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**Tagami et al.**

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(54) **MULTI-LAYERED WIRING LAYER AND METHOD OF FABRICATING THE SAME**

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(73) Assignee: **NEC Corporation**, Tokyo (JP)

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(51) **Int. Cl.**<sup>7</sup> ..... **H01L 23/48**; H01L 23/52

(52) **U.S. Cl.** ..... **257/751**; 257/762

(58) **Field of Search** ..... 257/751, 752,  
257/753, 758, 762, 773; 438/626, 627,  
628, 643, 644, 645

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*Primary Examiner*—Tom Thomas

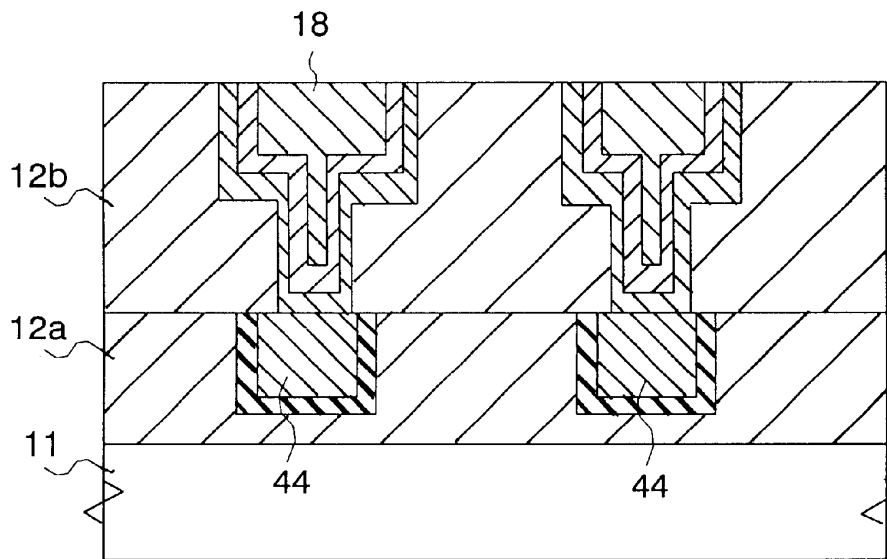
*Assistant Examiner*—Hung Kim Vu

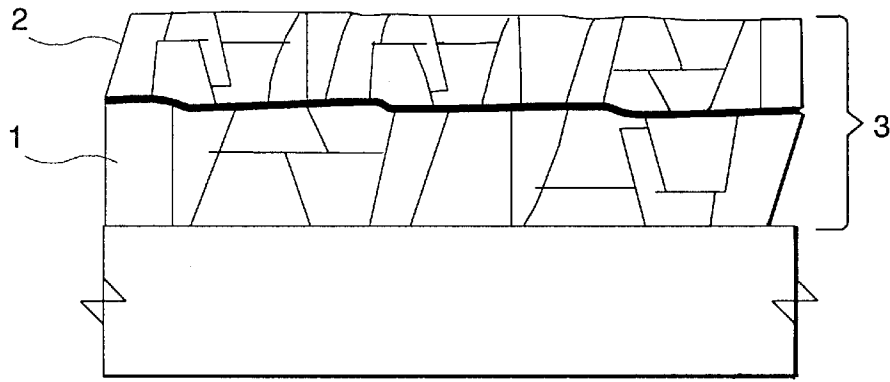
(74) *Attorney, Agent, or Firm*—Scully, Scott, Murphy & Presser

(57) **ABSTRACT**

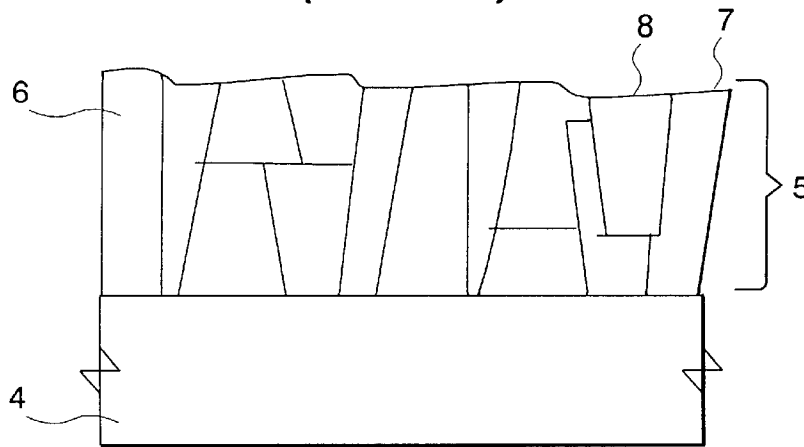
There is provided a barrier film preventing diffusion of copper from a copper wiring layer formed on a semiconductor substrate. The barrier film has a multi-layered structure of first and second films wherein the first film is composed of crystalline metal containing nitrogen therein, and the second film is composed of amorphous metal nitride. The barrier film is constituted of common metal atomic species. The barrier film prevents copper diffusion from a copper wiring layer into a semiconductor device, and has sufficient adhesion characteristic to both a copper film and an interlayer insulating film.

