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(71) Applicant: **APPLIED MATERIALS, INC.** [US/US];

3050 Bowers Avenue, Santa Clara, California 95054 (US).

(72) Inventors: **TANG, Hao-Ling**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **KUMAR, Arvind**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **PAKALA, Mahendra**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **WONG, Keith Tatseun**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **HSIAO, Yi-Hsuan**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **YANG, Dongqing**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **CONRAD, Mark**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **SOEDIBYO, Rio**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **YU, Minrui**; 3050 Bowers Avenue, Santa Clara, California 95054 (US).

(74) Agent: **BERGSTROM, James T.** et al.; Kilpatrick Townsend & Stockton LLP, 1100 Peachtree Street NE, Suite 2800, Mailstop: IP Docketing - 22, Atlanta, Georgia 30309 (US).

(54) Title: CONTACT CONSTRUCTION FOR SEMICONDUCTOR DEVICES WITH LOW-DIMENSIONAL MATERIALS

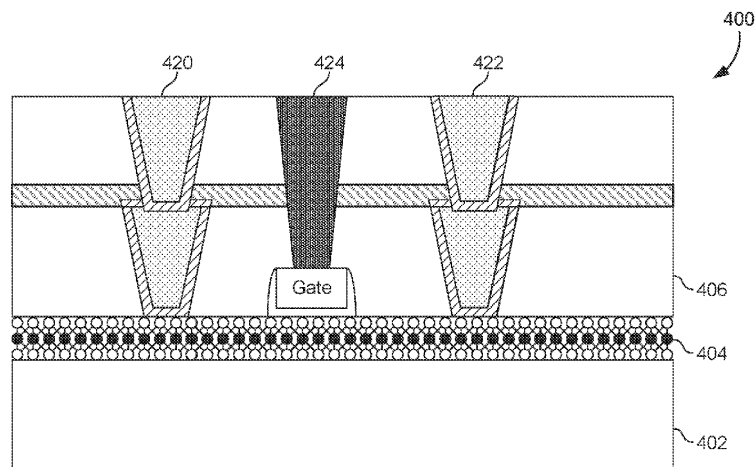


FIG. 4F

(57) **Abstract:** Two-dimensional (2D) materials formed in very thin layers improve the operation of semiconductor devices. However, forming a contact on 2D material tends to damage and penetrate the 2D material. A relatively gentle etch process has been developed that is very selective to the 2D material and allows vertical holes to be etched down to the 2D material without damaging or penetrating the 2D material. A low-power deposition process forms a protective liner when performing the metal fill to further prevent damage to the 2D material when forming the metal contacts in the holes. These processes allow a vertical metal contact to be formed on a planar 2D material or a vertical sidewall contact be formed in a 3D NAND without damaging the 2D material. This increases the contact area, reduces the contact resistance, and improves the performance of the 2D material in the device.

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