Description

This invention relates to an optical disk discriminating device for discriminating the kinds of the disk, such as the optical disk dedicated to reproduction or the recordable optical disk, and may be applied for example to an optical disk recording and/or reproducing apparatus provided with the function of opto-magnetic recording.

There has been extensively provided an optical disk device dedicated to reproduction, including a CD player or a video disk player employing an optical disk such as a digital audio disk or so-called compact disk or a video disk. There is also proposed an optical disk recording and/or reproducing apparatus in which data may be recorded and/or reproduced with the use of a rewritable opto-magnetic disk.

It is noted that, for optically reading the information recorded on the optical disk, an optical pickup head is extensively used in which the laser light is radiated on the recording surface of the optical disk to detect the light reflected from the recording surface. The disk dedicated to reproduction presents reflectivity on the recording surface different from that on the recording surface of the recordable disk, such that, in the case of the optical disk dedicated to reproduction, such as the compact disk, about 90 % of the light is reflected by the aluminium reflecting surface applied to the recording surface, whereas, in the case of the rewritable opto-magnetic disk, about 10 to 20 percent of the light is reflected from the opto-magnetic recording layer, such as the TbFeCo layer.

For assuring compatibility with respect to the compact disk in the optical disk recording and/or reproducing apparatus employing a rewritable opto-magnetic disk, it is necessary to switch the gains of the tracking servo or focus servo employing the reproduction outputs obtained at the optical pickup head, or occasionally to switch the polarities of the error signals in dependence upon the kind of the optical disk which is in use, since the reflectivities on the recording surfaces of the disk dedicated to reproduction and the recordable disk are different from each other, as discussed hereinabove.

Thus the present invention is aimed to realize an optical disk recording and/or reproducing apparatus wherein the operation of the optical disk recording and/or reproducing apparatus is switched automatically in dependence upon the kind of the optical disk to enable both the disk dedicated to reproduction and the recordable disk to be reproduced, and provides an optical disk discriminating device which is adapted for discriminating the disk dedicated to reproduction and the recordable disk from each other.

As is disclosed in IBM Technical Disclosure Bulletin Vol. 29, No. 3, August 1986, pages 995-996, which reflects the preamble of claim 1, it is known to discriminate disks by comparing the focus error signal with reference levels whilst moving the lens toward the disk and through the focusing point. This, though, suffers from the disadvantage that a non-data area of the disk is required to use this procedure.

Therefore according to the present invention there is provided an optical disk discriminating device comprising means for shifting an objective lens of an optical pickup along the optical axis, said optical pickup being adapted to detect the light reflected from the recording surface of the disk, signal processing means for producing focus error signals and reproduced RF signals from the detected output from the optical pickup, and discriminating circuit means having level comparator means adapted for comparing the level of a signal from said signal processing means with a reference level, whereby the kind of the optical disc is distinguished at said discriminating circuit means on the basis of the reflectivity of the recording surface of the optical disk, characterised in that said comparator means compares said RF signal level with said reference level and in that said type of disc is distinguished using said RF signal obtained when the optical lens is in the vicinity of the focused state.

According to this optical disc discriminating device, the signal level of the detection output of the optical pickup is changed as the objective lens of the optical pickup is shifted along the optical axis, and the difference in the peak level of the detection output signal caused by the difference in the reflectivities of the recording surfaces of the disk dedicated to reproduction and the recordable disk is used by the discriminating circuit means to produce a discriminating output signal between the disk dedicated to reproduction and the recordable disk.

Fig. 1 is a block diagram showing the essential construction of an embodiment of an optical disk discriminating device according to the present invention; Fig. 2 is a block diagram showing the construction of the reproducing system of a CD player to which the present invention is applied; Fig. 3 is a flow chart showing the steps of the discriminating operation in the above embodiment; Fig. 4 is a waveform diagram showing the operation of the discriminating circuit in the above embodiment, and Fig. 5 is a circuit diagram showing the construction of a focus servo circuit in the above embodiment.

