Description

The present invention relates generally to optical head devices for use in recording and/or reproduction of information, and more particularly, to an optical head device which causes a light beam to impinge upon a record medium and guides the light beam from the record medium to a photodetector for reproducing information recorded on the record medium and obtaining a tracking error signal used for maintaining the light beam incident upon the record medium in correct tracking relation to a record track formed in the record medium.

In an optical disc player for reproducing information recorded on an optical record disc, an optical head device is provided for constituting an optical arrangement to read an information signal from a record track formed in the optical record disc by the use of a laser light beam impinging upon the record track. The optical head device is required to produce the laser light beam, to cause the laser light beam to be focused correctly on the record track, which is usually very narrow in width, so as to trace faithfully the same, and to guide properly a reflected laser light beam obtained from the optical record disc to a photodetector. For fulfilling these requirements, the optical head device comprises a precise arrangement of various optical components including a semiconductor laser for generating a laser light beam, an objective lens disposed for facing the optical record disc to focus the laser light beam incident upon the optical record disc and to receive the reflected laser light beam from the optical record disc, other lenses, mirrors, prisms, photosensitive elements constituting the photodetector and so on, which is supported to be movable in both directions along an optical axis of the objective lens and perpendicular to the optical axis of the objective lens so that focus control for maintaining the laser light beam incident upon the optical record disc in correct focus relation to the record track and tracking control for maintaining the laser light beam incident upon the optical record disc in correct tracking relation to the record track are performed respectively.

In the focus control performed in the optical head device, a focus error signal which varies in response to variations in the focus condition of the laser light beam incident upon the record track in the optical record disc is produced based on detection output signals obtained from the photodetector to which the reflected laser light beam from the optical disc is guided and the objective lens is moved along its optical axis in accordance with the focus error signal. Further, in the tracking control performed in the optical head device, a tracking error signal which varies in response to variations in the tracking condition of the laser light beam incident upon the record track in the optical record disc is produced based on the detection output signals obtained from the photodetector to which the reflected laser light beam from the optical disc is guided and the optical axis of the objective lens is moved to have parallel displacements in a direction transverse perpendicularly to the record track in accordance with the tracking error signal.

For contributing to production of the focusing and tracking error signals, the photodetector provided in the optical head device comprises, for example, four photosensitive elements d_1, d_2, d_3 and d_4 disposed close to one another, as illustrated in Fig. 1. The photosensitive elements d_1 to d_4 are so arranged that the photosensitive elements d_1 and d_3 are aligned along a direction X corresponding to the tangential direction of the record track in the optical record disc and the photosensitive elements d_2 and d_4 are also aligned along the direction X. The reflected laser light beam coming through the objective lens from the record track in the optical record disc forms a beam spot Q on the photosensitive elements d_1 to d_4 as indicated by a dot-dash line in Fig. 1. The photosensitive elements d_1 to d_4 produce respective detection output signals S_1, S_2, S_3 and S_4 each dependent on a portion of the beam spot Q formed on each of the photosensitive elements d_1 to d_4.

A reproduced information signal is produced by summing up the detection output signals S_1 to S_4, and the focus error signal is obtained based on a difference between an added signal obtained by adding the detection output signal S_1 to the detection output signal S_4 and an added signal obtained by adding the detection output signal S_2 to the detection output signal S_3, in the same manner as disclosed in, for example, United States Patents No. 4,023,033 and No. 4,079,247.

The tracking error signal will now be considered. The record track in the optical record disc is composed of a series of pits having a depth which is a quarter of the wavelength λ of the laser light beam incident upon the record track. The laser light beam irradiating the record track is diffracted and reflected by the pits. Then, the laser light beam which is modulated by the record track is reflected back through the objective lens as the reflected laser light beam and reaches the photodetector to form the beam spot Q on the photosensitive elements d_1 to d_4. Accordingly, the reflected light beam produces a diffraction pattern corresponding to the positional relationship between one of the pits forming the record track and a beam spot formed by the laser light beam irradiating the record track. The diffraction pattern thus produced is moved in a direction corresponding to the direction X in relation to the photosensitive elements d_1 to d_4 at speed corresponding to the movement of the record track relative to the laser light beam irradiating the record track.

Figs. 2A, 2B and 2C illustrate the manner in which the foregoing process takes place. In each of Figs. 2A

to 2C, a designates positional relationships between a pit P and a beam spot L formed by the laser light beam irradiating the pit P, and b designates diffraction patterns (hatched portions) formed on an exit pupil surface of the objective lens by the reflected laser light beam in dependence on each of the positional relationships designated by a. Four quarters d_1, d_2, d_3 and d_4 shown at b indicate portions in which quantities of light are detected by the four photosensitive elements d_1, d_2, d_3 and d_4, respectively. The pit P moves from a position t_1 to a position t_2 in relation to the beam spot L. Fig. 2A shows a condition in which the beam spot L is displaced to the right in relation to the pit P. Fig. 2B illustrates a condition in which the beam spot L is positioned centrally on the pit P, namely, a correct tracking condition in which the laser light beam arrives properly at the record track in the optical record disc. Fig. 2C shows a condition in which the beam spot L is displaced to the left in relation to the pit P.

It is understood from Figs. 2A to 2C that when the beam spot L is centrally positioned on the pit P, that is, when the laser light beam incident upon the record track is in the proper tracking condition, a diffraction pattern in which quantities of light are symmetrically distributed among a couple of quarters d_1 and d_2 and among another couple of quarters d_3 and d_4, is produced, and when the beam spot L is displaced rightward or leftward in relation to the pit P, a diffraction pattern in which no symmetric distribution of the quantities of light is obtained among the quarters d_1 and d_2 and among the quarters d_3 and d_4, is produced with the light distribution out of symmetry in reversed patterns in the case where the beam pattern is disposed to the right and in the case where the beam pattern is disposed to the left, respectively. Based on the foregoing, the detection output signals S_1 to S_4 obtained from the photosensitive elements d_1 to d_4, respectively, may be supplied to and processed by a signal generating circuit for producing a signal which varies in dependence on the positional relationships between the beam spot L and the pit P, namely, the tracking error signal.

Fig. 3 shows one example of the signal generating circuit by which the tracking error signal is produced based on the detection output signals S_1 to S_4 obtained from the photosensitive elements d_1 to d_4, together with the reproduced output of an information signal recorded on the record medium, that is, a reproduced information signal.

