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Matsumura et al.

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[54] **METHOD FOR HEAT-PROCESSING SEMICONDUCTOR DEVICE AND APPARATUS FOR THE SAME**

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[30] **Foreign Application Priority Data**

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Oct. 24, 1989 [JP] Japan 1-276564

[51] Int. Cl.⁵ **H05B 3/68**

[52] U.S. Cl. **364/557; 219/457; 219/464**

[58] Field of Search 364/557, 505, 477; 219/405, 411, 388, 390, 457, 464, 465

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,481,406 11/1984 Muka 219/405 X
4,504,730 3/1985 Shimizu 219/405 X
4,688,180 8/1987 Motomiya 364/557 X
4,690,569 9/1987 Veitch 364/557 X

4,794,217 12/1988 Quan et al. 219/10.67 X
4,881,591 11/1989 Rignall 364/557 X
4,958,061 9/1990 Wakabayashi et al. 219/411
4,982,347 1/1991 Rackerby et al. 364/557
5,001,327 3/1991 Hirasawa et al. 219/390

FOREIGN PATENT DOCUMENTS

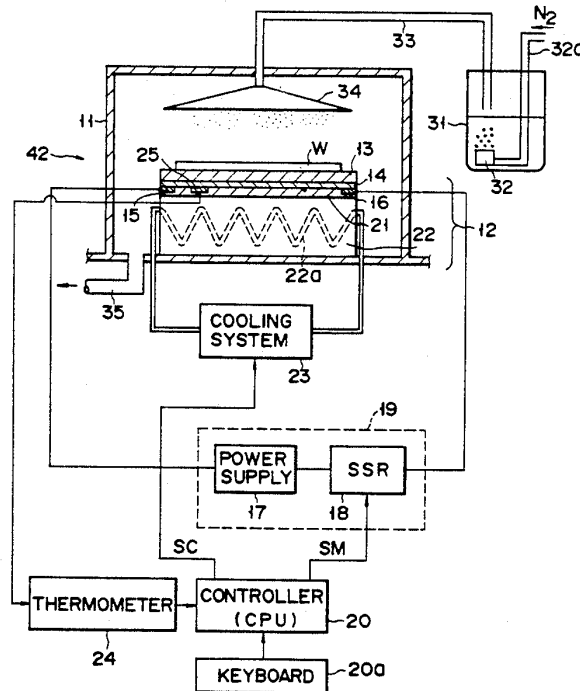
58-21332 2/1983 Japan .
61-12030 1/1986 Japan .
61-23321 1/1986 Japan .
61-67224 4/1986 Japan .
61-201426 9/1986 Japan .
61-235835 10/1986 Japan .
61-271834 12/1986 Japan .

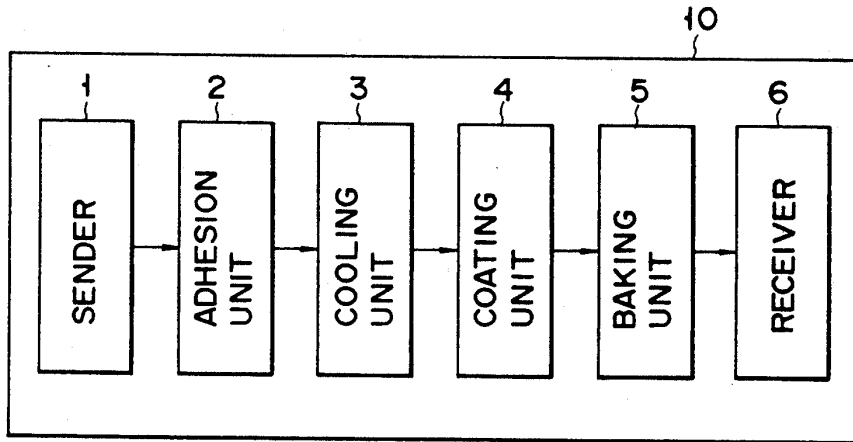
Primary Examiner—Joseph L. Dixon
Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt

ABSTRACT

[57] CPU stores information showing a time-temperature relationship and applicable for either heating a semiconductor wafer to a hold temperature for a predetermined period of time or cooling the wafer from the hold temperature over a predetermined period of time, or for both, read the information. A conductive thin film heats the wafer in accordance with the information. A sensor detects the temperature of the wafer. A control system controls either the heating of the wafer or the cooling thereof, or both, in accordance with the detected temperature signal and the information.

