[0279] The spin-valve type thin-film device shown in **FIG. 11** includes an antiferromagnetic layer **80** which has a long portion extending on and along a substrate **10** in the X direction as shown. The antiferromagnetic layer **80** is projected upward in a central portion thereof. Laminated on the projected portion of the antiferromagnetic layer **80** are a first pinned magnetic layer **81**, a nonmagnetic material layer **82**, a second pinned magnetic layer **83**, a nonmagnetic electrically conductive layer **84**, a first free magnetic layer **85**, a nonmagnetic material layer **86**, a second free magnetic layer **87**, and a protective layer **15**. The laminate, composed of the layers from the substrate **10** through the protective layer **15**, forms a multilayer film **201**.

[0280] In accordance with the present invention, the antiferromagnetic layer **80** is made of a Pt—Mn (platinum-manganese) alloy. Instead of the Pt—Mn alloy, the antiferromagnetic layer **80** may be made of an X—Mn alloy where X is a material selected from the group consisting of Pd, Ir, Rh, Ru, and alloys thereof, or a Pt—Mn—X' alloy where X' is a material selected from the group consisting of Pd, Ir, Rh, Ru, Au, Ag, and alloys thereof.

[0281] The first pinned magnetic layer **81**, the second pinned magnetic layer **83**, the first free magnetic layer **85**, and second free magnetic layer **87** are made of an Ni—Fe (nickel-iron) alloy, Co (cobalt), an Fe—Co (iron-cobalt) alloy, or an Fe—Co—Ni alloy.

[0282] The nonmagnetic electrically conductive layer **84** is made of a low electrical-resistance nonmagnetic electrically conductive material such as Cu (copper).

[0283] Referring to **FIG. 11**, metallic layers **88** and **88**, made of Cr or the like, and functioning as a buffer layer or a alignment layer, extend from a horizontal portion thereof coextending a width dimension T**44** of the antiferromagnetic layer **80** in the X direction, rising along the side end faces of the first pinned magnetic layer **81**, the nonmagnetic material layer **82**, the second pinned magnetic layer **83**, the nonmagnetic electrically conductive layer **84**, and the first free magnetic layer **85**. The use of the metallic layers **88** and **88** helps increase the strength of the bias magnetic field created by hard bias layers **89** and **89** to be described later.

[0284] Deposited on top of the metallic layers **88** and **88** are the hard bias layers **89** and **89** which are made of a Co—Pt (cobalt-platinum) alloy or a Co—Cr—Pt (cobalt-chromium-platinum) alloy.

[0285] Intermediate layers **90** and **90**, made of a nonmagnetic material, such as Ta, are respectively deposited on the hard bias layers **89** and **89**. Electrode layers **91** and **91**, made of Cr, Au, Ta, or W, are respectively deposited on top of the intermediate layers **90** and **90**.

[0286] Since the antiferromagnetic layer **80** extends beneath and along the hard bias layers **89** and **89** as shown in **FIG. 11**, the thickness of the hard bias layers **89** and **89** can be made thinner. The hard bias layers **89** and **89** are thus easily produced using a sputtering technique.

[0287] Referring to **FIG. 11**, the first pinned magnetic layer **81** and the second pinned magnetic layer **83**, having different magnetic moments, are laminated to each other with the nonmagnetic material layer **82** interposed therebetween, and function as a single pinned magnetic layer P.

[0288] The first pinned magnetic layer **81** is deposited on and in contact with the antiferromagnetic layer **80**, and is subjected to annealing in the presence of a magnetic field. An exchange anisotropic magnetic field takes place through exchange coupling at the interface between the first pinned magnetic layer **81** and the antiferromagnetic layer **80**. The magnetization direction of the first pinned magnetic layer **81** is thus pinned in the Y direction. When the magnetization direction of the first pinned magnetic layer **81** is pinned in the Y direction, the magnetization direction of the second pinned magnetic layer **83**, separated from the first pinned magnetic layer **81** by the intervening nonmagnetic material layer **82**, is pinned to be antiparallel to the magnetization direction of the first pinned magnetic layer **81**.

[0289] The direction of the sum of the magnetic moments of the first pinned magnetic layer **81** and the second pinned magnetic layer **83** becomes the magnetization direction of the pinned magnetic layer P.

[0290] The first pinned magnetic layer **81** and the second pinned magnetic layer **83** are in a ferrigmagnetic state with magnetization directions thereof being antiparallel, and the magnetization direction of the first pinned magnetic layer **81** and the magnetization direction of the second pinned magnetic layer **83** mutually pin each other. The magnetization direction of the pinned magnetic layer P, as a whole, is advantageously stabilized in one direction.

[0291] Referring to **FIG. 11**, the first pinned magnetic layer **81** and the second pinned magnetic layer **83** are manufactured of the same material with thicknesses thereof made different so that the two layers have different magnetic moments.

[0292] The nonmagnetic material layer **82**, interposed between the first pinned magnetic layer **81** and the second pinned magnetic layer **83**, is preferably made of a material selected from the group consisting of Ru, Rh, Ir, Cr, Re, Cu, and alloys thereof.

[0293] The first free magnetic layer **85** and the second free magnetic layer **87** are formed to have different magnetic moments. Here again, the first free magnetic layer **85** and the second free magnetic layer **87** are manufactured of the same material with thicknesses thereof made different so that the two layers have different magnetic moments.

[0294] The nonmagnetic material layer **86** is preferably made of a material selected from the group consisting of Ru, Rh, Ir, Cr, Re, Cu, and alloys thereof.

[0295] Referring to **FIG. 11**, the first free magnetic layer **85** and the second free magnetic layer **87**, having different magnetic moments, are laminated with the nonmagnetic material layer **86** interposed therebetween, and function as a single free magnetic layer F.

[0296] The first free magnetic layer **85** and the second free magnetic layer **87**, which are in a ferrimagnetic state with magnetization directions thereof being antiparallel, namely different from each other by 180 degrees, achieve the same effect, which can be provided by the use of a thin free magnetic layer F. This arrangement reduces the saturation magnetization, causing the magnetization of the free magnetic layer F to easily vary, and thereby improving the magnetic field detection sensitivity of the magnetoresistive-effect device.