An embodiment of the optical disk discriminating device according to the present invention will be explained in detail by referring to the drawings.

The embodiment shown in Figs. 1 to 5 represents an application of the present invention to the reproducing system of the CD player having the function of opto-magnetic recording. As shown in the block diagram of Fig. 2, the reproducing system of the CD player in the present embodiment has an optical pickup head 10 adapted for optically reading the information recorded on the recording surface of the optical disk 20, wherein the laser beam emitted from a laser source 1 is radiated on an optical disk 20 by way of a beam splitter 2 and an objective lens 3, with the reflected light from the recording surface of the optical disk 20 being conducted by way of the objective lens 3, beam splitter 2 and an analyzer 4 to a photosensor 5 adapted for detecting the reflected light and with the output detected by the photosensor 5 being transmitted by way of a signal processing circuit 6 and a signal output terminal 7 as to reproduced RF signal. Driving currents in the form of, for example, triangular waves, are caused to flow in a focus coil 9A by a focus driving circuit 9 to shift the objective lens 3 of the optical pickup head 10 along its optical axis to bring the system to a focused state. After the objective lens 3 is brought to its focused state, focus error signals derived at the signal processing circuit 6 from the detected output of the photosensor 5 are switched so as to be fed back through a focus servo circuit 8 to the focus drive circuit 9 for performing focus control.

In the present embodiment, reproduced RF signals obtained at the signal processing circuit 6 are transmitted to a disk discriminating circuit 30 such that the gain of the focus servo circuit 8 is switched by the discriminating output from the circuit 30 in dependence upon the kinds of the optical disk 20.

As shown in the block diagram of Fig. 1, the disk discriminating circuit 30 is formed by level comparators 32 and 33, to which the aforementioned reproduced RF signals are transmitted by way of a signal input terminal 31 and SR flipflops 34 and 35, to the set inputs of which are supplied comparison outputs of the level comparators 32 and 33. To the reset inputs of the SR flipflops 34 and 35, reset pulses are transmitted at the time of the disk discrimination from a system controller, not shown, by way of a reset input terminal 36.

When performing the disk discrimination in the reproducing system of the present embodiment, as shown in the flow chart of Fig. 3, the focus drive circuit 9 is driven by a system controller, not shown, in such a sequence that the objective lens 3 is brought to its lowermost position, the flipflops 34 and 35 of the discriminating circuit 30 are reset under this condition and the objective lens 3 is then raised to a position beyond the focused position so as to be then at a stand-by state. With the objective lens 3 shifted in this manner, the signal level is changed in dependence upon the position of the objective lens 3, such that a reproduced RF signal having a peak at the focused position is derived at the signal processing circuit 6 from the detection output of the optical pickup head 10.

It is noted that, when the optical disk 20 is a disk dedicated to reproduction, about 90 percent of the light is reflected by an aluminium reflecting film coated on the disk recording surface and, when it is a rewritable disk, about 10 to 20 percent of the light is reflected by an opto-magnetic recording film, such as TbFeCo film, so that the peak level of the aforementioned reproduced RF signal produced from the detection output of the optical pickup head 10 adapted for detecting the reflected light becomes higher in the case of the disk dedicated to reproduction than in the case of the recordable disk. In the present embodiment, a first reference level $Vref_1$ intermediate the peak level of the reproduced RF signal for the reproduction dedicated disk (SCD) and the peak level of the reproduced RF signal for the recordable disk (SMO) is supplied to a reference input terminal 37 of the level comparator 32, whilst a second reference level $Vref_2$ lower than the peak level of the reproduced RF signals for the recordable disk is supplied to the reference input terminal 38 of the level comparator 33.

