 37 and 47 are arranged on the information recording surfaces 20a and 20b, respectively.

Considering the above, second, third and fourth reflective mirrors 44, 45 and 46 are arranged on an optical path between the second optical path changing unit 43 and the second objective lens 47, so as to change the traveling path of the second light L2 to be irradiated at a right angle onto the information recording surface 20b.

In this embodiment of the present invention, a cubic type beam splitter is used as the first and second optical path changing units 33 and 43. However, a sheet type beam splitter, a polarized beam splitter, and a holographic optical element (HOE) can be used as the first and second optical path changing units 33 and 43. Particularly, when the HOE is used, each of the first light source 31 and the first photodetector 39, and the second light source 41 and the second photodetector 49, can be integrated into one module.

The swinging member 50 includes a mount 51 installed in the supporting unit 60 and a pair of first and second swing arms 52 and 55 extended from the mount 51 and protrusively formed to be placed on both sides of the optical disk 20.

The mount 51 is locked to the supporting unit 60. Most optical elements of the first and second optical pickups 30 and 40 are installed on the mount 51. For example, the light sources 31 and 41, the collimating lenses 32 and 42, the optical path changing units 33 and 43, the condensing lenses 38 and 48, and the photodetectors 39 and 49 are installed in the mount 51.

Here, in order to minimize the load on the mount 51, caused by the arrangement of the optical pickups 30 and 40, and the deterioration of resonance

characteristics, caused by rotation inertia, it is preferable that the optical pickups 30 and 40 are installed to be symmetrical with respect to the rotation center of the mount 51 and a center line C of the first and second swing arms 52 and 55.

The first and second swing arms 52 and 55 are formed to be extended from the mount 51 to face the information recording surfaces 20a and 20b, respectively. The first through fourth reflective mirrors 34, 44, 45 and 46 are installed in the first and second swing arms 52 and 55. The first and second swing arms 52 and 55 have light transmission holes 52a, 52b, 55a and 55b through which the first and second lights L1 and L2, whose paths are changed by the first through fourth reflective mirrors 34, 44, 45 and 46, pass. Also, first and second suspensions 53 and 56 for installing the first and second objective lenses 37 and 47 and first and second sliders 54 and 57 are installed in the first and second swing arms 51 and 55.

The first suspension 53, which is a plate spring having a predetermined elastic force, is coupled with one side of the first swing arm 52. The first slider 54 installed at the end of the first suspension 53 contacts the information recording surface 20a due to an elastic force of the first suspension 53. Also, the first objective lens 37 separated a predetermined distance from the information recording surface 20a is loaded into the first slider 54. That is, since the first slider 54 contacts the information recording surface 20a by the first suspension 53, the objective lens 37 is separated a uniform distance from the information recording surface 20a.

The second suspension 56 coupled with one surface of the second swing arm 55, i.e., the surface which faces the information recording surface 20b. The second slider 57 is installed at the end of the second suspension 56. The second slider 57 contacts the information recording surface 20b by the second suspension 56. The second objective lens 47 is installed in the second slider 57.

The supporting unit 60 interposed between the base 10 and the mount 51 supports the swing member 50 to be reciprocally rotatable centering around one hinge point on the base 10. For this, the supporting unit 60 includes a supporting protrusion 61 formed in the base and having a screw groove inside, a pivot bearing 62 installed in the supporting protrusion 61, and a supporting body 66 inserted into

the outer wheel 64 of the pivot bearing 62, to which the mount 51 and a coil member 71 of the following magnetic driving unit 70 is locked.

The pivot bearing 62 has an inner wheel 63 and an outer wheel 64. The inside of the inner wheel 63 is combined with the outer circumference of the support protrusion 61. A flange 64a is formed at a lower portion of the outer wheel 64 to control the downward movement of the supporting body 66. The pivot bearing 62 is installed at the outer circumference of the supporting protrusion 61 by locking a pivot screw 65 having a flange 65a on the top for controlling the upward movement of the pivot screw 65 to the supporting protrusion 61. The supporting body 66 is inserted into the outer circumference of the outer wheel 64. The downward movement of the supporting body 66 is controlled by a flange 64a. The upward movement of the supporting body 66 is controlled by a retainer ring 67 coupled with the upper end of the outer wheel 64.

The swing member 50 is combined with the supporting body 66 by a locking unit 68 such as a screw.

The magnetic driving unit 70 installed to extend from the supporting unit 60 to the base 10 provides the swing member 50 a reciprocal rotation driving force. For this, the magnetic driving unit 70 includes the coil member 71 installed in the supporting unit 60 to reciprocally rotate together with the swing member 50, yoke members 72 and 73 installed in the base 10 and located at the outer upper and lower portions of the coil member 71, and magnets 74 and 75 installed in the yoke members 71 and 73 so as to face the coil member 71. Thus, the magnetic driving unit 70 rotates the swing member 50 by a mutual electromagnetic force with the magnets 74 and 75, changed by controlling the intensity and direction of current applied to the coil member 71.

