magnetization of the free magnetic layer **14** is aligned in the X direction under the bias magnetic field in the X direction by the hard bias layers **17** and **17**.

[0150] The portion having a width dimension T2 in the center of the multilayer film **16** as shown in **FIG. 1** is a sensitive region E, and the portions, each having a width dimension T1, on both sides of the sensitive region E, are insensitive regions D and D.

[0151] In the sensitive region E, the magnetization of the pinned magnetic layer **12** is pinned in the Y direction as shown. Since the magnetization of the free magnetic layer **14** is aligned in the X direction, the magnetization of the pinned magnetic layer **12** is perpendicular to the magnetization of the free magnetic layer **14**. The magnetization of the free magnetic layer **14** varies sensitively in response to an external magnetic field from the recording medium. An electrical resistance varies in accordance with the relationship between the variation in the magnetization direction of the free magnetic layer **14** and the pinned magnetic field of the pinned magnetic layer **12**. A leakage magnetic field from the recording medium is thus detected in response to a variation in voltage due to the electrical resistance variation.

[0152] The sensitive region E of the multilayer film **16** is where the magnetoresistive effect is substantially exhibited, and the reproduction function is excellently performed here.

[0153] In contrast, in the insensitive regions D and D formed on both sides of the sensitive region E, the magnetizations of pinned magnetic layer **12** and the free magnetic layer **14** are greatly affected by the hard bias layers **17** and **17**, and the magnetization of the free magnetic layer **14** is less varying in response to the external magnetic field. In other words, the insensitive regions D and D provide a weak magnetoresistive effect with a reproduction capability thereof reduced.

[0154] In this invention, the width dimension T2 of the sensitive region E, and the width dimension of the insensitive region D of the multilayer film **16** are measured through the previously discussed micro track profile method (see **FIG. 31**).

[0155] Referring to **FIG. 1** in this invention, the electrode layers **18** and **18**, directly deposited on the hard bias layers **17** and **17** on both sides of the multilayer film **16**, are formed to extend over the insensitive region D of the multilayer film **16** by a width dimension of T3. The electrode layers **18** and **18** are made of Cr, Au, Ta, or W film, for instance. The width dimension of the top surface of the multilayer film **16** not covered with the electrode layers **18** and **18** is defined as an optical read track width O-Tw measured through an optical method.

[0156] The width dimension of the sensitive region E not covered with the electrode layers **18** and **18** substantially functions as a track width, and this width dimension is defined as a magnetic read track width M-Tw.

[0157] In the first embodiment shown in **FIG. 1**, the optical read track width O-Tw, the magnetic read track width M-Tw, and the width dimension T2 of the sensitive region E substantially have the same dimension.

[0158] The sense current is less likely to flow from the electrode layers **18** and **18** to the hard bias layers **17** and **17** in the present invention. The percentage of the sense current directly flowing into the multilayer film **16** without passing through the hard bias layers **17** and **17** is thus increased. With the electrode layers **18** and **18** respectively extending over the insensitive regions D and D, the junction area of the multilayer film **16** with the hard bias layers **17** and **17** and the electrode layers **18** and **18** increases, reducing the direct current resistance (DCR) and thereby improving the reproduction characteristics.

[0159] When the electrode layers **18** and **18** are formed to extend over the insensitive regions D and D, the sense current flowing into the insensitive regions is controlled and the noise generation is also controlled.

[0160] When the optical read track width O-Tw and the width dimension T2 (i.e., the magnetic read track width M-Tw) of the sensitive region E are set to be approximately the same dimension, the sense current more easily flows into the sensitive region E, thereby further improving the reproduction characteristics.

[0161] Although the electrode layers **18** and **18** fully cover the insensitive regions D and D in this invention, it is not a requirement that the electrode layers **18** and **18** fully cover the insensitive regions D and D. The insensitive regions D and D maybe partly exposed. In this case, the optical read track width O-Tw becomes larger than the magnetic read track width M-Tw. Specifically, the width dimension T3 of each electrode layer **18** extending over the multilayer film **16** is preferably within a range from 0 to 0.08 μm. The width dimension T3 is more preferably within a range from 0.05 μm to 0.08 μm.

[0162] Experimentally, it is found that the electrode layer **18** having a width T3 of 0.08 μm or larger generates a noise signal in the reproduction output. A width dimension of 0.08 μm is a maximum value on the top surface of the insensitive region D. If the electrode layer **18** having a width T3 of 0.08 μm or larger is formed, the electrode layer **18** partly covers the sensitive region E.

[0163] The electrode layers **18** and **18** extend over the multilayer film **16** but must not extend over the sensitive region E.

[0164] The sense current flows out, chiefly from the end of the electrode layer **18** extending over the multilayer film **16**. When the electrode layers **18** and **18** are formed on the sensitive region E that substantially exhibits the magnetoresistive effect, the area of the sensitive region E covered with the electrode layer **18** permits the sense current to less flow. The sensitive region E that presents an otherwise excellent magnetoresistive effect is partly degraded, thereby causing a drop in the reproduction output. Since the area of the sensitive region E covered with the electrode layer **18** still has some sensitivity, a variation in the magnetoresistance occurs in both ends of the magnetic read track width M-Tw, inconveniently generating noise.

[0165] According to the results of a micro magnetic simulation, when the width dimension T3 of the electrode layer **18** is set to be 0.05 μm or wider, the electrode layers **18** and **18** cover the areas of the free magnetic layer **14** where a magnetization direction thereof is disturbed, and improves the reproduction characteristics of the magnetoresistive-effect device.

[0166] The angle θ**1** made between the top surface **15***a* of the protective layer **15** and an end face **18***a* of the electrode