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# United States Patent [19]

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Iwamura et al.

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

[75] Inventors: **Naoyuki Iwamura; Yasutsugu Aoki**, both of Suwa, Japan

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

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[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.<sup>6</sup> ..... **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

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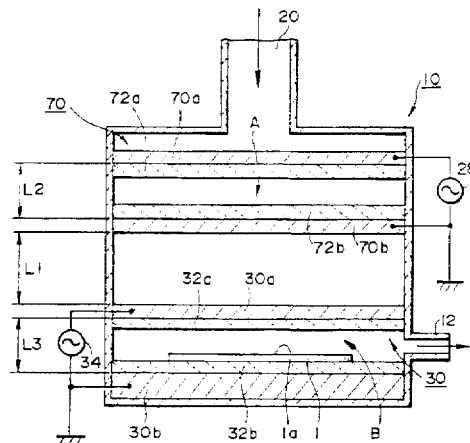
Primary Examiner—Mark H. Paschall

Attorney, Agent, or Firm—Stroock & Stroock & Lavan LLP

### [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**



INTEL 1007

FIG. 1

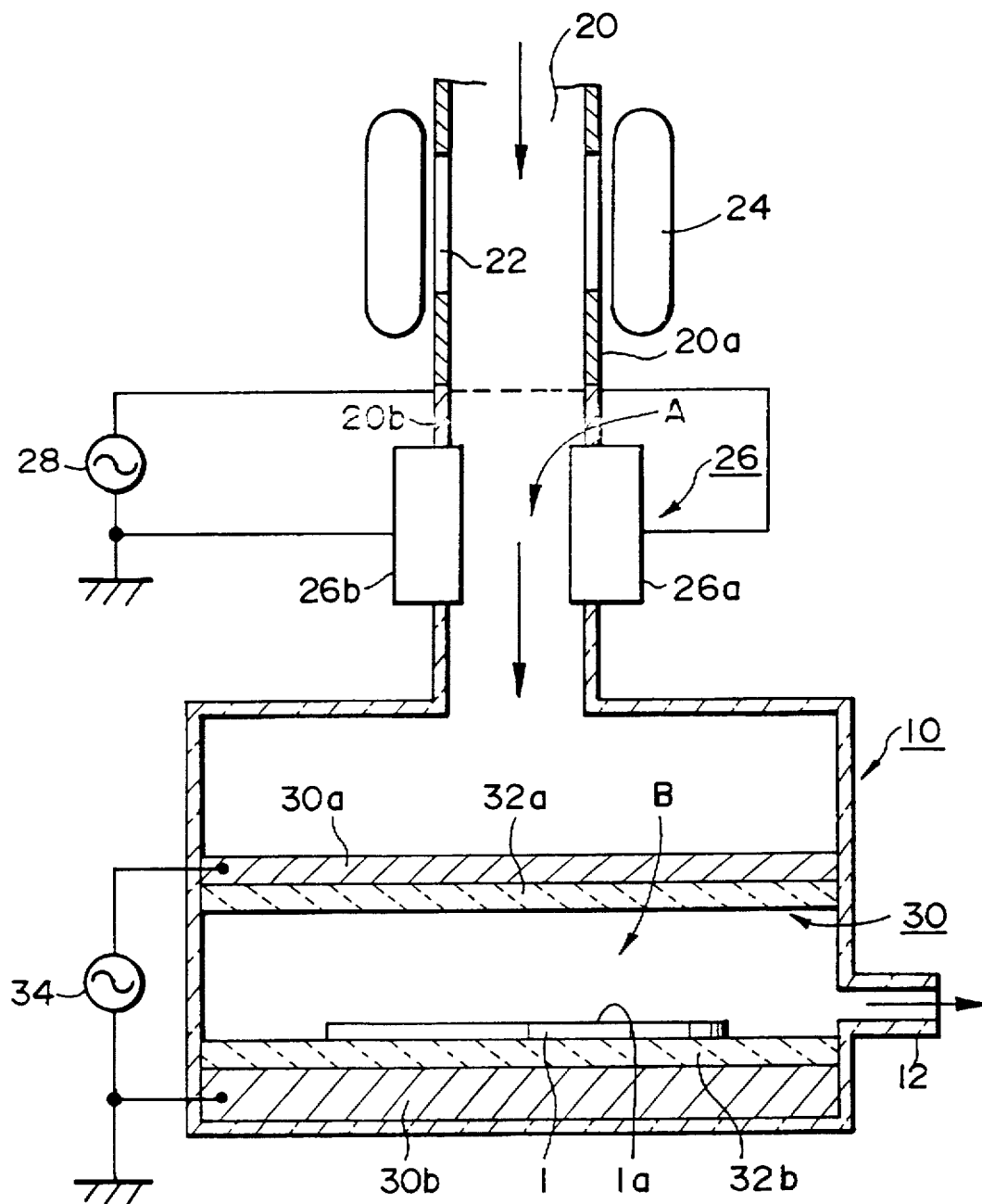


FIG. 2

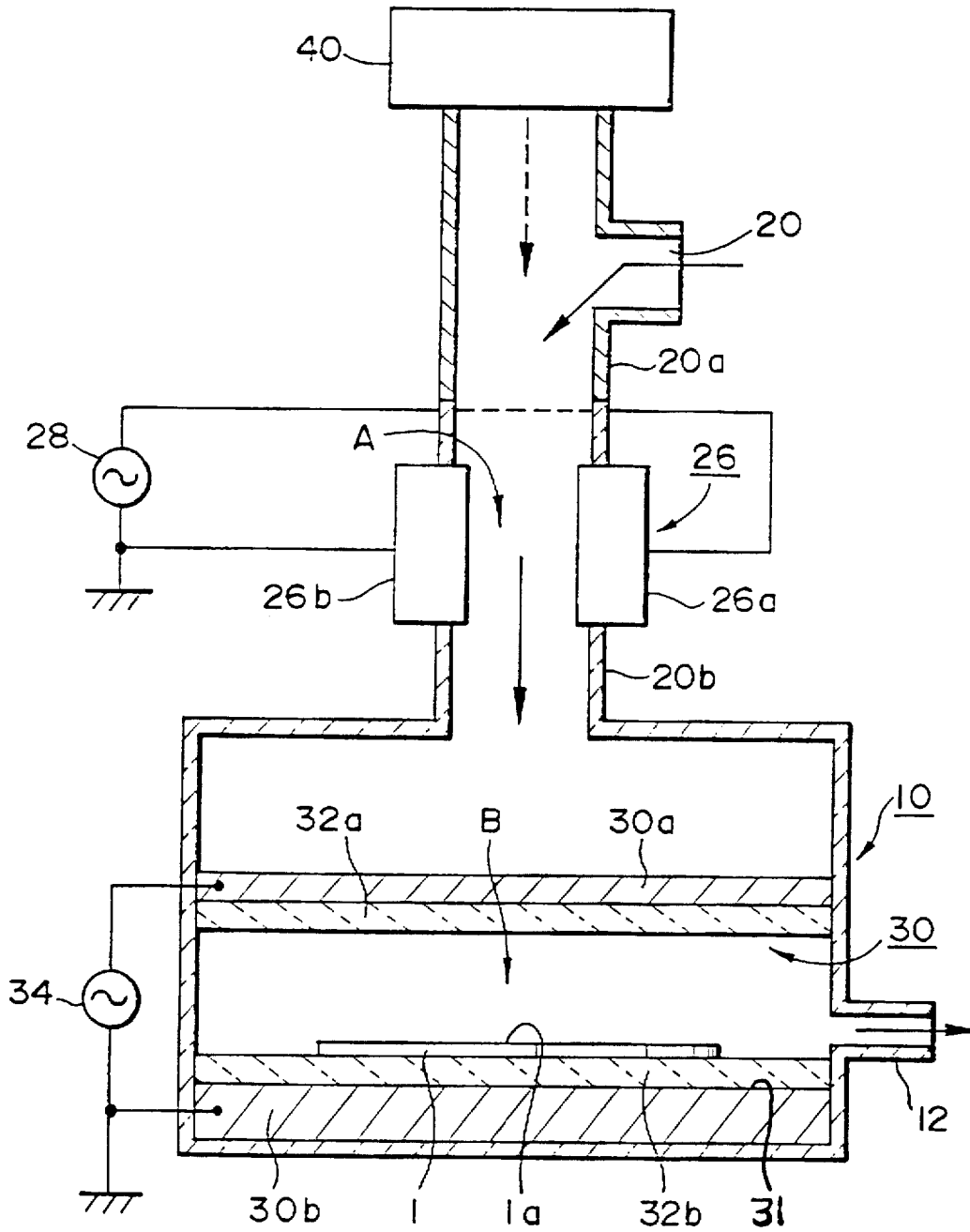


FIG. 3

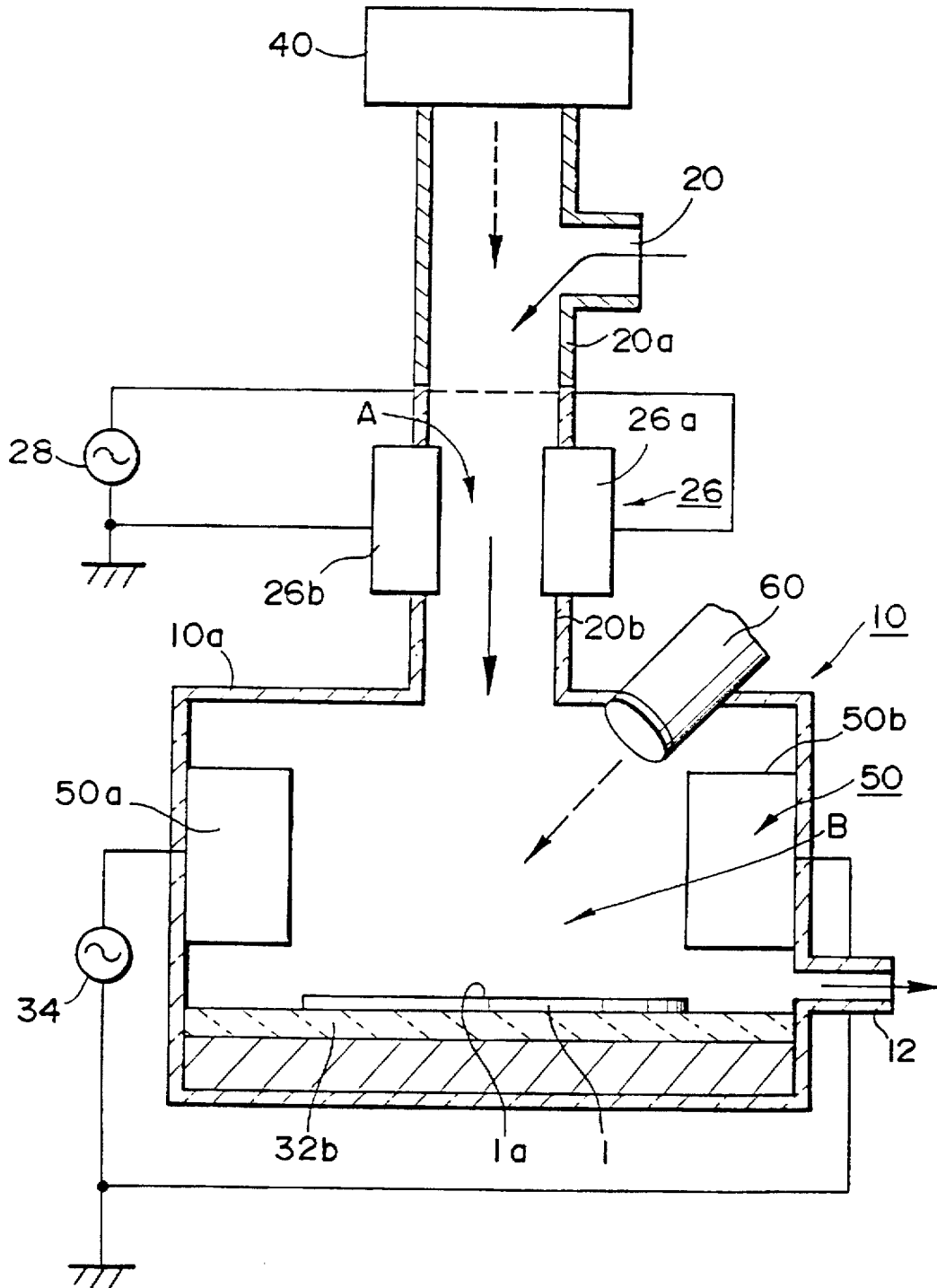
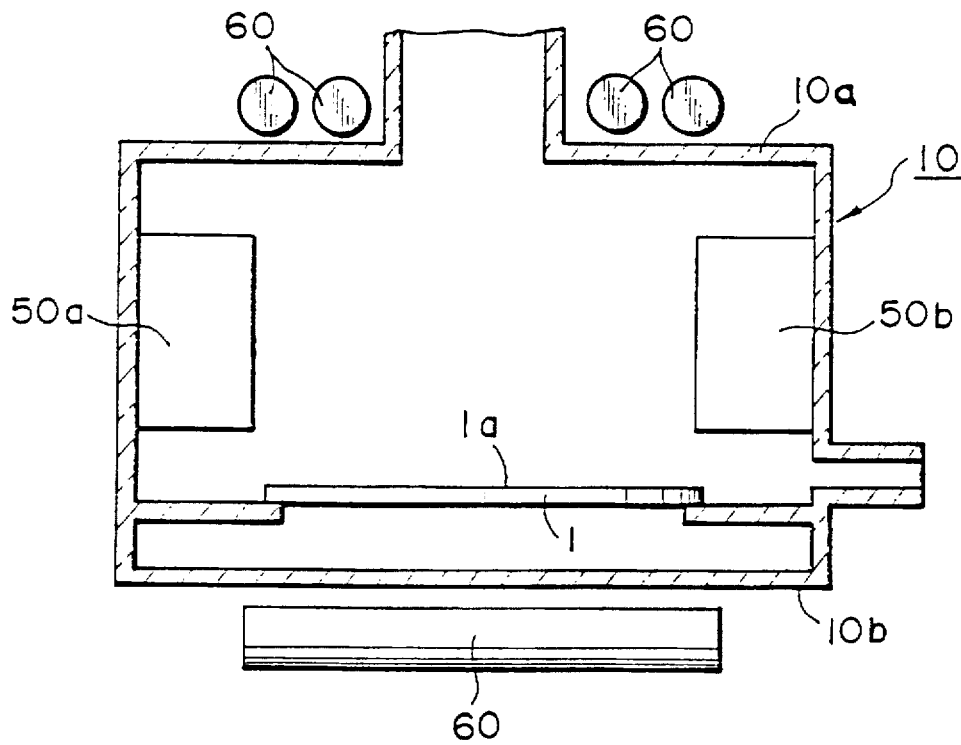


FIG. 4



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