**10 Claims, 20 Drawing Sheets**

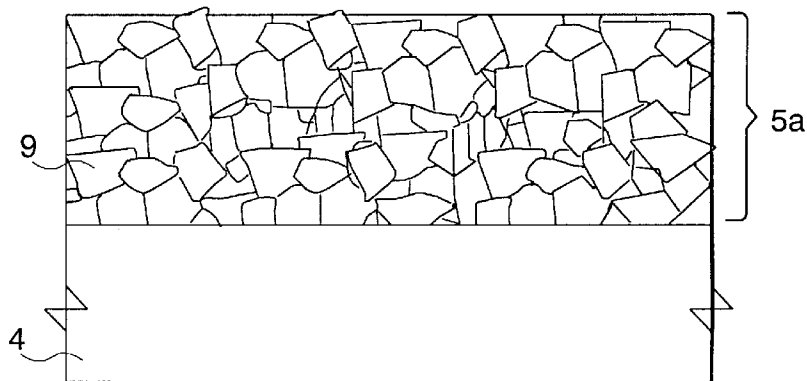




**FIG. 1**  
*(Prior Art)*



**FIG. 2**  
*(Prior Art)*



**FIG. 3**  
*(Prior Art)*

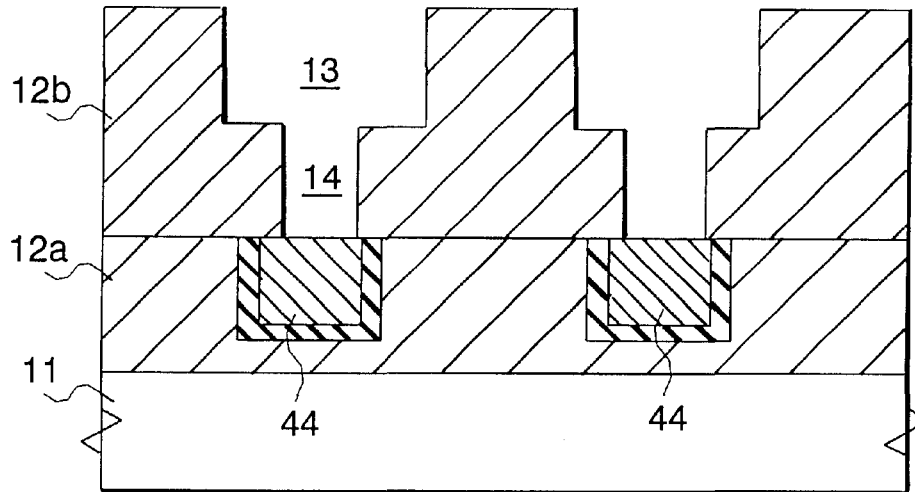


FIG. 4A

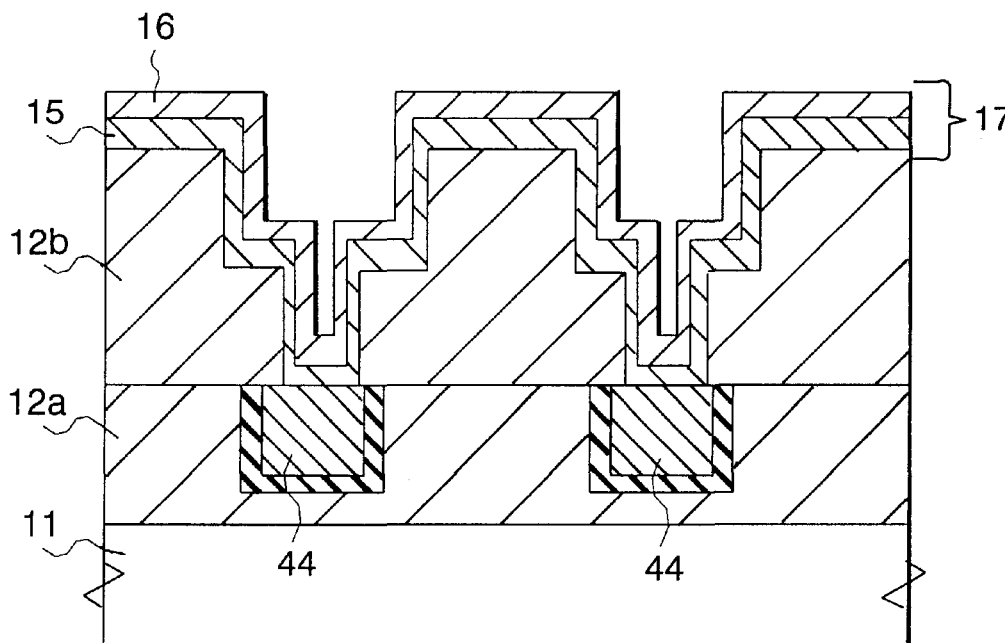


FIG. 4B

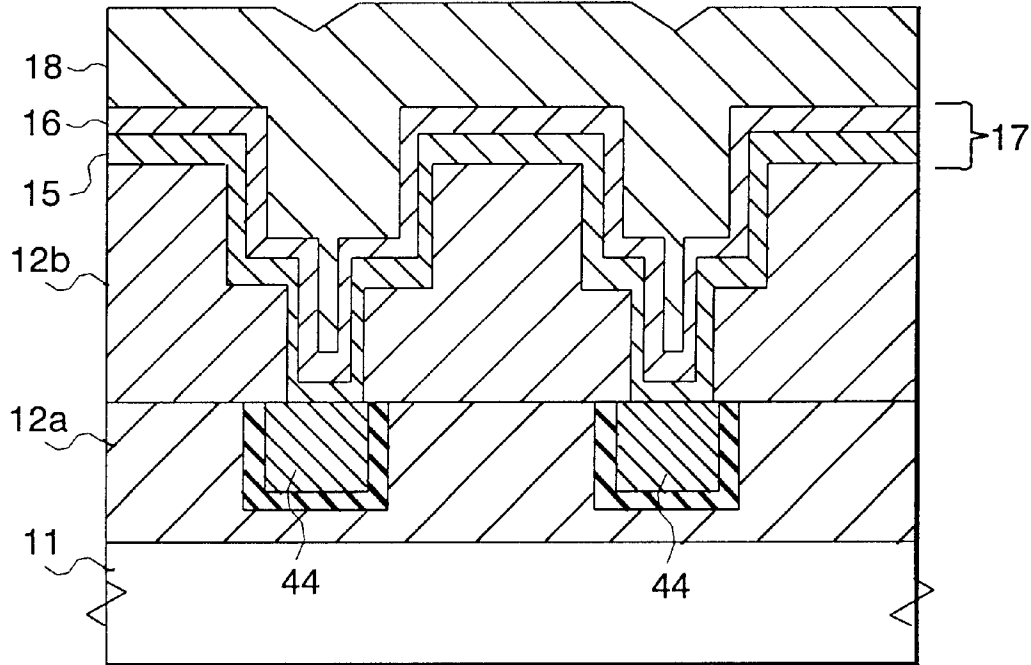


FIG. 4C

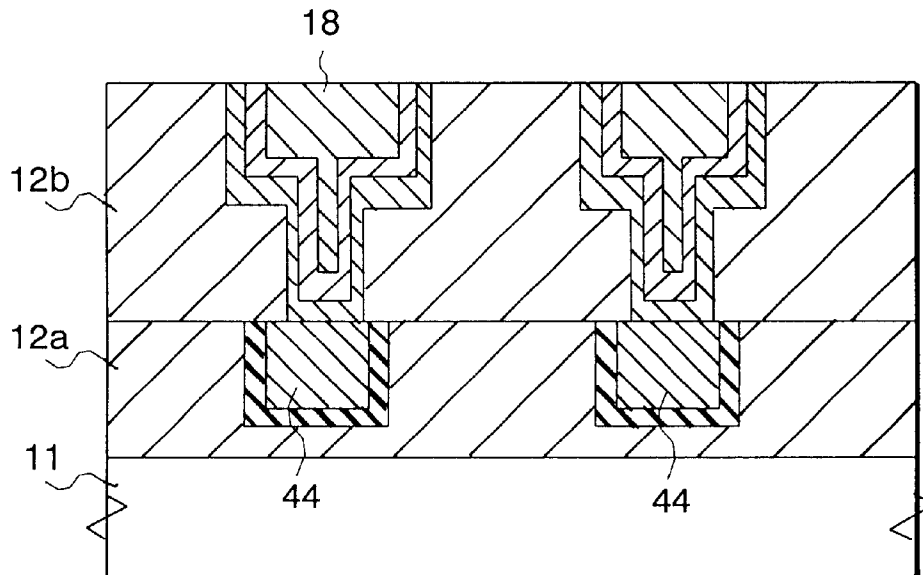