Referring to FIG. 4, an optical recording/reproducing apparatus according to a second embodiment of the present invention, like the optical recording/reproducing apparatus according to the first embodiment, includes a base 10, an optical disk 20 which is rotatably installed on the base 10 and has information recording surfaces 20a and 20b at both sides thereof, optical pickups 30 and 40 for recording and reproducing information by irradiating light onto the information recording surfaces

20a and 20b, a swing member 150 into which the optical pickups 30 and 40 are mounted, a supporting unit 60 for supporting the swing member 150 to be reciprocally rotatable, and a magnetic driving unit 70 for driving the swing member 150. The structure of the swing member 150 and the optical arrangement of the optical pickup of the optical recording/reproducing apparatus of the second embodiment is different from the optical recording/reproducing apparatus of the first embodiment.

Here, since elements having the same reference numerals as those of the first embodiment, have similar or the same functions as those of the first embodiment, detailed explanation thereof will be omitted.

The swing member 150 includes first and second mounts 151 and 152 and first and second swing arms 155 and 156. The second mount 152 is installed in the support 60. The second swing arm 156 is extended from the first mount 151 and is formed to be protrusive so as to be located on the information recording surface 20a of the optical disk 20. The first mount 151 is combined with the second mount 152. The first swing arm 155 is formed to be extended from the first mount 151 and is formed to be protrusive so as to be located on the information recording surface 20a. Some elements of first and second optical pickups 30' and 40' are installed in the first and second mounts 151 and 152, respectively. The second mount 152 includes a spacer 153 which encloses most elements of the second optical pickup 40' and which has a step 153a in the upper portion thereof so as to easily install the first mount 151 on the second mount 152, with the installation space of the second optical pickup 40' secured. One side of the bottom of the first mount 151 is put on the step 153a of the spacer 153 and is locked to the second mount 152 by a general locking unit 158. The first mount 151 is surrounded by a cover 159 so as to protect the first optical pickup 30' installed therein.

The optical recording/reproducing apparatus having the above structure can be applied to two or more optical disks 20, which are arranged on the same axis and separated from each other by a predetermined interval. The optical recording/reproducing apparatus can be easily installed by including the swing members 50 illustrated with reference to FIG. 4 which are equal in number to the

optical disks 20, sequentially stacking the swing members 50 in a vertical direction, and then locking the swing members 50 to each other.

FIG. 5 shows an example of the case where two optical disks 21 and 23 are adopted. As shown in FIG. 5, the optical recording/reproducing apparatus can be easily installed by including two swing arms 150 each including first and second mounts 151 and 152 and first and second swing arms 155 and 156, arranging the swing members 150 to be located on the information recording surfaces of the optical disks 21 and 23, and then locking the swing members 150 to each other.

Here, in order to increase the magnetic driving force by the magnetic driving unit 70, the magnetic driving units illustrated with reference to FIGs. 2 through 4 can be paired.

As described above, the optical recording/reproducing apparatus according to the present invention provides the following effects.

First, it is possible to minimize deterioration of resonance characteristics by rotation inertia by symmetrically arranging the optical elements on the swing member centering around the rotating center.

Second, it is possible to reduce access and tracking times required for changing the information recording surfaces compared with the plural optical disk recording/reproducing method using one light source and light receiving device by including the optical pickups having light sources corresponding to the respective information recording surfaces.

Third, the plural optical disks can be simultaneously formatted.

Fourth, it is possible to prevent a delay in the access time caused by an increase in the load applied to the supporting unit since the driving force of the magnetic driving unit can be easily increased when a plurality of optical disks are stacked.

Fifth, since the optical pickup is installed in the swing member, and the optical path hardly changes during tracking, the optical axis tilts slightly, whereas in a separation type, some optical systems are fixed to the base.



What is claimed is:

1. A swing arm driving type optical recording/reproducing apparatus, comprising:

a base;

at least one optical disk rotatably installed on the base, both sides of which are information recording surfaces;

a plurality of optical pickups which are equal in number to the information recording surfaces, each including a light source for irradiating light, an optical path changing means arranged on an optical path between the light source and each information recording surface for changing the traveling path of light, an objective lens arranged between the optical path changing means and the information recording surface for condensing incident light on the information recording surface, and a photodetector for receiving the light reflected from the information recording surface and incident via the objective lens and the optical path changing means;

a swing member including a mount on which the light source, the optical path changing means, and the photodetector are installed, a plurality of swing arms extended from the mount, a suspension one end of which is installed on a surface which faces the information recording surface of each swing arm for elastically biasing the other end, and a slider which is installed at the end of the suspension, which contacts the information recording surface by the elastic bias of the suspension, and into which the objective lens is loaded;

a supporting means interposed between the base and the mount for supporting the swing member to be reciprocally rotatable centering around one hinge point on the base; and

a magnetic driving means for reciprocally rotating the swing member.

2. The apparatus of claim 1, wherein the supporting means comprises:

a supporting protrusion formed on the base;

a pivot bearing inserted into the outer circumference of the supporting protrusion and having an inner wheel and an outer wheel freely rotated against the inner wheel; and



a supporting body inserted into the outer wheel of the pivot bearing and to which the mount of the swing member is locked.

3. The apparatus of claim 1 or 2, wherein the magnetic driving means comprises:

a coil member installed in the swing member and/or the supporting means;
yoke members installed in the base and located at outer upper and lower portions of the coil; and

magnets installed in the yokes so as to face the coil member,

wherein the swing member is rotated by the intensity and direction of current applied to the coil member and a mutual electromagnetic force with the magnets.