In the circuit shown in Fig. 3, the detection output signals S_1 and S_4 obtained from the photosensitive elements d_1 and d_4, respectively are added to each other by an adder 11, and the detection output signals S_2 and S_3 obtained from the photosensitive elements d_2 and d_3, respectively, are added to each other by an adder 12. Output signals from the adders 11 and 12 are supplied to an adder 13 to produce an output signal S_5 and supplied also to a subtracter 14 to produce an output signal S_6. The output signal S_5 obtained from the adder 13 serves as the reproduced information signal, and the output signal S_6 obtained from the subtracter 14 comprises a signal residing in a frequency band of the information signal recorded on the record track in the optical record disc and varying whenever the beam spot L on the optical record disc passes through the pit P and serves as the tracking error signal which indicates deviations of the beam spot L from the center of the record track formed by the series of pits.

Further, in the circuit shown in Fig. 3, the output signal S_5 obtained from the adder 13 is supplied to both of pulse generators 15 and 16. The pulse generator 15 produces a pulse signal S_7 in response to each rising edge of the output signal S_5 and the pulse generator 16 produces a pulse signal S_8 in response to each falling edge of the output signal S_5. On the other hand, the output signal S_6 obtained from the subtracter 14 is supplied to both of sampling-hold circuits 17 and 18. In the sampling-hold circuit 17, the level of the output signal S_6 is sampled by the pulse signal S_8 and each level sampled by pulse signal S_8 is held to produce an output signal S_9. Similarly, in the sampling-hold circuit 18, the level of the output signal S_6 is sampled by the pulse signal S_7 and each level sampled by pulse signal S_7 is held to produce an output signal S_{10}. Each of the output signals S_9 and S_{10} obtained from the sampling-hold circuits 17 and 18, respectively, has a polarity varying from negative to positive or vice versa when the beam spot L is moved to traverse the record track and a level representative of the deviations of the beam spot L from the center of the record track. Consequently, the output signals S_9 and S_{10} can be employed as tracking control signals. These output signals S_9 and S_{10} are supplied to a differential circuit 19 to produce a tracking control signal S_{11} which is more reliable and delivered to an output terminal 20.

In the previously proposed optical head device as described above, wherein the tracking error signal is produced in such a manner as aforementioned, four photosensitive elements constituting the photodetector are required to be arranged precisely in mutual positional relation and in direction of alignment, and this results in that the photodetector per se and devices for positioning the photodetector become complicated in configuration. Further, a bidirectional optical arrangement is required to be provided for controlling a position on the photodetector upon which the reflected laser light beam is incident exactly in each of two directions perpendicular to each other.

Especially, in the case where the previously proposed optical head device is equipped with an integrated light beam generating and detecting unit which comprises a semiconductor substrate on which a photodetector, a semiconductor laser, and a prism for

directing a laser light beam generated by the semiconductor laser to impinge upon an optical record disc and for guiding a reflected laser light beam obtained from the optical record disc to the photodetector are provided, as disclosed in the Japanese patent application published before examination under publication number 62-197731, and its equivalent EP-A-0,258,450 reflecting the preamble of claim 1, the disadvantage resulting from the photodetector composed of four photosensitive elements which are provided for producing the tracking error signal as described above is more serious. EP-A-0,258,450 also discloses the use of two photosensors, each consisting of three parallel elements, to obtain a focusing error signal. GB-A-2,196,115 discloses a photodetector that is divided into four regions for producing a focus error signal and a tracking error signal, in which the angle between the direction of track movement and the alignment of the photodetector is varied in response to the output from the regions in order to minimize the adverse effects of the diffracted light of the track on the focus error signal.

Accordingly, it is an object of the present invention to provide an optical head device for use in recording and/or reproduction of information, by which a light beam is caused to impinge upon a record medium and the light beam from the record medium is guided to a photodetecting portion so that detection output signals used for producing at least a reproduced signal of information recorded on the record medium and a tracking error signal are obtained from the photodetecting portion, and which avoids the aforementioned disadvantages and problems encountered with the prior art.

Another object of the present invention is to provide an optical head device for use in recording and/or reproduction of information, by which a light beam is caused to impinge upon a record medium and the light beam from the record medium is guided to a photodetecting portion so that detection output signals used for producing at least a reproduced signal of information recorded on the record medium and a tracking error signal are obtained from the photodetecting portion, and which can supply the detection output signals of the photodetecting portion from which a reliable tracking error signal is obtained under a condition wherein the photodetecting portion is simplified in configuration and it is not required to control a position on the photodetecting portion upon which the light beam from the record medium is incident exactly in each of two directions perpendicular to each other.

A further object of the present invention is to provide an optical head device for use in recording and/or reproduction of information, by which a light beam is caused to impinge upon a record medium and the light beam from the record medium is guided to a photodetecting portion so that detection output signals used for producing at least a reproduced signal of information recorded on the record medium and a tracking error signal are obtained from the photodetecting portion, and which can supply the detection output signals of the photodetecting portion from which a reliable tracking error signal is obtained under a condition wherein the photodetecting portion is simplified in configuration and a exact bidirectional control for a position on the photodetecting portion upon which the light beam from the record medium is incident is not required even in the case where an integrated light beam generating and detecting unit is employed in the device.

According to the present invention there is provided an optical head device for use in recording and/or reproduction of information comprising: light beam generating means, lens means for causing a light beam obtained from said light beam generating means to impinge upon a record medium and receiving the light beam from the recording medium, photodetecting means to which the light beam from the record medium received by said lens means is guided, said photodetecting means comprising a group of photosensitive elements including a central and two side photosensitive elements separated from each other by a pair of parallel dividing portions each extending along a predetermined direction and disposed to form a common light receiving plane on which a beam spot is formed by the light beam guided to said photodetecting means for detecting the light beam guided to the photodetecting means to produce respective detection output signals, and signal generating means for producing a tracking signal used for maintaining the laser light beam impinging upon the record medium in correct tracking relation to the record track in the record medium, characterised by said predetermined direction along which each of the parallel dividing portions extends being selected to be at an angle between 0 and 90 degrees to a direction of movement of a diffraction pattern appearing in the beam spot formed on the common light receiving plane in accordance with a record track in the record medium and by said respective detection output signals being of use in such manner that said signal generating means produce said tracking signal based on the difference between the detection output signal from the central photosensitive element and an added signal obtained by adding the detection output signals from the side photosensitive elements to each other.