FIG. 4D

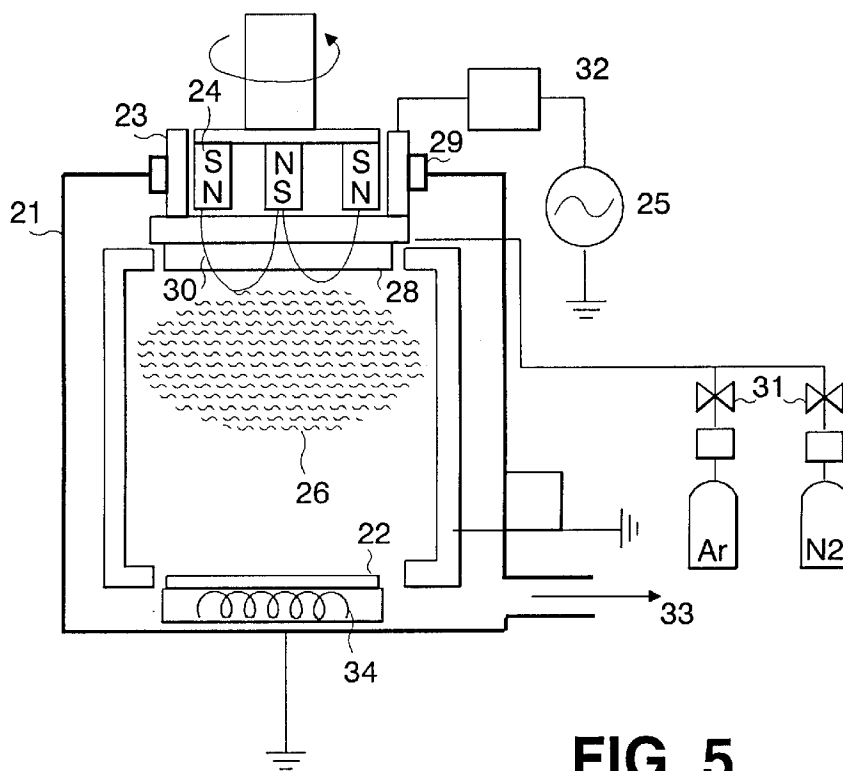


FIG. 5

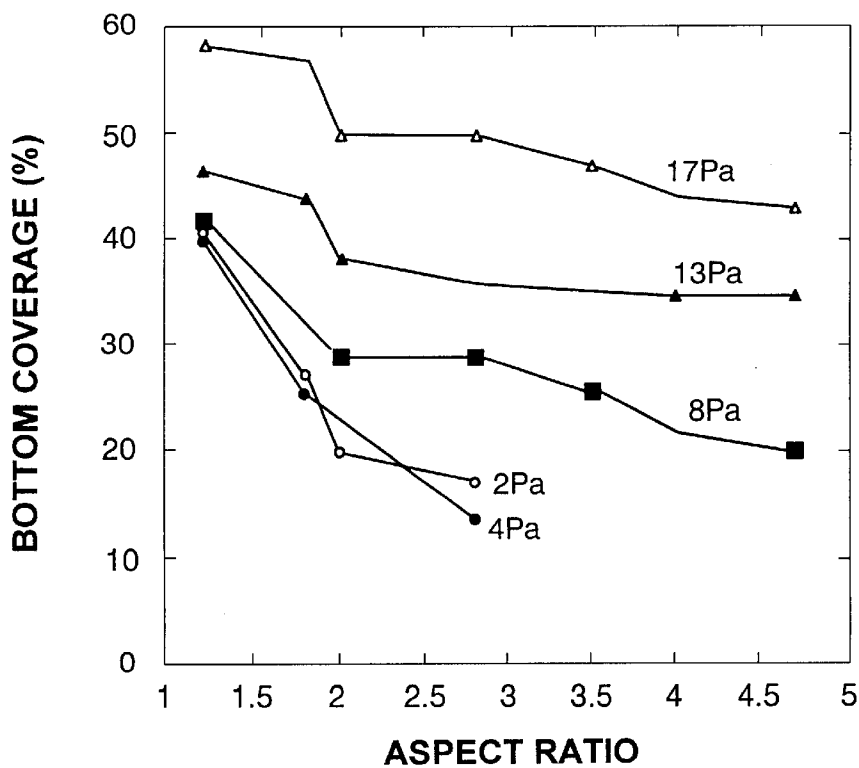


FIG. 6

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