

EXHIBIT A

(12) **United States Patent**
Markle

(10) **Patent No.:** **US 6,660,651 B1**
(45) **Date of Patent:** **Dec. 9, 2003**

(54) **ADJUSTABLE WAFER STAGE, AND A METHOD AND SYSTEM FOR PERFORMING PROCESS OPERATIONS USING SAME**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 136 days.

(21) Appl. No.: **10/010,463**

(22) Filed: **Nov. 8, 2001**

(51) **Int. Cl.⁷** **H01L 21/00**

(52) **U.S. Cl.** **438/729**; 156/345.24; 156/345.51; 438/9; 438/694

(58) **Field of Search** 156/345.23, 345.51, 156/345.55, 345.24; 438/8, 9, 694-729; 216/67

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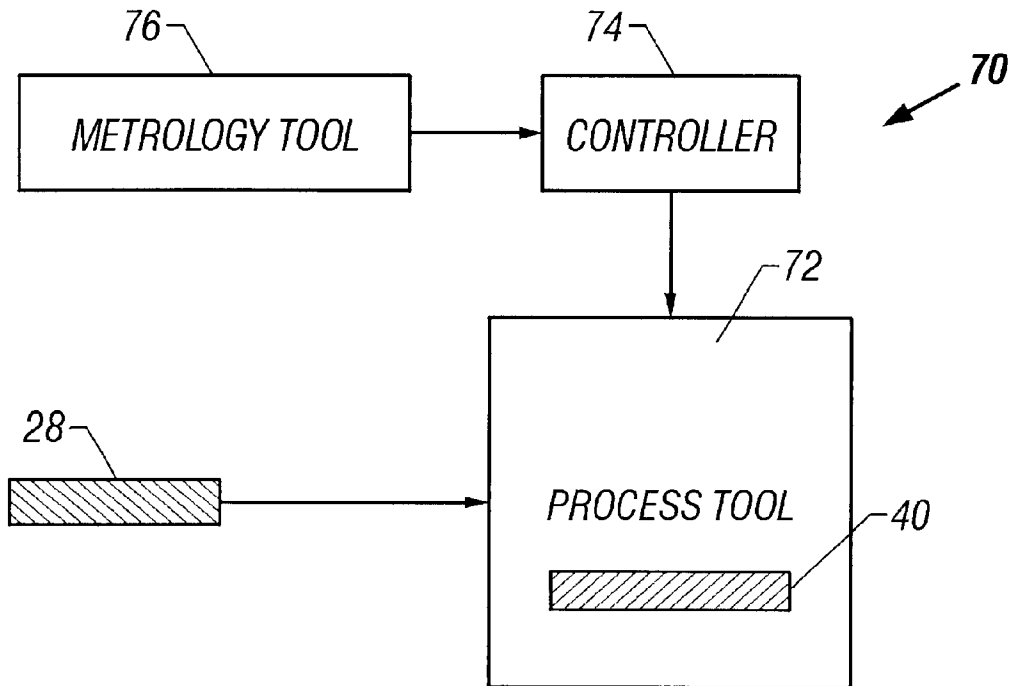
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(57) **ABSTRACT**

A process tool comprised of an adjustable wafer stage and various methods and systems for performing process operations using same is disclosed herein. In one illustrative embodiment, the process tool is comprised of a process chamber, and an adjustable wafer stage in the process chamber to receive a wafer positioned thereabove, the wafer stage having a surface that is adapted to be raised, lowered or tilted. In further embodiments, the process tool further comprises at least three pneumatic cylinders or at least three rack and pinion combinations, each of which are operatively coupled to the wafer stage by a ball and socket connection. A system disclosed herein is comprised of a metrology tool for measuring a plurality of wafers processed in a process tool to determine across-wafer variations produced by the process tool, a process tool comprised of an adjustable wafer stage that has a surface adapted to receive a wafer to be processed in the tool, and a controller for adjusting a plane of the surface of the wafer stage based upon the determined across-wafer variations produced by the tool, whereby the process tool processes at least one subsequently processed wafer positioned on the wafer stage after the plane of the surface of the wafer stage has been adjusted.