Advantageously, the photodetecting means further comprises an additional group of photosensitive elements including a central and two side photosensitive elements separated from each other by a pair of parallel dividing portions each extending along said predetermined direction and disposed to form a common light receiving plane on which a beam spot is formed by the light beam guided to said photodetecting means for detecting the light beam guided to the

photodetecting means to produce respective detection output signals, and the light beam guided to said photodetecting means is caused to be incident upon said first mentioned group of photosensitive elements and said second group of photosensitive elements successively with a focusing point thereof on an optical path formed between said first group of photosensitive elements and said second group of photosensitive elements and said signal generating means produces said tracking signal based on a difference between an added signal obtained by adding the detection output signal from the central photosensitive elements of said first group of photosensitive elements and the detection output signal from the central photosensitive element of said second group of photosensitive elements to each other and an added signal obtained by summing up the detection output signals from the side photosensitive elements of said first group of photosensitive elements and the detection output signals from the side photosensitive elements of said second group of photosensitive elements.

In the optical head device thus constituted in accordance with the present invention, since the group of photosensitive elements including three photosensitive elements separated from each other by two parallel dividing portions each extending along the predetermined direction is provided in the photodetecting portion so that the predetermined direction along which each of the parallel dividing portions extends is arranged to be at the angle between 0 and 90 degrees to the direction of movement of the diffraction pattern appearing in the beam spot formed on the group of photosensitive elements by the light beam from the record medium in accordance with the record track in the record medium, the diffraction pattern in the beam spot formed on the group of photosensitive elements varies in accordance with the positional relationship between the record track in the record medium and a beam spot formed on the record disc by the light beam impinging thereon in substantially the same manner as that shown in Figs. 2A to 2C and described above.

Then, each of the central photosensitive element and two side photosensitive elements produces the detection output signal in response to the portion of the light beam from the record medium received thereby and the tracking error signal is produced based on the detection output signal from the central photosensitive element and the added signal obtained by adding the detection output signals from the side photosensitive elements to each other.

In the optical head device according to the present invention thus arranged, the predetermined direction along which each of the parallel dividing portions extends in the photodetecting portion is not required to be arranged so exactly and a position on the group of photosensitive elements upon which the light beam guided to the photodetecting portion is incident is also not required to be controlled so exactly in the predetermined direction. Consequently, with the optical head device according to the present invention, a reliable tracking error signal is obtained under a condition wherein the photodetecting portion is simplified in configuration and an exact bidirectional control for a position on the photodetecting portion upon which the light beam from the record medium is incident is not required even in the case where an integrated light beam generating and detecting unit is employed in the optical head device.

Further, in the embodiment which is provided with the photodetecting portion having the first and second groups of photosensitive elements, the detection output signals from which a focus error signal is also produced, in addition to the reproduced signal of information recorded on the record medium and the tracking error signal, are obtained from the photodetecting portion.

The above, and other objects, features and advantages of the present invention will become apparent from the following detailed description which is to be read in conjunction with the accompanying drawings.

Fig. 1 is a schematic view showing a photodetector employed in a previously proposed optical head device;

Figs. 2A to 2C are a set of diagrams used for explaining the positional relationship between a pit forming a record track in a record medium and a beam spot formed by a light beam incident upon the record medium as known in the prior art;

Fig. 3 is a block diagram showing a signal generating circuit connected with the photodetector shown in Fig. 1;

Fig. 4 is a schematic perspective view showing one embodiment of optical head device for use in recording and/or reproduction of information according to the present invention;

Fig. 5 is a cross-sectional view showing one example of a movable optical assembly employed in the embodiment shown on Fig. 4;

Fig. 6 is an enlarged cross-sectional view showing a light beam generating and detecting unit and a package containing the light beam generating and detecting unit, together with other optical elements, used in the movable optical assembly shown in Fig. 5;

Fig. 7 is a schematic plan view of the light beam generating and detecting unit used in the movable optical assembly shown in Fig. 5;

Figs. 8A to 8C are a set of diagrams used for explaining the positional relationship between a pit forming a record track in a record medium and a beam spot formed by a light beam caused to impinge upon the record medium by the movable optical assembly shown in Fig. 5; and

Fig. 9 is a block diagram showing a signal generating circuit connected with a photodetecting portion of the light beam generating and detecting unit used in the movable optical assembly shown in Fig. 5

Figs. 4 to 7 show one embodiment of optical head device for use in recording and/or reproduction of information according to the present invention. This embodiment shown in Figs. 4 to 7 is, in actual use, incorporated in a disc player.

Referring to Fig. 4, the embodiment has a case 30 provided with an opening 30a to which an objective lens 31 contained in the case 30 faces. On the occasion of actual use in the disc player, the embodiment is mounted on the upper surface of a movable base member 34 which is engaged to be movable with guide members 32 and 33 provided in the disc player. The movable base member 34 is driven by a driving mechanism, which is provided in the disc player with a pinion engaging with a rack portion 34a formed on the movable base member 34 to be moved in a direction along the radius of an optical record disc mounted on the disc player under the guidance by the guide members 32 and 33.

In the case 30 of the embodiment, a movable optical assembly including the objective lens 31 and a supporting and driving assembly operative to support the movable optical assembly and to move the same in predetermined directions are contained.

As shown in Fig. 5, the movable optical assembly has a supporting member 36 on which the objective lens 31 and an integrated element mounting board 35 are mounted. The integrated element mounting board 35 is provided with a flexible connecting film 35a extending therefrom.

In the supporting member 36, a package 37 which contains a light beam generating and detecting unit 38 is mounted on the inner surface of the integrated element mounting board 35. Further, a mirror 39 is held by the supporting member 36 to be disposed under the light beam generating and detecting unit 38, and another mirror 40 is also held by the supporting member 36 under the objective lens 31 to be disposed on the axis of the objective lens 31.

The movable optical assembly is disposed so as to cause the objective lens 31 mounted on the supporting member 36 to face the under surface of an optical record disc R. In the movable optical assembly thus disposed, the light beam generating and detecting unit 38 contained in the package 37 is operative to generate a laser light beam directed toward the mirror 39 which is positioned under the light beam generating and detecting unit 38. The laser light beam from the light beam generating and detecting unit 38 is reflected by the mirror 39 and then reflected further by the mirror 40 to be directed upward to enter the objective lens 31. The objective lens 31 is operative to focus the laser light beam from the mirror 40 on a record track Rt formed in the optical record disc R. Then, a reflected laser light beam obtained from the optical record disc R returns through the objective lens 31 to the mirror 40 to be reflected thereby. The reflected laser light beam reflected by the mirror 40 is further reflected by the mirror 39 to be directed upward to the light beam generating and detecting unit 38 contained in the package 37.

As shown in Fig. 6 in which the light beam generating and detecting unit 38 contained in the package 37 is enlarged, the package 37 mounted on the inner surface of the integrated element mounting board 35 comprises a body 41 in which the light beam generating and detecting unit 38 is disposed and a glass plate member 42 attached to the body 41. The laser light beam generated by the light beam generating and detecting unit 38 passes through the glass plate member 42 to the mirror 39 and the reflected laser light beam reflected by the mirror 39 passes through the glass plate member 42 to the light beam generating and detecting unit 38.