12 Claims, 8 Drawing Sheets





PRIOR ART

FIG. 1

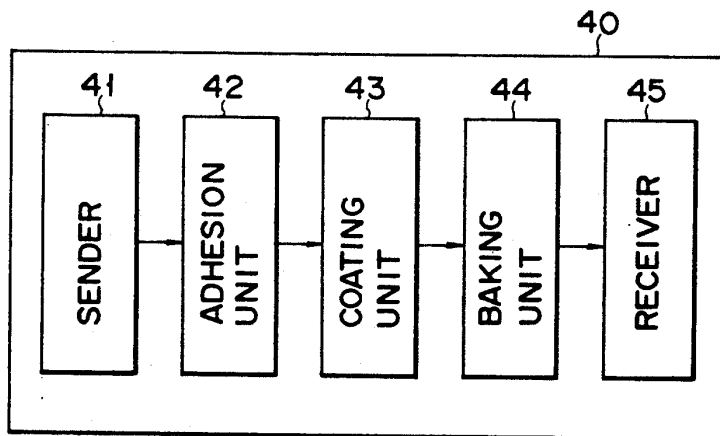
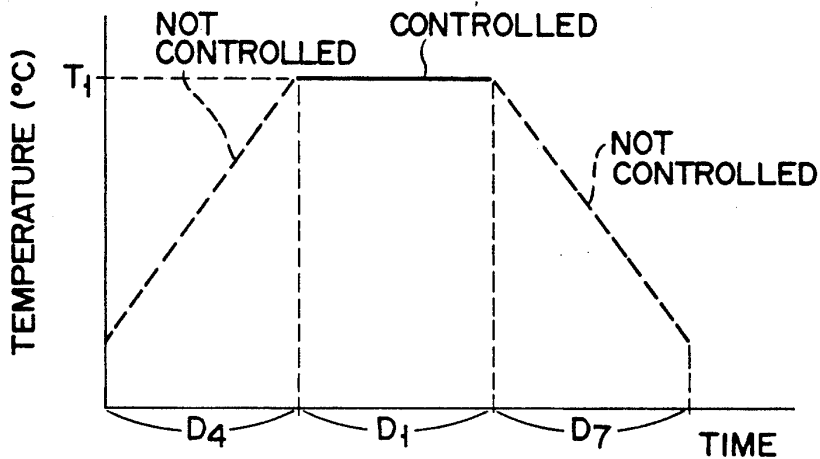
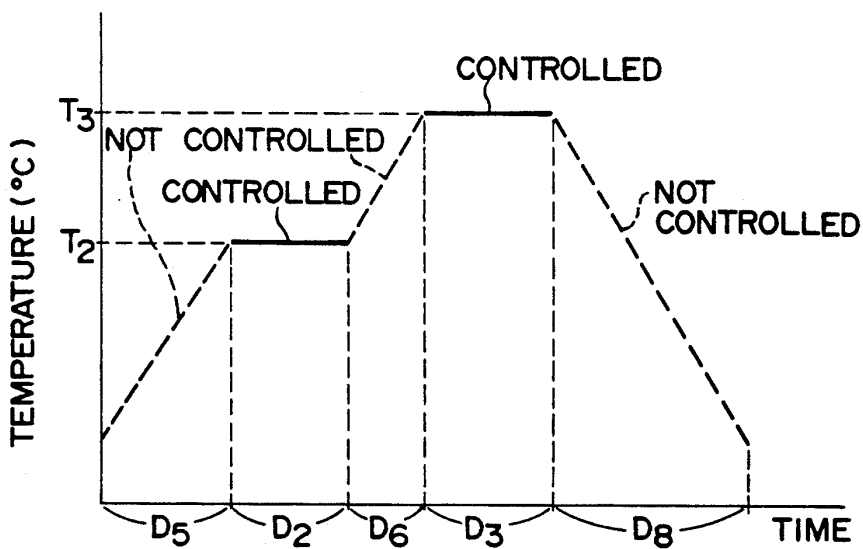