86 Claims, 3 Drawing Sheets



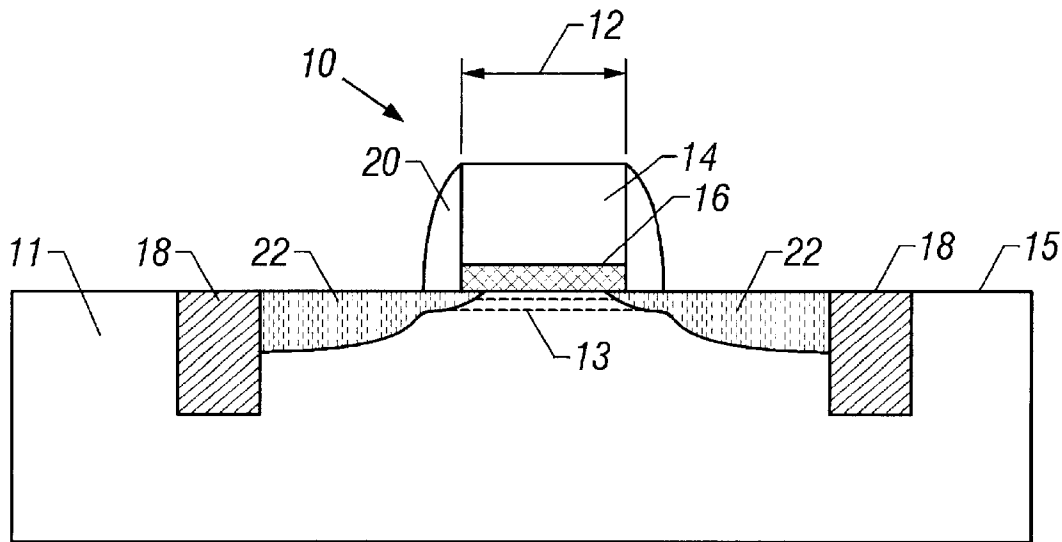


FIG. 1
(Prior Art)

