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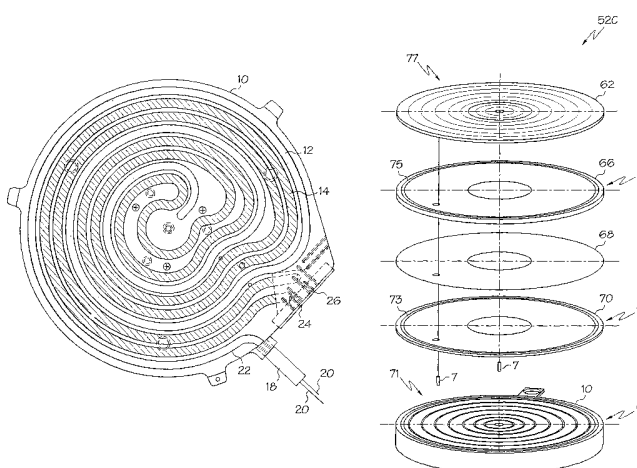
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(54) Title: WAFER CHUCK HAVING WITH INTERLEAVED HEATING AND COOLING ELEMENTS



(57) Abstract: A workpiece chuck used, for example, to support a semiconductor wafer during processing, is described. In one aspect, the chuck includes a thermal plate assembly which includes both heating and cooling capability. The heating element (12) can be a resistive heater in a coiled configuration disposed in a plane. The cooling can be performed via a cooling fluid circulated through cooling tubes (14) which are also disposed in a coiled configuration in a plane. The heating element and cooling tubes are coiled in an interleaved fashion to provide uniform heating and cooling while allowing them to simultaneously occupy the same plane. In another aspect, the chuck of the invention provides for interchangeable top surface assemblies used to support the workpiece chuck. The thermal plate assembly includes mechanical mounting for the top surface assembly. The interchangeable nature of the top surface assemblies permits the user to use multiple top surfaces with a single thermal plate.

INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01L21/68 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 06, 30 April 1998 (1998-04-30) -& JP 10 050811 A (MIYATA R ANDEI:KK), 20 February 1998 (1998-02-20) abstract; figure 11	1-10, 13-21
X	US 5 213 349 A (ELLIOTT JOE C) 25 May 1993 (1993-05-25)	23,24
A	column 4, line 24 - line 51	3,5, 11-14
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A	column 7, line 1 - line 32; figure 3 column 13, line 6 - line 22	14
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *P* document published prior to the international filing date but later than the priority date claimed

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

Z document member of the same patent family

Date of the actual completion of the international search

12 July 2002

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22. 07. 2002

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International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 099 571 A (TOMPKINS ROBERT E ET AL) 31 March 1992 (1992-03-31) column 3, line 63 - column 4, line 8 column 4, line 53 - line 61 -----	24
X	DE 33 06 999 A (CENSOR PATENT VERSUCH) 6 October 1983 (1983-10-06) abstract; figure 4 -----	1 23, 24
X	US 5 846 375 A (WILHOIT MICHAEL S ET AL) 8 December 1998 (1998-12-08) column 3, line 3 - line 8 column 5, line 9 - line 14 -----	1
X	US 5 651 823 A (BICHE MICHAEL R ET AL) 29 July 1997 (1997-07-29) column 15, line 33 - line 37 -----	1
P, X	WO 01 01460 A (TRIO TECH INTERNAT) 4 January 2001 (2001-01-04) page 26, line 31 - page 27, line 5; figure 19 -----	1-4, 7-12, 14-22
A	US 5 033 538 A (HIRSCHER HANS ET AL) 23 July 1991 (1991-07-23) the whole document -----	1-4, 15-17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/21522

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-22

A thermal control apparatus for a workpiece chuck comprising: a heating element and a cooling element wherein the heating plane and cooling plane are situated in the same plane.

2. Claim : 23

A workpiece chuck for supporting a workpiece comprising: a lower support, a thermal plate, a mounting apparatus on the thermal plate, and an upper support assembly wherein the mounting apparatus is adapted to hold a plurality of types of support assemblies so that the support assemblies are interchangeable on the thermal plate assembly.

3. Claim : 24

A workpiece chuck for supporting a workpiece comprising: a lower support, a thermal plate assembly on the lower support, an upper support assembly on the thermal plate wherein a hard coating layer is interposed between the thermal plate assembly and the upper support assembly.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/21522

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INTERNATIONAL SEARCH REPORT

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International Application No

PCT/US 01/21522

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