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**United States Patent** [19]**Motoda et al.**[11] **Patent Number:** **5,906,860**[45] **Date of Patent:** **May 25, 1999**[54] **APPARATUS FOR TREATING A SUBSTRATE WITH RESIST AND RESIST-TREATING METHOD**[75] Inventors: **Kimio Motoda; Kiyomitsu Yamaguchi; Yoshitaka Matsuda**, all of Kumamoto; **Tetsu Kawasaki**, Yamanashi-ken, all of Japan[73] Assignee: **Tokyo Electron Limited**, Tokyo, Japan[21] Appl. No.: **08/832,816**[22] Filed: **Apr. 4, 1997**[30] **Foreign Application Priority Data**

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[51] **Int. Cl.<sup>6</sup>** ..... **B05D 3/12; B05C 11/02**[52] **U.S. Cl.** ..... **427/240; 427/385.5; 427/425; 118/52; 118/663**[58] **Field of Search** ..... **427/240, 385.5, 427/425; 118/8, 52, 663**[56] **References Cited****U.S. PATENT DOCUMENTS**

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The invention provides an apparatus for treating a substrate with resist, comprising a spin chuck for horizontally holding a substrate, a first motor for variably rotating the spin chuck, a nozzle for applying resist solution onto the upper surface of the substrate held on the spin chuck, a cup having an upper opening through which the substrate is put in or taken out of the cup and a lower opening through which extends the driving shaft of the spin chuck, the cup positioned to surround the substrate held on the spin chuck to receive liquid centrifugally separated from the substrate which is rotated about its axis, a lid to close the upper opening of the cup to define a space around the substrate, a second motor for variably rotating the cup independently of the spin chuck rotation, a liftable cylinder for relatively moving at least one of the spin chuck and cup, which are positioned apart from each other, toward each other to achieve mutual contact, and an O-ring for hermetically sealing the mutual contact portion between the cup and spin chuck when these cup and spin chuck are brought into mutual contact by the liftable cylinder. When the cup and spin chuck are brought into mutual contact by the liftable cylinder, the lower opening of the cup is closed by the spin chuck to form a hermetic space. The spin chuck and cup are rotated in synchronism by first and second motors while the chamber is kept hermetically closed.

**27 Claims, 12 Drawing Sheets**