In the light beam generating and detecting unit 38, as shown in Fig. 6, first and second photodetectors 51 and 52 are formed to align in a semiconductor substrate 50 so as to constitute a photodetecting portion. A semiconductor laser 53 is also provided on the surface of the semiconductor substrate 50. Further, a protective coating layer 54 is formed to cover the surface of the semiconductor substrate 50 except a portion thereof on which the semiconductor laser 53 is placed and a prism 55 is fixed on a portion of the protective coating layer 54 covering the photodetecting portion constituted on the semiconductor substrate 50 wherein the first and second photodetectors 51 and 52 are formed. With such optical elements, the light beam generating and detecting unit 38 is integrated.

The prism 55 has a semi-transparent surface 55a which faces the semiconductor laser 53 and is inclined in relation to the surface of the semiconductor substrate 50 on which the semiconductor laser 53 is placed.

In the light beam generating and detecting unit 38 thus constituted, the laser light beam generated by the semiconductor laser 53 is reflected by the semi-transparent surface 55a of the prism 55 to pass through the glass plate member 42 toward the mirror 39. Then, the laser light beam from the semi-transparent surface 55a of the prism 55 is reflected twice by the mirrors 39 and 40 and caused to impinge upon the record track Rt in the optical record disc R through the objective lens 31. On the other hand, the reflected laser light beam obtained from the record track Rt in the optical record disc R returns through the objective lens 31 and is reflected twice by the mirrors 40 and 39. Then, the reflected laser light beam from the mirror 39 passes through the semi-transparent surface 55a of the prism 55 to enter the

prism 55. In the prism 55, a part of the reflected laser light beam reaches to the first photodetector 51 and the rest of the reflected laser light beam is reflected to reach to the second photodetector 52. The reflected laser light beam is arranged to have a focusing point on an optical path formed between the first and second photodetectors 51 and 52 in the prism 55.

As shown in Fig. 7, each of the first and second photodetectors 51 and 52 formed in the semiconductor substrate 50 comprises a group of photosensitive elements including a central photosensitive element and two side photosensitive elements facing each other with the central photosensitive element between. In more detail, the first photodetector 51 comprises three rectangular photosensitive elements D_1, D_2 and D_3 which are separated from each other by a couple of parallel dividing portions E_1 and E_2 so that the photosensitive element D_2 is positioned at the center and the photosensitive elements D_1 and D_3 are positioned at both sides of the photosensitive element D_2 and disposed to form a common light receiving plane, and similarly, the second photodetector 52 comprises three rectangular photosensitive elements D_1', D_2' and D_3' which are separated from each other by a couple of parallel dividing portions E_1' and E_2' so that the photosensitive element D_2' is positioned at the center and the photosensitive elements D_1' and D_3' are positioned at both sides of the photosensitive element D_2' and disposed to form a common light receiving plane.

The semiconductor substrate 50, in which the first and second photodetectors 51 and 52 are formed in the above mentioned manner and on which the semiconductor laser 53 and the prism 55 are provided, is fixed to the inner surface of the body 41 of the package 37 in such a manner that a direction along which each of the parallel dividing portions E_1 and E_2 in the first photodetector 51 and the parallel dividing portions E_1' and E_2' in the second photodetector 52 extends is set to be at an angle θ within an angle range of 0 to 90 degrees, for example, 45 degrees to a direction corresponding to the tangential direction of the record track Rt in the optical record disc R, as indicated with arrows X in Fig. 7. Accordingly, each of the photosensitive elements D_1 to D_3 constituting the first photodetector 51 and the photosensitive elements D_1' to D_3' constituting the second photodetector 52 also extends to be at the angle θ to the direction corresponding to the tangential direction of the record track Rt in the optical record disc R indicated with the arrows X.

The part of the reflected laser light beam which comes from the record track Rt in the optical record disc R through the objective lens 31 to enter the prism 55 reaches to the common light receiving plane formed by the photosensitive elements D_1 to D_3 constituting the first photodetector 51 and forms a beam spot U thereon as shown in Fig. 7 and another part of the reflected laser light beam reaches to the common light receiving plane formed by the photosensitive elements D_1' to D_3' constituting the second photodetector 52 and forms a beam spot U' thereon as shown in Fig. 7. The photosensitive elements D_1 to D_3 produce respective detection output signals V_1, V_2 and V_3 in response to portions of the beam spot U irradiating the photosensitive elements D_1 to D_3, respectively, and the photosensitive elements D_1' to D_3' produce respective detection output signals V_1', V_2' and V_3' in response to portions of the beam spot U' irradiating the photosensitive elements D_1' to D_3', respectively. These detection output signals V_1 to V_3 and V_1' to V_3' are derived through the integrated element mounting board 35 and the flexible connecting film 35a from the light beam generating and detecting unit 38.

The record track Rt in the optical record disc R is also composed of a series of pits having a depth which is a quarter of the wavelength of the laser light beam incident upon the record track Rt, and therefore the laser light beam impinging upon the record track Rt through the objective lens 31 is diffracted and reflected by the pits. Accordingly, the reflected light beam which returns through the objective lens 31 from the record track Rt in the optical record disc R and is guided to the first and second photodetectors 51 and 52 so as to form the beam spots U and U' on the photosensitive elements D_1 to D_3 and the photosensitive elements D_1' to D_3', respectively, produces a diffraction pattern in each of the beam spots U and U', which corresponds to the positional relationship between one of the pits forming the record track Rt and a beam spot formed by the laser light beam irradiating the record track Rt. The diffraction pattern thus produced in each of the beam spots U and U' is moved in the direction corresponding to the tangential direction of the record track Rt in the optical record disc R, as indicated with arrows X in Fig. 7, in relation to each of the first and second photodetectors 51 and 52 at speed corresponding to the movement of the record track Rt relative to the laser light beam irradiating the record track Rt.

Figs. 8A, 8B and 8C illustrate the manner in which the movement of the diffraction pattern mentioned above takes place. In each of Figs. 8A to 8C, a designates positional relationships between a pit P and a beam spot L formed by the laser light beam irradiating the pit P, and b designates diffraction patterns (hatched portions) formed on an exit pupil surface of the objective lens 31 by the reflected laser light beam in dependence on each of the positional relationships designated by a. Three divided areas $D_1(D_1')$, $D_2(D_2')$ and $D_3(D_3')$ shown at b indicate portions in which quantities of light are detected by the photosensitive elements D_1 to D_3 constituting the first photodetector 51 and portions in which quantities of light are detected by the photosensitive elements D_1' to D_3' constituting the second photodetector 52. The

pit P moves from a position T_1 to a position T_2 in relation to the beam spot L. Fig. 8A shows a condition in which the beam spot L is displaced to the right in relation to the pit P. Fig. 8B illustrates a condition in which the beam spot L is positioned centrally on the pit P, namely, a correct tracking condition in which the laser light beam arrives properly at the record track Rt in the optical record disc R. Fig. 8C shows a condition in which the beam spot L is displaced to the left in relation to the pit P.