FIG. 4



PRIOR ART
FIG. 2



PRIOR ART
FIG. 3

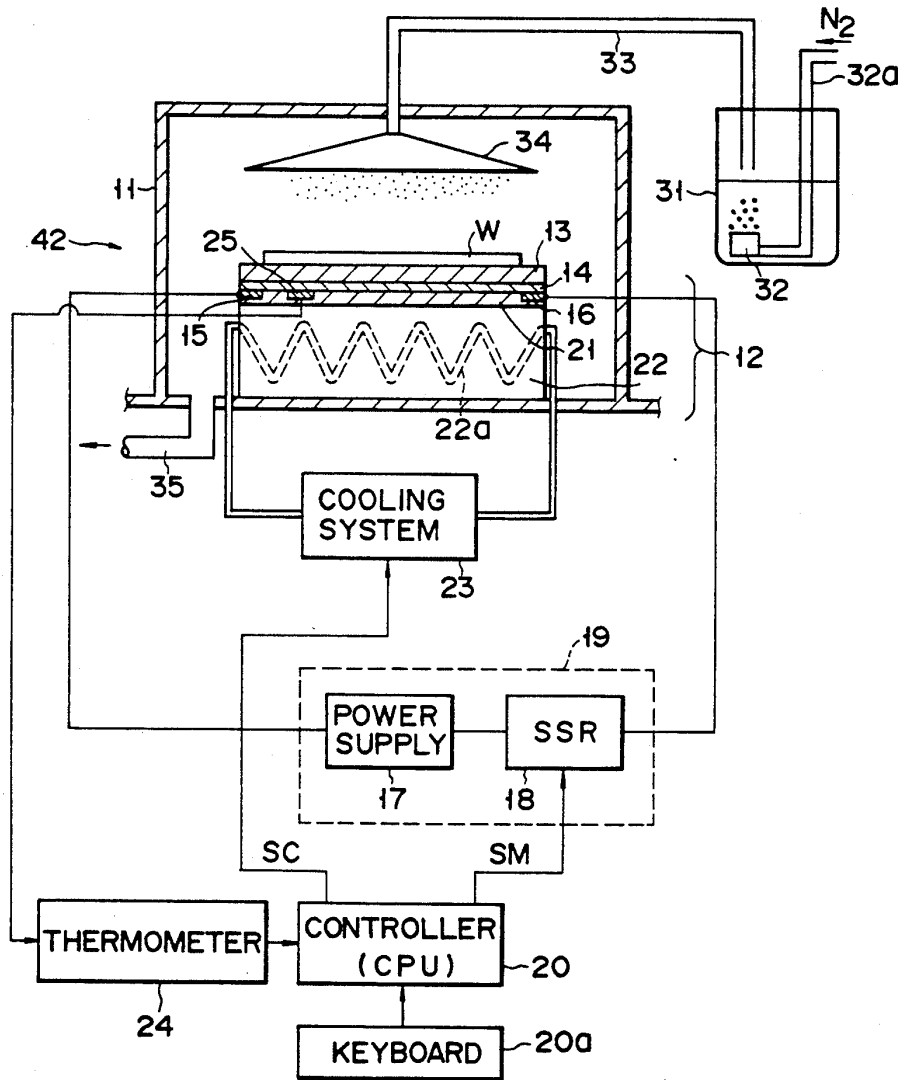


FIG. 5A

