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Iwamura et al.

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[54] **PLASMA TREATMENT APPARATUS AND METHOD**

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[73] Assignee: **Seiko Epson Corporation**, Tokyo, Japan

5,340,618	8/1994	Tanisaki et al.	427/488
5,368,685	11/1994	Kumihashi et al.	156/643.1
5,384,167	1/1995	Nishiwaki et al.	427/569
5,391,855	2/1995	Tanisaki	219/121.43
5,399,830	3/1995	Maruyama	219/121.43
5,407,121	4/1995	Koopman et al.	228/206
5,449,432	9/1995	Hanawa	156/643.1
5,499,754	3/1996	Bobbio et al.	228/42
5,597,438	1/1997	Grewal et al.	156/345

[21] Appl. No.: **598,082**

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[30] Foreign Application Priority Data

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Dec. 5, 1995	[JP]	Japan	7-344404

[51] Int. Cl.⁶ **B23K 10/00**

[52] U.S. Cl. **219/121.43; 219/121.44; 219/121.51; 156/345; 156/646.1**

[58] **Field of Search** 219/121.43, 121.36, 219/121.4, 121.59, 121.52, 121.51; 156/345, 643.1; 204/298.34, 298.06, 192.1, 298.37, 298.16, 298.38

FOREIGN PATENT DOCUMENTS

371693	6/1990	European Pat. Off.	.
59-158525	9/1984	Japan	.
60-1861	1/1985	Japan	.
61-127866	6/1986	Japan	.
1-125829	5/1989	Japan	.
2-190489	7/1990	Japan	.
2-281734	11/1990	Japan	.
3-174972	7/1991	Japan	.
3-219082	9/1991	Japan	.
3-236475	10/1991	Japan	.
4-186619	7/1992	Japan	.
5-82478	4/1993	Japan	.
6-2149	1/1994	Japan	.
6-190269	7/1994	Japan	.

[56] References Cited

U.S. PATENT DOCUMENTS

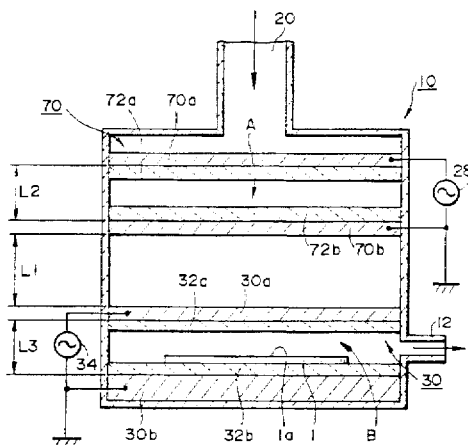
3,762,941	10/1973	Hou	117/93.1
4,012,307	3/1977	Phillips	204/192
4,430,547	2/1984	Yoneda et al.	219/121
4,705,593	11/1987	Haigh et al.	156/635
4,708,766	11/1987	Hynecek	156/643
4,749,440	6/1988	Blackwood et al.	156/646
4,857,382	8/1989	Liu et al.	428/156
4,921,157	5/1990	Dishon et al.	228/124
5,000,819	3/1991	Pedder et al.	156/643
5,045,166	9/1991	Bobbio	204/192
5,120,568	6/1992	Schuurmans et al.	427/37
5,126,164	6/1992	Okazaki et al.	427/39
5,147,520	9/1992	Bobbio	204/192
5,178,682	1/1993	Tsukamoto et al.	118/722
5,201,995	4/1993	Reisman et al.	156/646
5,225,659	7/1993	Kusano et al.	249/121
5,240,559	8/1993	Ishida	456/666
5,290,378	3/1994	Kusano et al.	156/272
5,292,370	3/1994	Tsai et al.	156/345
5,316,739	5/1994	Yoshikawa et al.	422/186

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[57] ABSTRACT

A plasma treatment and apparatus which enables improved uniform plasma treatment over the entire surface of an object to be treated, improved yield, and higher treatment speed is provided. In a gas introduction passage, the gas capable of plasma discharge is preexcited to raise its level of excitation. A first pair of plasma generation electrodes downstream along the gas flow passage use the preexcited gas to generate a plasma in a first plasma generation position. Further downstream, a second pair of plasma generation electrodes positioned in a second plasma generation position, where the activated state of the gas activated in the first plasma region is maintained, activates the gas to generate a plasma containing activated gas species. The object to be treated is treated by the activated gas species in the second plasma region.