It is understood from Figs. 8A to 8C that when the beam spot L is centrally positioned on the pit P, that is, when the laser light beam incident upon the record track Rt is in the proper tracking condition, a diffraction pattern in which quantities of light are symmetrically distributed among the divided area $\underline{D_2}(\underline{D_2}')$ and a combination of the divided areas $\underline{D_1}(\underline{D_1}')$ and $\underline{D_3}(\underline{D_3}')$ is produced, and when the beam spot L is displaced rightward or leftward in relation to the pit P, a diffraction pattern in which no symmetric distribution of the quantities of light is obtained among the divided area $\underline{D_2}(\underline{D_2}')$ and the combination of the divided areas $\underline{D_1}(\underline{D_1}')$ and $\underline{D_3}(\underline{D_3}')$ is produced with the light distribution out of symmetry in reversed patterns in the case where the beam pattern is disposed to the right and in the case where the beam pattern is disposed to the left, respectively. Based on the foregoing, it is further understood that, by applying the detection output signals V_1, V_2 and V_3 obtained from the photosensitive elements D_1, D_2 and D_3, respectively, and the detection output signals V_1', V_2' and V_3' obtained from the photosensitive elements D_1', D_2' and D_3', respectively, to a signal generating circuit in which the detection output signal V_2 and a combination of the detection output signals V_1 and V_3 are processed separately and the detection output signal V_2' and a combination of the detection output signals V_1' and V_3' are also processed separately, a signal which varies in dependence on the positional relationships between the beam spot L and the pit P, namely, the tracking error signal can be obtained from the signal generating circuit.

Fig. 9 shows one example of the signal generating circuit by which the tracking error signal is produced based on the detection output signals V_1 to V_3 obtained from the photosensitive elements D_1 to D_3, respectively, and the detection output signals V_1' to V_3' obtained from the photosensitive elements D_1' to D_3', respectively, together with a reproduced output of an information signal recorded on the record track Rt in the optical record disc R, that is, a reproduced information signal and a focusing error signal.

The circuit shown in Fig. 9 is connected with the photosensitive elements D_1 to D_3 constituting the first photodetector 51, each of which extends to be at the angle θ to the direction of movement of the diffraction pattern corresponding to the positional relationship between the pit P forming the record track Rt in the optical record disc R and the beam spot L formed by the laser light beam irradiating the record track Rt, as indicated by an arrow X close to the first photodetector 51, and also with the photosensitive elements D_1' to D_3' constituting the second photodetector 52, each of which extends to be at the angle θ to the direction of movement of the diffraction pattern, as indicated by an arrow X close to the second photodetector 52.

In the circuit shown in Fig. 9, the detection output signals V_1 and V_3 obtained from the photosensitive elements D_1 and D_3, respectively, are added to each other by an adder 61, the detection output signals V_1' and V_3' obtained from the photosensitive elements D_1' and D_3', respectively, are added to each other by an adder 62, and the detection output signal V_2 obtained from the photosensitive elements D_2 and the detection output signals V_2' obtained from the photosensitive elements D_2' are added to each other by an adder 63. Further, an output signal V_4 obtained from the adder 61 and an output signal V_4' obtained from the adder 62 are added to each other by an adder 64.

Then, an output signal V_5 obtained from the adder 63 and an output signal V_6 obtained from the adder 64 are supplied to an adder 65 to produce an output signal V_7 and supplied also to a subtracter 66 to produce an output signal V_8. The output signal V_7 obtained from the adder 65 corresponds to the sum of the detection output signals V_1 to V_3 and V_1' to V_3' and therefore serves as the reproduced information signal. The output signal V_8 obtained from the subtracter 66 comprises a signal residing in a frequency band of the information signal recorded on the record track Rt in the optical record disc R and varying whenever the beam spot L on the optical record disc R passes through the pit P and serves as the tracking error signal which indicates deviations of the beam spot L on the optical record disc R from the center of the record track Rt formed by the series of pits P.

The detection output signal V_2 and the output signal V_4 obtained from the adder 61 are supplied to a subtracter 73, and the detection output signal V_2' and the output signal V_4' obtained from the adder 62 are supplied to a subtracter 74. Then, output signals obtained from the subtracters 73 and 74, respectively, are supplied to a subtracter 75 to produce an output signal V_{14}. This output signal V_{14} varies in response to the focusing condition of the laser light beam incident upon the record track Rt in the optical record disc R and delivered to an output terminal 76 as the focus error signal.

Further, in the circuit shown in Fig. 9, the output signal V_7 obtained from the adder 65 is supplied to both of pulse generators 67 and 68. The pulse generator 67 produces a pulse signal V_9 in response to each rising edge of the output signal V_7 and the pulse generator 68 produces a pulse signal V_{10} in response to each falling edge of the output signal V_7. On the other hand, the output signal V_8 obtained from the subtract-

er 66 is supplied to both of sampling-hold circuits 69 and 70. In the sampling-hold circuit 69, the level of the output signal V_8 is sampled by the pulse signal V_{10} and each level sampled by pulse signal V_{10} is held to produce an output signal V_{11}. Similarly, in the sampling-hold circuit 70, the level of the output signal V_8 is sampled by the pulse signal V_9 and each level sampled by pulse signal V_9 is held to produce an output signal V_{12}. Each of the output signals V_{11} and V_{12} obtained from the sampling-hold circuits 69 and 70, respectively, has a polarity varying from negative to positive or vice versa when the beam spot L formed on the optical record disc R is moved to traverse the record track Rt and a level representative of the deviations of the beam spot L from the center of the record track Rt. Consequently, the output signals V_{11} and V_{12} can be employed as tracking control signals. These output signals V_{11} and V_{12} are supplied to a differential circuit 71 to produce a tracking control signal V_{13} which is more reliable and delivered to an output terminal 72.