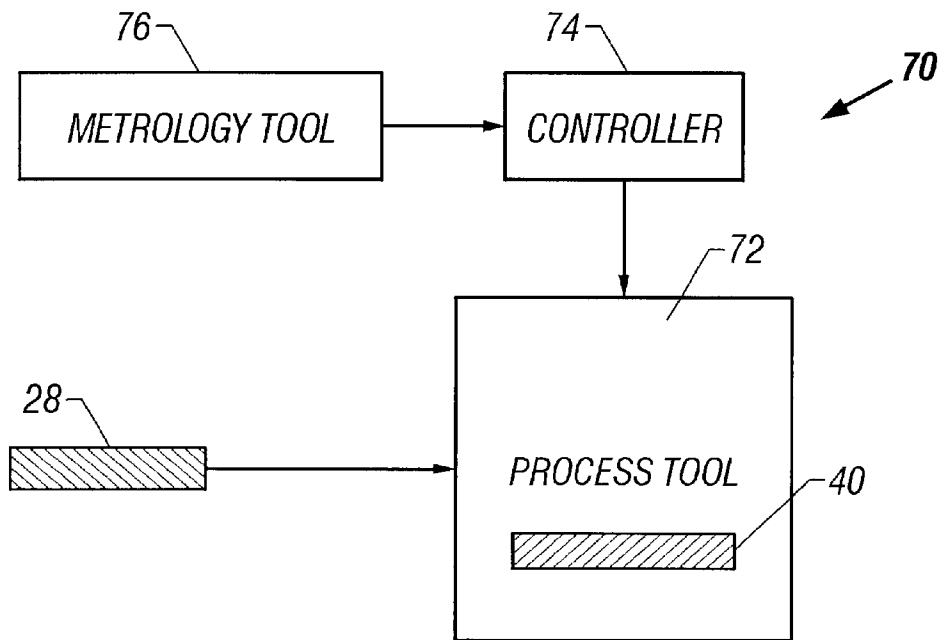


FIG. 6

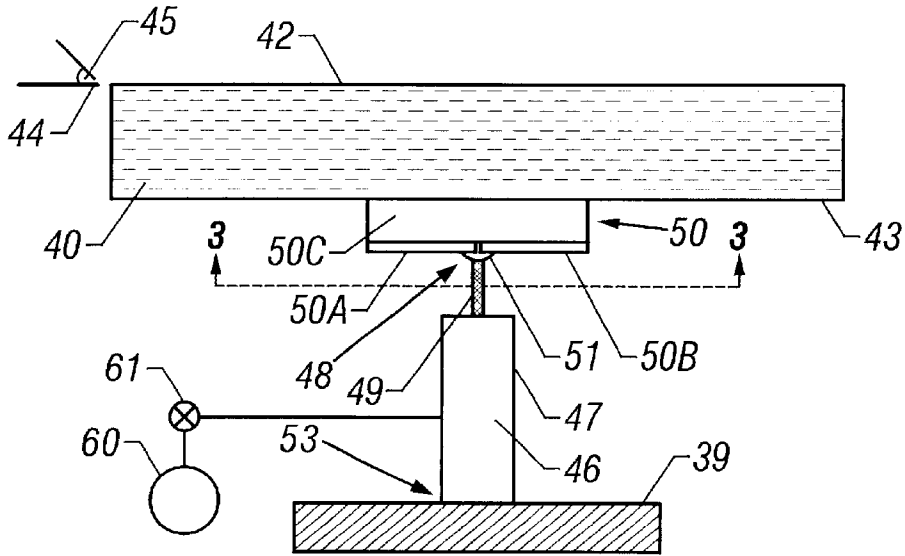


FIG. 2

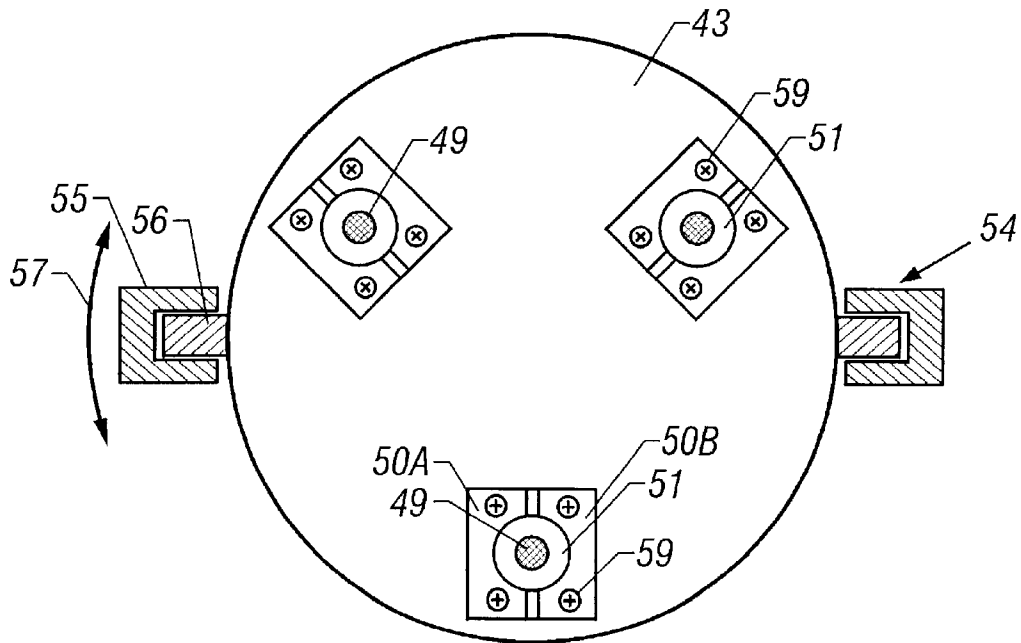


FIG. 3

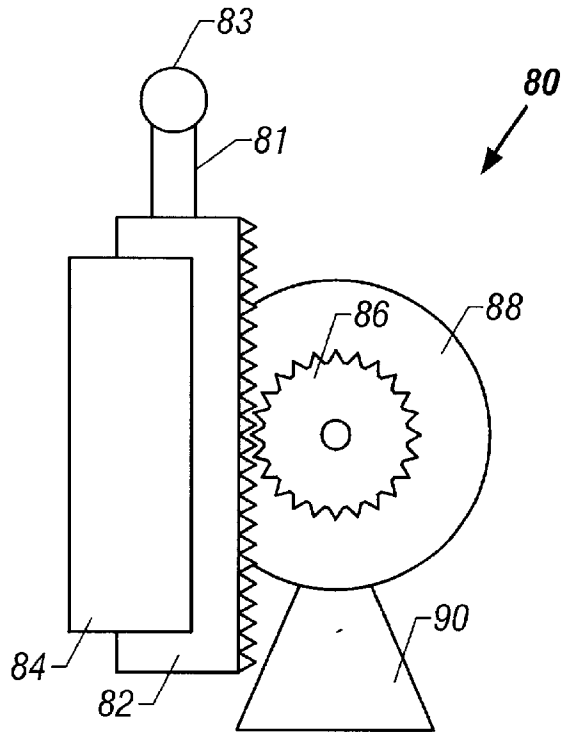


FIG. 4

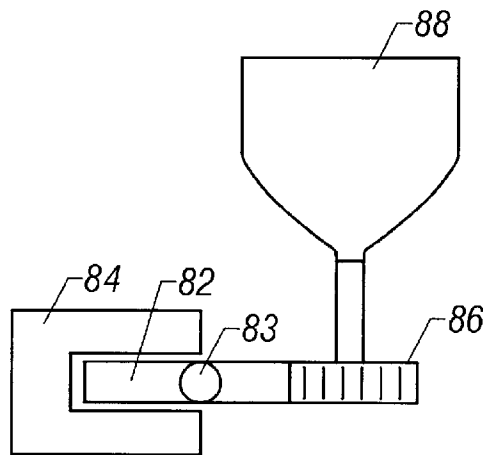


FIG. 5

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