37 Claims, 9 Drawing Sheets



GILLETTE 1007

FIG. 1

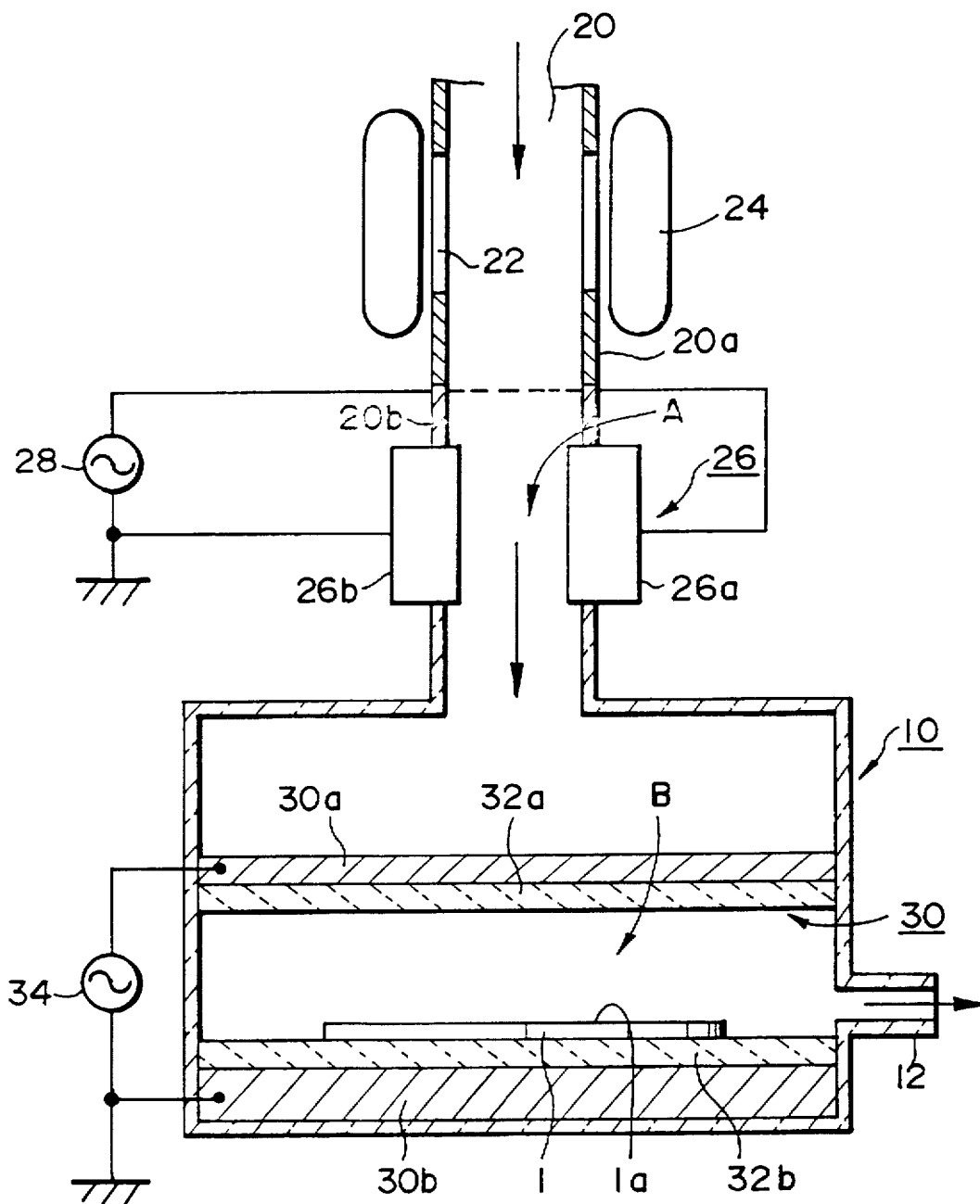