Although, in the embodiment described above, the detection output signal V_2 from the photosensitive element D_2 and the combined signal obtained by adding the detection output signals V_1 and V_3 from the photosensitive elements D_1 and D_3, which are derived from the first photodetector 51, and the detection output signal V_2' from the photosensitive element D_2' and the combined signal obtained by adding the detection output signals V_1' and V_3' from the photosensitive elements D_1' and D_3', which are derived from the second photodetector 52, are used for producing the output signal V_8 which serves as the tracking error signal, it is possible to use the detection output signal V_2 and the combined signal obtained by adding the detection output signals V_1 and V_3, which are derived from the first photodetector 51, or the detection output signal V_2' and the combined signal obtained by adding the detection output signals V_1' and V_3', which are derived from the second photodetector 52, for producing the tracking error signal.

Claims

1. An optical head device for use in recording and/or reproduction of information comprising:

light beam generating means (53),

lens means (31) for causing a light beam obtained from said light beam generating means (53) to impinge upon a record medium (R) and receiving the light beam from the recording medium (R),

photodetecting means (51) to which the light beam from the record medium (R) received by said lens means (31) is guided, said photodetecting means comprising a group of photosensitive elements including a central (D_2) and two side photosensitive elements (D1, D3) separated from each other by a pair of parallel dividing portions (E1, E2) each extending along a predetermined direction and disposed to form a common light receiving plane on which a beam spot (U) is formed by the light beam guided to said photodetecting means (51) for detecting the light beam guided to the photodetecting means to produce respective detection output signals (V_1, V_2, V_3), and

signal generating means for producing a tracking signal used for maintaining the laser light beam impinging upon the record medium in correct tracking relation to the record track (RT) in the record medium (R),

characterised by said predetermined direction along which each of the parallel dividing portions extends being selected to be at an angle between 0 and 90 degrees to a direction of movement of a diffraction pattern appearing in the beam spot formed on the common light receiving plane in accordance with a record track (RT) in the record medium (R) and by said respective detection output signals (V_1, V_2, V_3) being of use in such manner that said signal generating means produce said tracking signal based on the difference between the detection output signal (V_2) from the central photosensitive element (D2) and an added signal obtained by adding the detection output signals (V_1, V_3) from the side photosensitive elements (D1, D3) to each other.

2. An optical head device according to claim 1, wherein said photodetecting means further comprises a second group of photosensitive elements (52) including a central (D'2) and two side photosensitive elements (D'1, D'3) separated from each other by a pair of parallel dividing portions (E'1, E'2) each extending along said predetermined direction and disposed to form a common light receiving plane on which a beam spot (U') is formed by the light beam guided to said photodetecting means for detecting the light beam guided to the photodetecting means to produce respective detection output signal (V'_1, V'_2, V'_3), and the light beam guided to said photodetecting means is caused to be incident upon said first mentioned group (51) of photosensitive elements (D1-D3) and said second group (52) of photosensitive elements (D'1-D'3) successively with a focusing point thereof on an optical path formed between said first group of photosensitive elements (D1-D3) and said second group of photosensitive elements (D'1-D'3) and said signal generating means produces said tracking signal based on a difference between an added signal obtained by adding the detection output signal (V_2) from the central photosensitive elements

er 66 is supplied to both of sampling-hold circuits 69 and 70. In the sampling-hold circuit 69, the level of the output signal V_8 is sampled by the pulse signal V_{10} and each level sampled by pulse signal V_{10} is held to produce an output signal V_{11}. Similarly, in the sampling-hold circuit 70, the level of the output signal V_8 is sampled by the pulse signal V_9 and each level sampled by pulse signal V_9 is held to produce an output signal V_{12}. Each of the output signals V_{11} and V_{12} obtained from the sampling-hold circuits 69 and 70, respectively, has a polarity varying from negative to positive or vice versa when the beam spot L formed on the optical record disc R is moved to traverse the record track Rt and a level representative of the deviations of the beam spot L from the center of the record track Rt. Consequently, the output signals V_{11} and V_{12} can be employed as tracking control signals. These output signals V_{11} and V_{12} are supplied to a differential circuit 71 to produce a tracking control signal V_{13} which is more reliable and delivered to an output terminal 72.

Although, in the embodiment described above, the detection output signal V_2 from the photosensitive element D_2 and the combined signal obtained by adding the detection output signals V_1 and V_3 from the photosensitive elements D_1 and D_3, which are derived from the first photodetector 51, and the detection output signal V_2' from the photosensitive element D_2' and the combined signal obtained by adding the detection output signals V_1' and V_3' from the photosensitive elements D_1' and D_3', which are derived from the second photodetector 52, are used for producing the output signal V_8 which serves as the tracking error signal, it is possible to use the detection output signal V_2 and the combined signal obtained by adding the detection output signals V_1 and V_3, which are derived from the first photodetector 51, or the detection output signal V_2' and the combined signal obtained by adding the detection output signals V_1' and V_3', which are derived from the second photodetector 52, for producing the tracking error signal.

Claims

1. An optical head device for use in recording and/or reproduction of information comprising:

light beam generating means (53),

lens means (31) for causing a light beam obtained from said light beam generating means (53) to impinge upon a record medium (R) and receiving the light beam from the recording medium (R),

photodetecting means (51) to which the light beam from the record medium (R) received by said lens means (31) is guided, said photodetecting means comprising a group of photosensitive elements including a central (D_2) and two side photosensitive elements (D1, D3) separated from each other by a pair of parallel dividing portions (E1, E2) each extending along a predetermined direction and disposed to form a common light receiving plane on which a beam spot (U) is formed by the light beam guided to said photodetecting means (51) for detecting the light beam guided to the photodetecting means to produce respective detection output signals (V_1, V_2, V_3), and

signal generating means for producing a tracking signal used for maintaining the laser light beam impinging upon the record medium in correct tracking relation to the record track (RT) in the record medium (R),

characterised by said predetermined direction along which each of the parallel dividing portions extends being selected to be at an angle between 0 and 90 degrees to a direction of movement of a diffraction pattern appearing in the beam spot formed on the common light receiving plane in accordance with a record track (RT) in the record medium (R) and by said respective detection output signals (V_1, V_2, V_3) being of use in such manner that said signal generating means produce said tracking signal based on the difference between the detection output signal (V_2) from the central photosensitive element (D2) and an added signal obtained by adding the detection output signals (V_1, V_3) from the side photosensitive elements (D1, D3) to each other.

