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Heim et al.

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[54] MAGNETORESISTIVE SPIN VALVE SENSOR WITH IMPROVED PINNED FERROMAGNETIC LAYER AND MAGNETIC RECORDING SYSTEM USING THE SENSOR

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[22] Filed: **Oct. 15, 1993**

[51] Int. Cl.⁶ **G11B 5/39**

[52] U.S. Cl. **360/113; 324/207.21; 324/252; 338/32 R**

[58] Field of Search **360/113; 338/32 R, 338/32 H; 324/252, 207.21**

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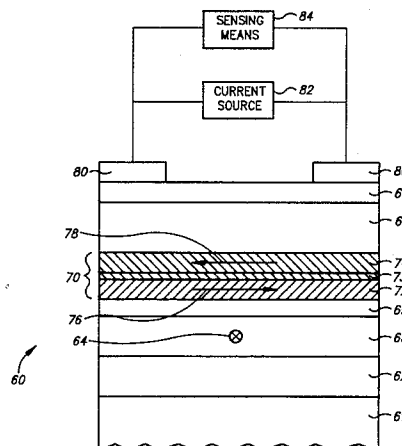
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[57] ABSTRACT

A spin valve magnetoresistive (MR) sensor uses a multilayered laminated pinned ferromagnetic layer in place of the conventional single-layer pinned layer. The laminated pinned layer has at least two ferromagnetic films separated by an antiferromagnetically coupling film. By appropriate selection of the thickness of the antiferromagnetically coupling film, depending on the material combination selected for the ferromagnetic and antiferromagnetically coupling films, the ferromagnetic films become antiferromagnetically coupled. In the preferred embodiment, the pinned layer is formed of two films of nickel-iron (Ni-Fe) separated by a ruthenium (Ru) film having a thickness less than approximately 10 Å. Since the pinned ferromagnetic films have their magnetic moments aligned antiparallel with one another, the two moments can be made to essentially cancel one another by making the two ferromagnetic films of substantially the same thickness. As a result, there is essentially no dipole field to adversely affect the free ferromagnetic layer, which improves the sensitivity of the sensor and allows higher recording density to be achieved in a magnetic recording data storage system.

46 Claims, 6 Drawing Sheets



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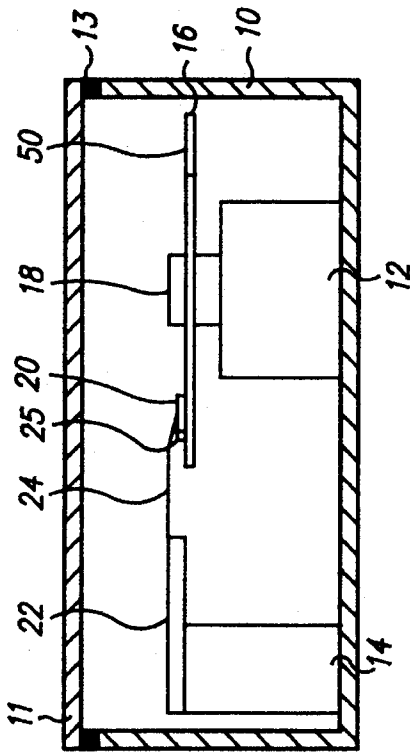


FIG. 1 (PRIOR ART)