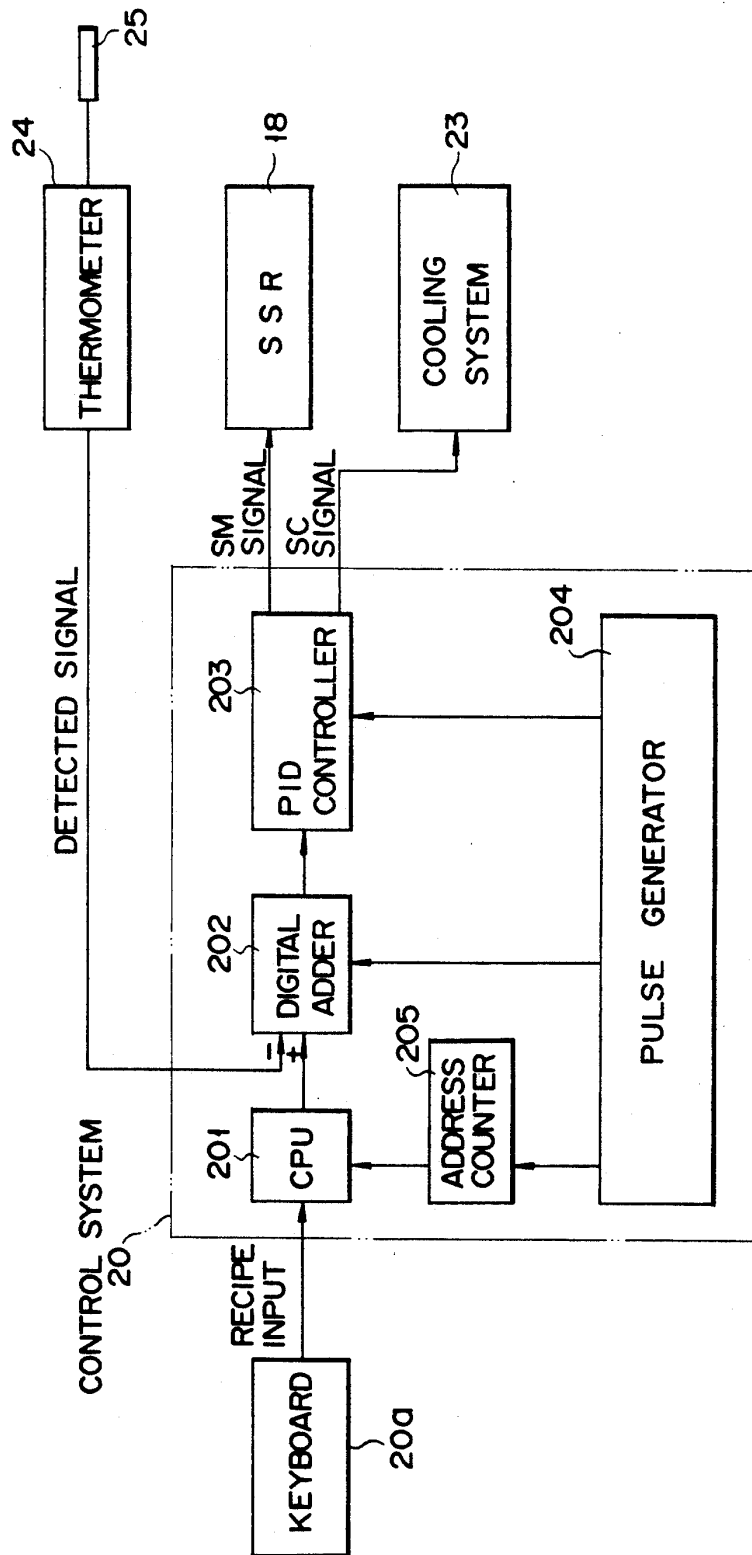


FIG. 5B

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