2. An optical head device according to claim 1, wherein said photodetecting means further comprises a second group of photosensitive elements (52) including a central (D'2) and two side photosensitive elements (D'1, D'3) separated from each other by a pair of parallel dividing portions (E'1, E'2) each extending along said predetermined direction and disposed to form a common light receiving plane on which a beam spot (U') is formed by the light beam guided to said photodetecting means for detecting the light beam guided to the photodetecting means to produce respective detection output signal (V'_1, V'_2, V'_3), and the light beam guided to said photodetecting means is caused to be incident upon said first mentioned group (51) of photosensitive elements (D1-D3) and said second group (52) of photosensitive elements (D'1-D'3) successively with a focusing point thereof on an optical path formed between said first group of photosensitive elements (D1-D3) and said second group of photosensitive elements (D'1-D'3) and said signal generating means produces said tracking signal based on a difference between an added signal obtained by adding the detection output signal (V_2) from the central photosensitive elements

(D2) of said first group (51) of photosensitive elements and the detection output signal from the central photosensitive element (D'2) of said second group (52) of photosensitive elements to each other and an added signal obtained by summing up the detection output signals (V_1, V_3) from the side photosensitive elements (D1, D3) of said first group of photosensitive elements (51) and the detection output signals (V_1', V_3') from the side photosensitive elements (D'1, D'2) of said second group of photosensitive elements (52).

3. An optical head device according to claim 2, wherein said photodetecting means comprises a semiconductor substrate (50) in which said first group of photosensitive elements (51) and said second group of photosensitive elements (52) are formed to be aligned in said predetermined direction and an optical element (55) disposed on said semiconductor substrate (50) for guiding the laser light beam from the record medium (R) received by said lens means (31) to both of said first group of photosensitive elements and said second group of photosensitive elements.

4. An optical head device according to any one of the preceding claims, wherein said predetermined direction along which each of the parallel dividing portions (E_1, E_2, E'_1, E'_2) extends is selected to be substantially at an angle of 45 degrees to the direction of movement of the diffraction pattern appearing in the beam spot formed on the common light receiving plane in accordance with the record track (RT) in the record medium (R).

Patentansprüche

1. Anordnung mit einem optischen Kopf zur Aufzeichnung und/oder Wiedergabe von Information, mit
einer Vorrichtung (53) zum Erzeugen eines Lichtstrahles,
einer Linsenvorrichtung (31), durch die ein von der Vorrichtung (53) zum Erzeugen eines Lichtstrahles erhaltener Lichtstrahl auf ein Aufzeichnungsmedium (R) einfällt,
und zum Aufnehmen des Lichtstrahles vom Speichermedium (R),
eine Fotodektor-Anordnung (51), zu der der von der Linsenvorrichtung (31) aufgenommene Lichtstrahl vom Aufzeichnungsmedium (R) geführt wird, wobei die Fotodetektoranordnung eine Gruppe von lichtempfindlichen Elementen aufweist, die ein mittleres (D_2) und zwei seitliche lichtempfindliche Elemente (D_1, D_3) umfasst, die durch ein Paar paralleler Trennabschnitte (E1, E2) voneinander getrennt sind, die in eine vorbestimmte Richtung weisen und so angelegt sind, daß sie eine gemeinsame Lichtempfangsebene bilden, auf der ein Strahlfleck (U) durch den Lichtstrahl gebildet wird, der zu der Fotodetektoranordnung (51) geführt wird zum Detektieren des zur Fotodetektoranordnung geführten Lichtstrahles zum Erzeugen jeweiliger Detektions-Ausgangssignale (V_1, V_2, V_3), und
eine Signalerzeugungsvorrichtung zum Erzeugen eines Spursignales, das zum Halten des auf das Aufzeichnungsmedium einfallenden Laserlichtstrahles in der richtigen Spur in Bezug auf die Aufzeichnungsspur (RT) auf dem Aufzeichnungsmedium (R) dient, dadurch **gekennzeichnet,**
daß die vorbestimmte Richtung, in die jeder der parallelen Trennabschnitte weist, in einem Winkel zwischen 0° und 90° zur Bewegungsrichtung eines Beugungsmusters gewählt ist, das in dem auf der gemeinsamen Lichtempfangsebene in Übereinstimmung mit einer Aufzeichnungsspur (RT) des Aufzeichnungsmediums (R) gebildeten Strahlfleck erscheint, und daß die jeweiligen Detektions-Ausgangssignale (V_1, V_2, V_3) dergestalt von Nutzen sind, daß die Signalerzeugungsvorrichtung das Spursignal auf der Grundlage der Differenz zwischen dem Detektions-Ausgangssignal (V_2) vom mittleren lichtempfindlichen Element (D_2) und einem durch das Addieren der Detektions-Ausgangssignale (V_1, V_3) der seitlichen lichtempfindlichen Elemente (V_1, V_3) erhaltenen Summensignal erzeugt.

2. Anordnung mit einem optischen Kopf gemäß Anspruch 1, wobei die Fotodetektor-Vorrichtung weiterhin eine zweite Gruppe von lichtempfindlichen Elementen (52) mit einem mittleren (D'2) und zwei seitlichen lichtempfindlichen Elementen (D'1, D'3) umfaßt, die voneinander durch ein Paar paralleler Trennabschnitte (E'1, E'2) getrennt sind, die jeweils in die vorbestimmte Richtung weisen und so angelegt sind, daß sie eine gemeinsame Lichtempfangsebene bilden, auf der ein Strahlfleck (U') durch den der Fotodektorvorrichtung zugeführten Lichtstrahl gebildet wird zum Detektieren des der Fotodektorvorrichtung zugeführten Lichtstrahles, um entsprechende Detektions-Ausgangssignale (V'1, V'2, V'3) zu erzeugen, und wobei der der Fotodetektor-Vorrichtung zugeführte Lichtstrahl mit einem Brennpunkt nacheinander auf die erste Gruppe (51) lichtempfindlicher Elemente (D1-D3) und auf die zweite Gruppe (52) lichtempfindlicher Elemente (D'1-D'3) auf einem optischen Weg einfällt, der zwischen der ersten Gruppe lichtempfindlicher Elemente (D1-D3) und der zweiten Gruppe lichtempfindlicher

Elemente (D'1-D'3) gebildet ist, und wobei die Signalerzeugungsvorrichtung das Spursignal auf der Grundlage der Differenz zwischen einem Summensignal, das durch das Addieren des Detektions-Ausgangssignales (V2) des mittleren lichtempfindlichen Elementes (D2) der ersten Gruppe (51) lichtempfindlicher Elemente und des Detektions-Ausgangssignales des mittleren lichtempfindlichen Elementes (D'2) der zweiten Gruppe (52) lichtempfindlicher Elemente erhalten wird, und eines Summensignales, das durch das Addieren der Detektions-Ausgangssignale (V1, V3) der seitlichen lichtempfindlichen Elemente (D1, D3) der ersten Gruppe lichtempfindlicher Elemente (51) und der Detektions-Ausgangssignale (V'1, V'3) der seitlichen lichtempfindlichen Elemente (D'1, D'2) der zweiten Gruppe lichtempfindlicher Elemente (52) erhalten wird.