When the optical disk 20 is a disk dedicated to reproduction, comparison outputs CO_1 and CO_2 of the level comparators 32 and 33 of the discriminating circuit 30 are both at logical "1", such that the flipflops 34 and 35 are set by these comparison outputs and discrimination outputs Q_1 and Q_2 at the logical "1" are produced at the discrimination output terminals 39 and 40. When the optical disk 20 is a recordable disk, only the comparison output CO_2 of one of the level comparators 33 of the discriminating circuit 30 is at logical "1" such that the flipflop 35 is set by this comparison output and the discrimination output Q_2 at the logical "1" is produced at the one discriminating output terminal 40. Thus the discriminating circuit 30 indicates that the optical disk is not attached in position when the discriminating outputs Q_1 and Q_2 produced at the discriminating output terminals 39 and 40 are at logical "0", that the optical disk 20 attached in position is a recordable disk when only the discriminating output Q_2 produced at the one discriminating output terminal 40 is at logical "1" and that the optical disk 20 attached in position is a disk dedicated to reproduction when the discriminating output Q_1 produced at the other discriminating output terminal 39 is at logical "1".

The focus servo circuit 8 in the present embodiment has an output terminal of a first servo amplifier 81 connected to an input terminal of a

second servo amplifier 83 via first resistor 82 and has said input terminal of the second servo amplifier 83 grounded via series circuit consisting of a switch 84 and a second resistor 85. The focus servo circuit is so designed that, when the discriminating output Q_1 of the aforementioned discriminating circuit 30 is at logical "1", that is, when the optical disk 20 attached in position is a disk dedicated to reproduction, the switch 84 is closed to lower the servo gain to effect servo control suitable for the disk dedicated to reproduction.

In accordance with the optical disk discriminating device of the present embodiment, the difference in the reflectivity on the record surface of the optical disk is sensed to produce discrimination outputs for the disk dedicated to reproduction and the recordable disk, such that, by the application of the discriminating device, there may be realized an optical disk recording and reproducing apparatus wherein the operation of the optical disk recording and reproducing apparatus is automatically switched in dependence upon the kinds of the optical disk to permit the reproduction of both the disk dedicated to reproduction and the recordable disk.

Claims

1. An optical disk discriminating device comprising means for shifting an objective lens (3) of an optical pickup (10) along the optical axis, said optical pickup (10) being adapted to detect the light reflected from the recording surface of the disk (20), signal processing means (6) for producing focus error signals and reproduced RF signals from the detected output from the optical pickup, and discriminating circuit means (30) having level comparator means (32, 33) adapted for comparing the level of a signal from said signal processing means with a reference level, whereby the kind of the optical disc (20) is distinguished at said discriminating circuit means (30) on the basis of the reflectivity of the recording surface of the optical disk (20), characterised in that said comparator means (32, 33) compares said RF signal level with said reference level and in that said type of disc is distinguished using said RF signal obtained when the optical lens is in the vicinity of the focused state.

2. The device according to claim 1, characterised in that the level comparator means (32, 33) are adapted to compare the reproduced RF signal level from the signal processing means (6) with the reference level for discrimination of the disk dedicated to reproduction and with the reference level for discrimination of the recordable disk.

3. The device according to claim 2, characterised in that said discriminating circuit means (30) comprises a first memory means (34) for temporarily storing the first comparison output by said comparator means (32) and a second memory means (35) for temporarily storing a second comparison output by said comparator means (33).

4. The device according to claim 3, characterised in that said first and second memory means (34, 35) are provided with the function of clearing the memory contents thereof.

Patentansprüche

1. Eine optische Platten diskrimierende Vorrichtung, die aufweist:

Mittel zum Verschieben einer Objektivlinse (3) eines optischen Aufnehmers (10) entlang einer optischen Achse, wobei der optische Aufnehmer (10) zur Detektion des von der Aufzeichnungsoberfläche der Platte (20) reflektierten Lichtes ausgebildet ist,

Signalbearbeitungsmittel (6) zur Erzeugung von Fokusfehlersignalen und reproduzierten RF-Signalen aus dem detektierten Ausgangssignal des optischen Aufnehmers, und