FIG. 2

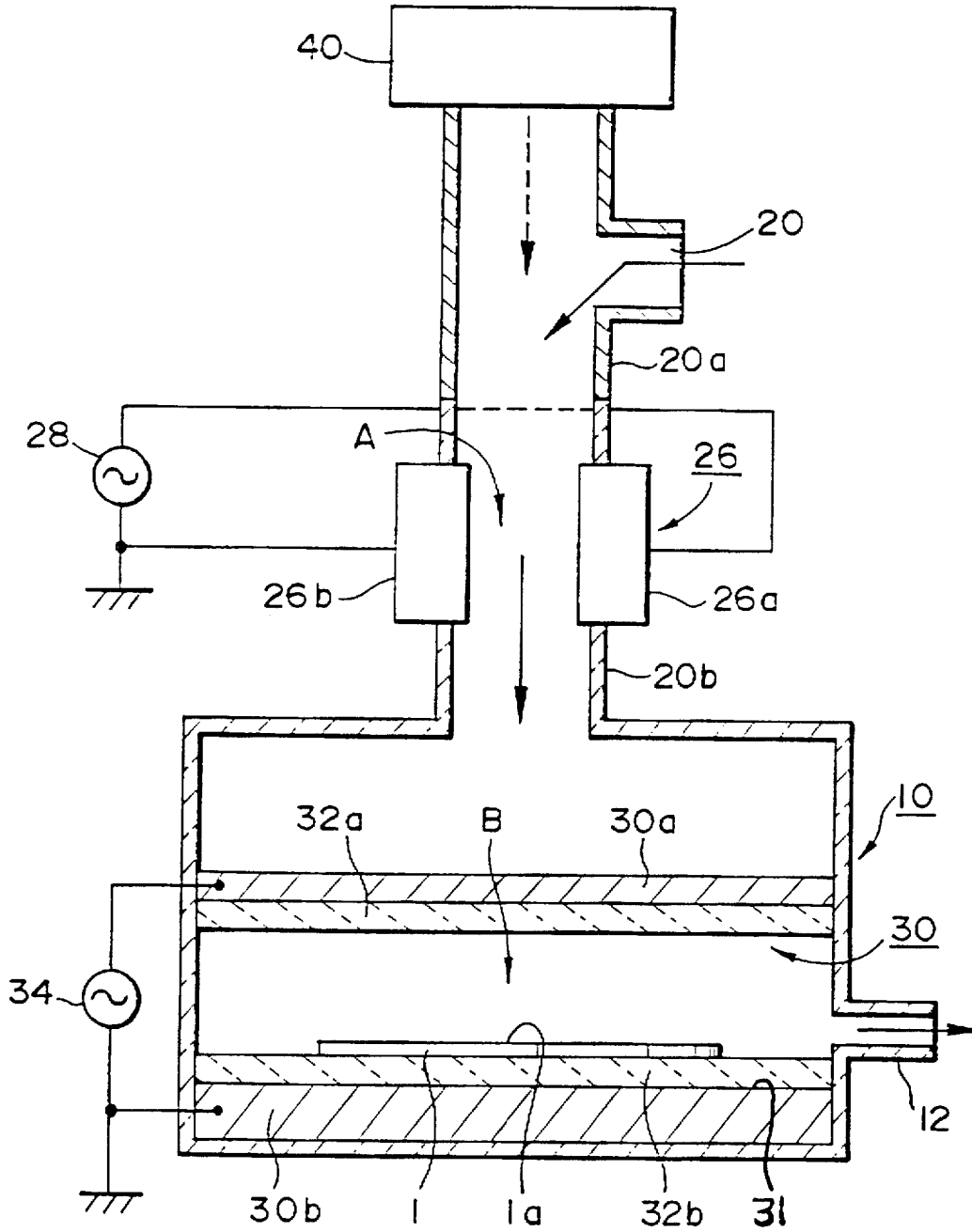


FIG. 3

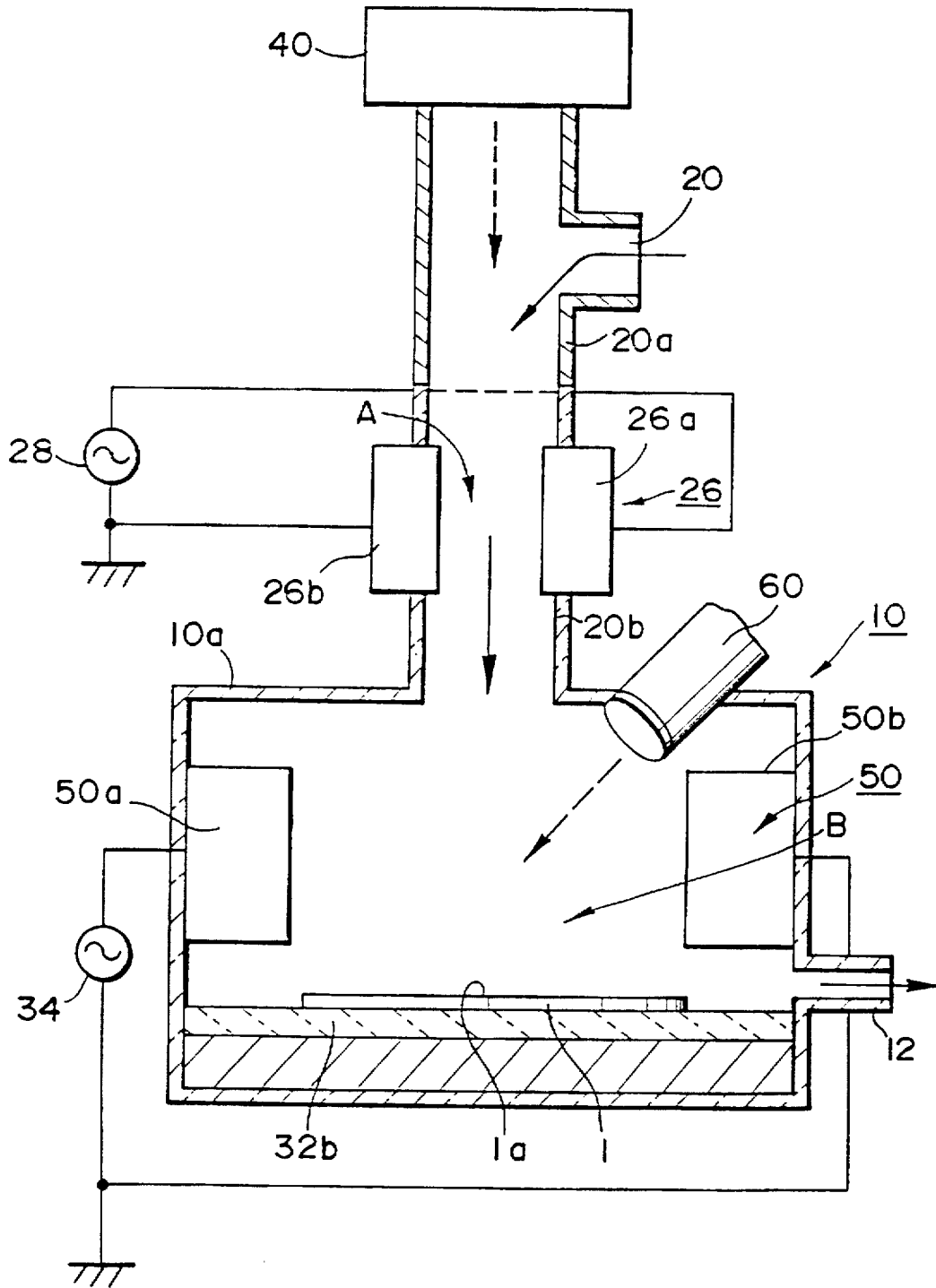