3. Anordnung mit einem optischen Kopf gemäß Anspruch 2, wobei die Fotodektor-Vorrichtung ein Halbleitersubstrat (50) umfaßt, in dem die erste Gruppe lichtempfindlicher Elemente (51) und die zweite Gruppe lichtempfindlicher Elemente (52) in die vorbestimmte Richtung ausgerichtet ausgebildet sind, und ein optisches Element (55), das auf dem Halbleitersubstrat (50) angeordnet ist, um den von der Linsenvorrichtung (31) aufgenommenen Laserlichtstrahl vom Aufzeichnungsmedium (R) zur ersten Gruppe lichtempfindlicher Elemente und zur zweiten Gruppe lichtempfindlicher Elemente zu führen.

4. Anordnung mit einem optischen Kopf gemäß einem der vorhergehenden Ansprüche, wobei die vorbestimmte Richtung, in die jeder der parallelen Trennabschnitte (E_1, E_2, E'_1, E'_2) weist, so gewählt ist, daß sie sich im wesentlichen in einem Winkel von 45° zur Bewegungsrichtung des Beugungsmusters befindet, das in dem auf der gemeinsamen Lichtempfangsebene in Übereinstimmung mit der Aufzeichnungsspur (RT) des Aufzeichnungsmediums (R) gebildeten Strahlfleck erscheint.

Revendications

1. Dispositif de tête optique utilisé pour l'enregistrement et/ou la reproduction d'informations comprenant :

un dispositif de génération de faisceau de lumière (53),

un dispositif de lentille (31) pour entraîner un faisceau de lumière obtenu par ledit dispositif de génération de faisceau de lumière (53) à frapper un support d'enregistrement (R) et pour recevoir un faisceau de lumière dudit support d'enregistrement (R),

un dispositif de photodétection (51) sur lequel le faisceau de lumière du support d'enregistrement (R) reçu par ledit dispositif de lentille (31) est guidé, ledit dispositif de photodétection comprenant un groupe d'éléments photosensibles comprenant un élément central (D_2) et deux éléments photosensibles latéraux (D_1 ; D_3) séparés l'un de l'autre par une paire de parties de division parallèles (E_1, E_2) s'étendant chacune le long d'une direction prédéterminé et disposée pour former un plan de réception de lumière commun sur lequel un spot de faisceau (U) est formé par le faisceau de lumière guidé vers ledit dispositif de photodétection (51) pour détecter le faisceau de lumière guidé sur le dispositif de photodétection pour produire des signaux de sortie de détection respectifs (V_1, V_2, V_3), et

un dispositif de génération de signal pour produire un signal de suivi de piste utilisé pour maintenir le faisceau de lumière laser frappant le support d'enregistrement dans un suivi de piste correct en relation avec la piste d'enregistrement (Rt) du support d'enregistrement (R),

caractérisé en ce que ladite direction prédéterminée le long de chacune des parties de division parallèles s'étend en étant sélectionnée pour former un angle compris entre 0 et 90 degrés par rapport à une direction de déplacement d'un dessin de diffraction apparaissant dans le spot de faisceau formé sur le plan de réception de lumière commun selon une piste d'enregistrement (Rt) du support d'enregistrement (R) et par lesdits signaux de sortie de détection respectifs (V_1, V_2, V_3) étant utilisés de manière telle que ledit dispositif de génération de signaux produit ledit signal de suivi de piste sur la base de la différence entre le signal de sortie de détection (V_2) de l'élément photosensible central (D_2) et un signal additionné obtenu par addition des signaux de sortie de détection (V_1, V_2) des éléments photosensibles latéraux (D_1, D_3) l'un avec l'autre.

2. Dispositif de tête optique selon la revendication 1, dans lequel ledit dispositif de photodétection comprend en outre un second groupe d'éléments photosensibles (52) comprenant un élément central (D'_2) et deux éléments photosensibles latéraux (D'_1, D'_3) séparés l'un de l'autre par une paire de parties de division parallèles (E'1, E'2) s'étendant chacune le long de ladite direction prédéterminée et disposées pour former un plan de réception de lumière commun sur lequel un spot de faisceau (U') est formé par le faisceau de lumière guidé sur ledit dispositif de photodétection pour détecter le faisceau de lumière guidé vers le dispositif de photodétection pour produire des si-

* C L M S *

gnaux de sortie de détection respectifs (V_1', V_2', V_3'), et le faisceau de lumière guidé sur ledit dispositif de photodétection est contraint d'être incident sur ledit premier groupe mentionné (51) des éléments photosensibles (D1 à D3) et ledit second groupe (52) des éléments photosensibles (D'1 à D'3) successivement avec un point de focalisation de ceux-ci sur un trajet optique formé entre ledit premier groupe des éléments photosensibles (D1 à D3) et ledit second groupe des éléments photosensibles (D'1 à D'3) et ledit dispositif de génération de signal produit ledit signal de suivi de piste sur la base d'une différence entre un signal additionné obtenu en additionnant l'un avec l'autre le signal de sortie de détection (V_2) des éléments photosensibles centraux (D2) dudit premier groupe (51) des éléments photosensibles et le signal de sortie de détection de l'élément photosensible central (D'2) dudit second groupe (52) d'éléments photosensibles et un signal additionné obtenu en additionnant les signaux de sortie de détection (V_1, V_3) des éléments photosensibles latéraux (D1, D3) dudit premier groupe des éléments photosensibles (51) et les signaux de sortie de détection (V'_1, V'_3) des éléments photosensibles latéraux (D'1, D'2) dudit second groupe des éléments photosensibles (52).

3. Dispositif de tête optique selon la revendication 2, dans lequel ledit dispositif de photodétection comprend un substrat semi-conducteur (50) dans lequel ledit premier groupe d'éléments photosensibles (51) et ledit second groupe d'éléments photosensibles (52) sont formés pour être alignés dans ladite direction prédéterminée et un élément optique (55) disposé sur ledit substrat semi-conducteur (50) pour guider le faisceau de lumière laser du support d'enregistrement (R) reçu par ledit dispositif de lentille (31) à la fois dudit premier groupe d'éléments photosensibles et dudit second groupe d'éléments photosensibles.

4. Dispositif de tête optique selon l'une quelconque des revendications précédentes, dans lequel ladite direction prédéterminée le long de chacune des parties de division parallèles (E1, E2, E'1, E'2) s'étend, est sélectionnée pour former essentiellement un angle de 45 degrés par rapport à la direction de déplacement du dessin de diffraction apparaissant dans le spot de faisceau formé sur le plan de réception de lumière commun selon la piste d'enregistrement (Rt) du support d'enregistrement (R).