Diskriminierungsschaltungsmittel (30) mit zum Vergleich des Signalpegels eines Signales von den Signalbearbeitungsmitteln mit einem Referenzpegel ausgebildeten Pegelvergleichsmitteln (32,33), wobei die Art der optischen Platte (20) von den Diskriminierungsschaltungsmitteln (30) auf der Basis des Reflexionsvermögens der Aufzeichnungsoberfläche der optischen Platte (20) unterscheidbar ist,
dadurch **gekennzeichnet,**
daß die Vergleichsmittel (32,33) den RF-Signalpegel mit dem Referenzpegel vergleichen und daß die Art der Platte unterscheidbar ist durch die Verwendung des RF-Signales, das erhältlich ist, wenn sich die optische Linse in der Nähe des fokussierten Zustandes befindet.

2. Vorrichtung nach Anspruch 1,
dadurch **gekennzeichnet,**
daß die Pegelvergleichsmittel (32,33) ausgebildet sind, um den reproduzierten RF-Signalpegel von den Signalbearbeitungsmitteln (6) mit dem Referenzpegel zur Diskriminierung der zur Reproduktion bestimmten Platte und mit dem Referenzpegel zur Diskriminierung der aufzeichnungsfähigen Platte zu vergleichen.

second servo amplifier 83 via first resistor 82 and has said input terminal of the second servo amplifier 83 grounded via series circuit consisting of a switch 84 and a second resistor 85. The focus servo circuit is so designed that, when the discriminating output Q_1 of the aforementioned discriminating circuit 30 is at logical "1", that is, when the optical disk 20 attached in position is a disk dedicated to reproduction, the switch 84 is closed to lower the servo gain to effect servo control suitable for the disk dedicated to reproduction.

In accordance with the optical disk discriminating device of the present embodiment, the difference in the reflectivity on the record surface of the optical disk is sensed to produce discrimination outputs for the disk dedicated to reproduction and the recordable disk, such that, by the application of the discriminating device, there may be realized an optical disk recording and reproducing apparatus wherein the operation of the optical disk recording and reproducing apparatus is automatically switched in dependence upon the kinds of the optical disk to permit the reproduction of both the disk dedicated to reproduction and the recordable disk.

Claims

1. An optical disk discriminating device comprising means for shifting an objective lens (3) of an optical pickup (10) along the optical axis, said optical pickup (10) being adapted to detect the light reflected from the recording surface of the disk (20), signal processing means (6) for producing focus error signals and reproduced RF signals from the detected output from the optical pickup, and discriminating circuit means (30) having level comparator means (32, 33) adapted for comparing the level of a signal from said signal processing means with a reference level, whereby the kind of the optical disc (20) is distinguished at said discriminating circuit means (30) on the basis of the reflectivity of the recording surface of the optical disk (20), characterised in that said comparator means (32, 33) compares said RF signal level with said reference level and in that said type of disc is distinguished using said RF signal obtained when the optical lens is in the vicinity of the focused state.

2. The device according to claim 1, characterised in that the level comparator means (32, 33) are adapted to compare the reproduced RF signal level from the signal processing means (6) with the reference level for discrimination of the disk dedicated to reproduction and with the reference level for discrimination of the recordable disk.

3. The device according to claim 2, characterised in that said discriminating circuit means (30) comprises a first memory means (34) for temporarily storing the first comparison output by said comparator means (32) and a second memory means (35) for temporarily storing a second comparison output by said comparator means (33).

4. The device according to claim 3, characterised in that said first and second memory means (34, 35) are provided with the function of clearing the memory contents thereof.