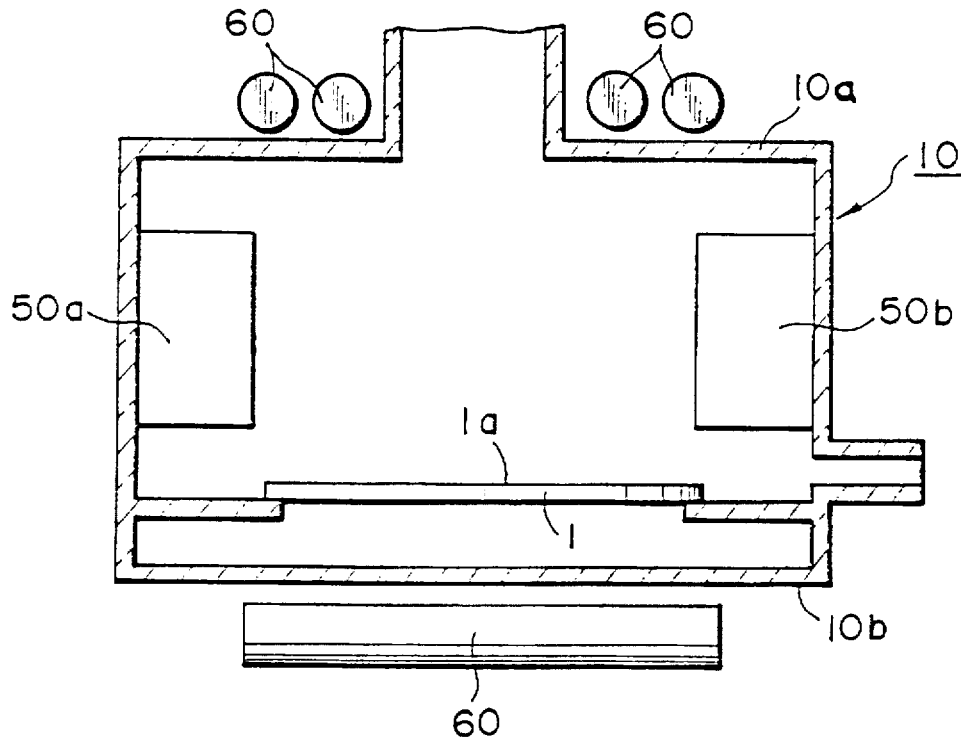


FIG. 4



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