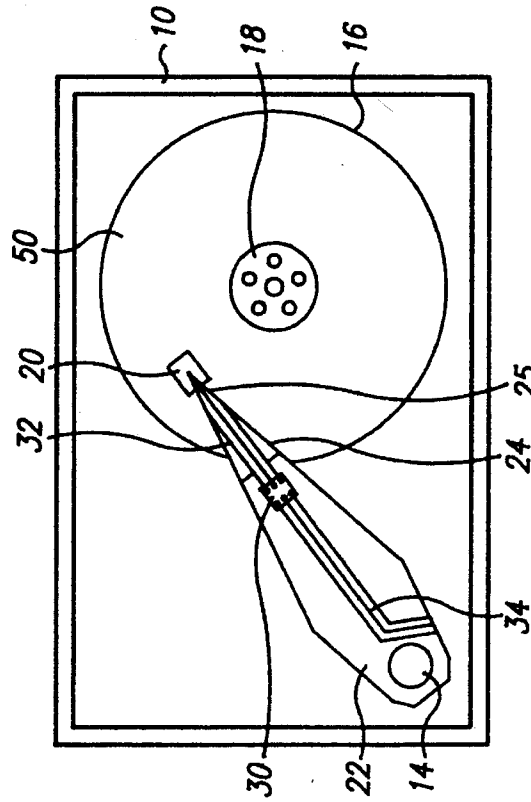
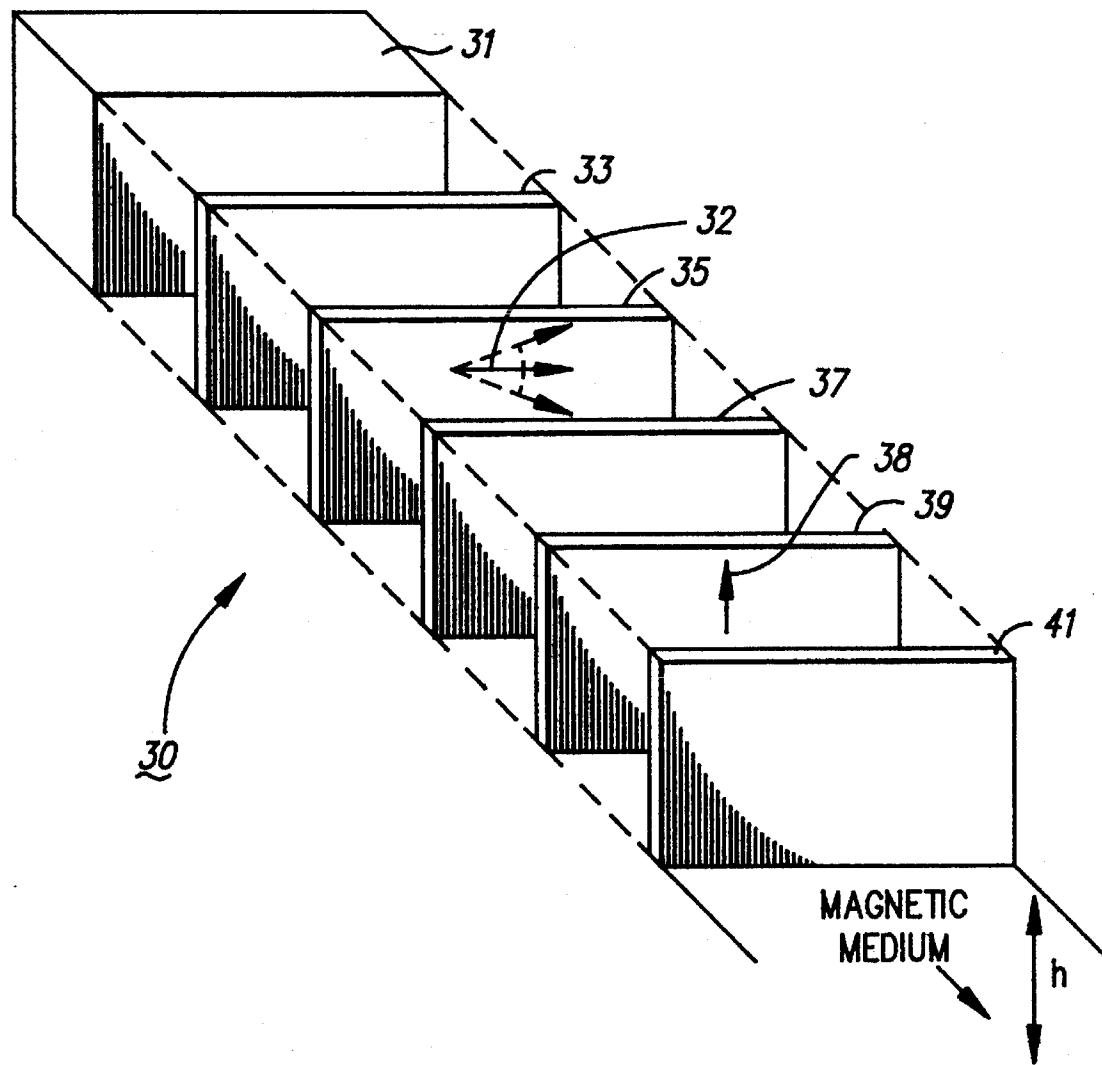
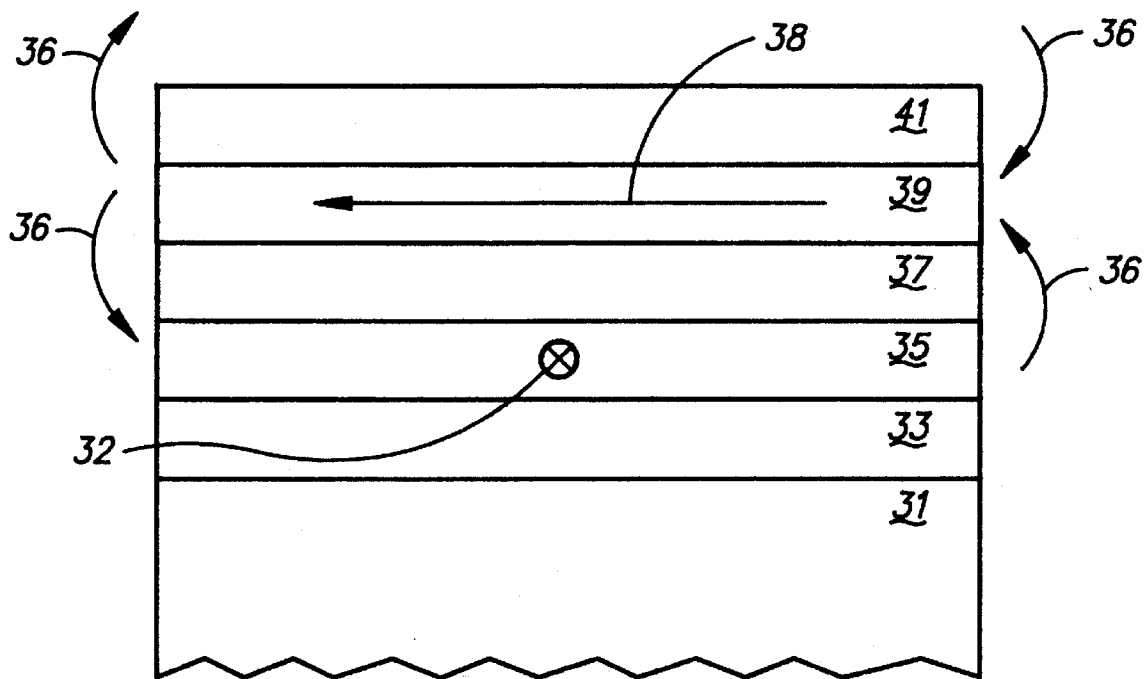


FIG. 2 (PRIOR ART)



(PRIOR ART)

FIG. 3



(PRIOR ART)

FIG. 4

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