Patentansprüche

1. Eine optische Platten diskrimierende Vorrichtung, die aufweist:

   Mittel zum Verschieben einer Objektivlinse (3) eines optischen Aufnehmers (10) entlang einer optischen Achse, wobei der optische Aufnehmer (10) zur Detektion des von der Aufzeichnungsoberfläche der Platte (20) reflektierten Lichtes ausgebildet ist,

   Signalbearbeitungsmittel (6) zur Erzeugung von Fokusfehlersignalen und reproduzierten RF-Signalen aus dem detektierten Ausgangssignal des optischen Aufnehmers, und

   Diskriminierungsschaltungsmittel (30) mit zum Vergleich des Signalpegels eines Signales von den Signalbearbeitungsmitteln mit einem Referenzpegel ausgebildeten Pegelvergleichsmitteln (32,33), wobei die Art der optischen Platte (20) von den Diskriminierungsschaltungsmitteln (30) auf der Basis des Reflexionsvermögens der Aufzeichnungsoberfläche der optischen Platte (20) unterscheidbar ist,
   dadurch **gekennzeichnet,**
   daß die Vergleichsmittel (32,33) den RF-Signalpegel mit dem Referenzpegel vergleichen und daß die Art der Platte unterscheidbar ist durch die Verwendung des RF-Signales, das erhältlich ist, wenn sich die optische Linse in der Nähe des fokussierten Zustandes befindet.

2. Vorrichtung nach Anspruch 1,
   dadurch **gekennzeichnet,**
   daß die Pegelvergleichsmittel (32,33) ausgebildet sind, um den reproduzierten RF-Signalpegel von den Signalbearbeitungsmitteln (6) mit dem Referenzpegel zur Diskriminierung der zur Reproduktion bestimmten Platte und mit dem Referenzpegel zur Diskriminierung der aufzeichnungsfähigen Platte zu vergleichen.

3. Vorrichtung nach Anspruch 2, dadurch **gekennzeichnet,** daß die Diskriminierungsschaltungsmittel (30) erste Speichermittel (34) zur vorübergehenden Speicherung des ersten durch die Vergleichsmittel (32) ausgegebenen Vergleiches und zweite Speichermittel (35) zur vorübergehenden Speicherung eines zweiten durch die Vergleichsmittel (33) ausgegebenen Vergleiches enthalten.

4. Vorrichtung nach Anspruch 3, dadurch **gekennzeichnet,** daß die ersten und zweiten Speichermittel mit einer Funktion zum Löschen der entsprechenden Speicherinhalte ausgestattet sind.

Revendications

1. Discriminateur de disque optique comprenant un dispositif pour décaler une lentille d'objectif (3) d'une tête de lecture (10) le long de l'axe optique, ladite tête optique (10) étant adaptée pour détecter la lumière réfléchie par la surface d'enregistrement du disque (20), un dispositif de traitement du signal (6) pour produire des signaux d'erreur de focalisation et des signaux RF reproduits à partir de la sortie détectée de la tête de lecture optique, et un circuit de discrimination (30) ayant un dispositif comparateur de niveau (32, 33) adapté pour comparer les niveaux d'un signal du dispositif de traitement du signal avec un niveau de référence, le type de disque optique (20) est ainsi discriminé par ledit circuit de discrimination (30) sur la base de la réflectivité de la surface d'enregistrement du disque optique (20), caractérisé en ce que ledit dispositif comparateur (32, 33) compare ledit niveau du signal RF avec ledit niveau du signal de référence et en ce que ledit type de disque est discriminé en utilisant ledit signal RF obtenu lorsque la lentille optique est au voisinage de l'état focalisé.

2. Dispositif selon la revendication 1, caractérisé en ce que les dispositifs comparateurs de niveau (32, 33) sont adaptés pour comparer le niveau du signal RF reproduit par le dispositif de traitement du signal (6) avec le niveau de référence pour la discrimination du disque dédié à la reproduction et avec le niveau de référence pour la discrimination du disque enregistrable.

3. Dispositif selon la revendication 2, caractérisé en ce que ledit circuit de discrimination (30) comprend un premier dispositif à mémoire (34) pour stocker temporairement la première sortie de comparaison dudit dispositif comparateur (32) et un second dispositif à mémoire (35) pour stocker temporairement une seconde sortie de comparaison dudit dispositif comparateur (33).

4. Dispositif selon la revendication 3, caractérisé en ce que lesdits premiers et seconds dispositifs à mémoire (34, 35) sont pourvus de la fonction d'effacement du contenu mémoire de ceux-ci.