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# United States Patent [19]

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Hasebe et al.

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[54] **METHOD OF FORMING COATING FILM AND APPARATUS THEREFOR**

[58] **Field of Search** ..... 118/313, 319, 118/320, 321, 323, 52; 427/425, 426, 240; 134/902

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[56] **References Cited**

**U.S. PATENT DOCUMENTS**

4,564,280	1/1986	Fukuda .....	118/321
5,002,008	3/1991	Ushijima et al. ....	118/313
5,066,616	11/1991	Gordon .	
5,089,305	2/1992	Ushijima et al. ....	118/321
5,374,312	12/1994	Hasibe et al. ....	118/52
5,403,397	4/1995	Beckers et al. ....	118/52

**FOREIGN PATENT DOCUMENTS**

2 458 363	2/1981	France .
28 09 286	9/1979	Germany .
58-82521	5/1983	Japan .
61-150332	9/1986	Japan .
62-86719	4/1987	Japan .
63-301520	12/1988	Japan .

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**Related U.S. Application Data**

[62] Division of application No. 08/686,910, Jul. 26, 1996, Pat. No. 5,942,035, which is a division of application No. 08/217,636, Mar. 25, 1994, Pat. No. 5,658,615.

[30] **Foreign Application Priority Data**

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Dec. 16, 1993	[JP]	Japan .....	5-343722
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[57] **ABSTRACT**

An apparatus for forming a coating film, comprises a spin chuck for supporting a substrate with one surface facing upward and rotating the substrate about a vertical axis, a first nozzle for supplying a solvent of a coating solution on the substrate, and a second nozzle for supplying the coating solution on a central portion of the substrate. The first and second nozzles are supported by a head such that the supported nozzle moves between a dropping position above the substrate and a waiting position offset from the substrate. The solvent and coating solution are diffused along the surface of the substrate by rotating the spin chuck.

**7 Claims, 17 Drawing Sheets**

[51] **Int. Cl.**<sup>7</sup> ..... **B05C 5/00**  
[52] **U.S. Cl.** ..... **118/52; 118/313; 118/319; 118/320; 118/321; 118/323**

