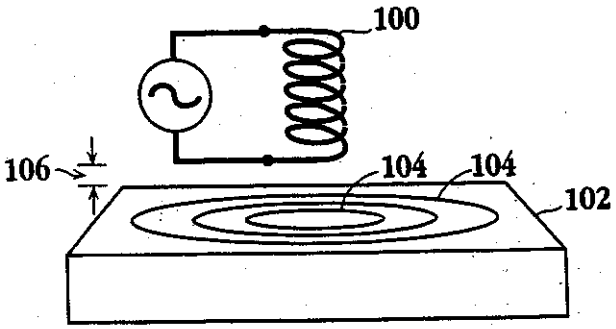


Fig. 1 (prior art)

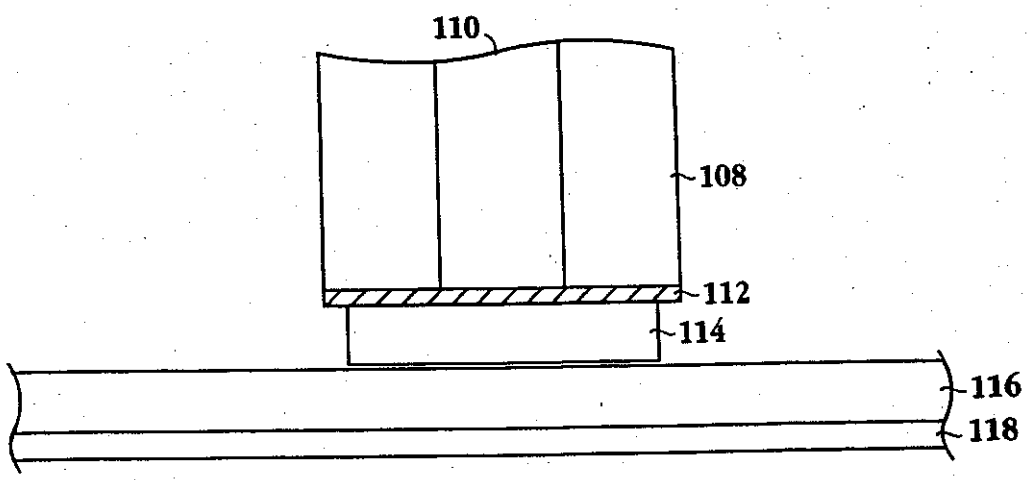


Fig. 2A (prior art)

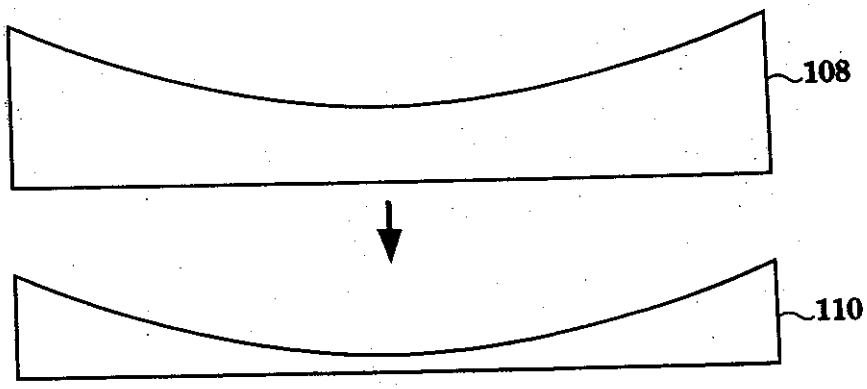


Fig. 2B (prior art)

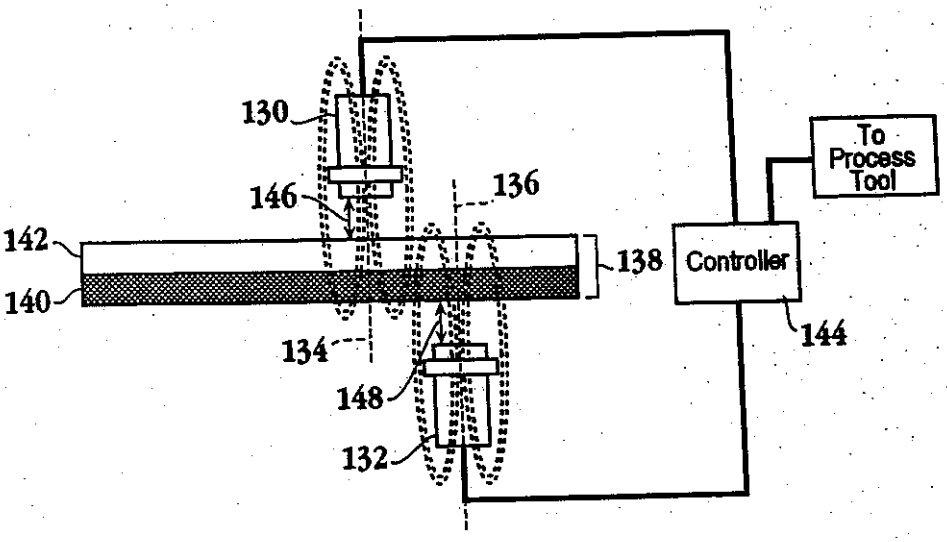

130
146
136
142
140
138
Controller
To Process Tool
144
134
148
132

Fig. 3

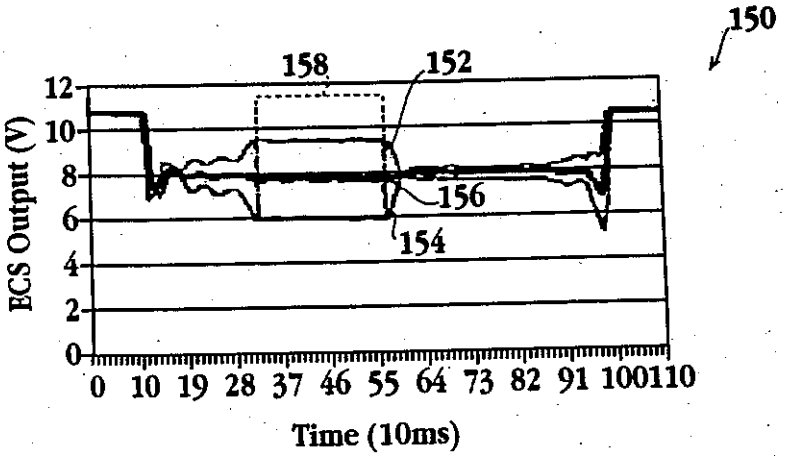

150
158
152
156
154
ECS Output (V)
12
10
8
6
4
2
0
0 10 19 28 37 46 55 64 73 82 91 100110
Time (10ms)

Fig. 4

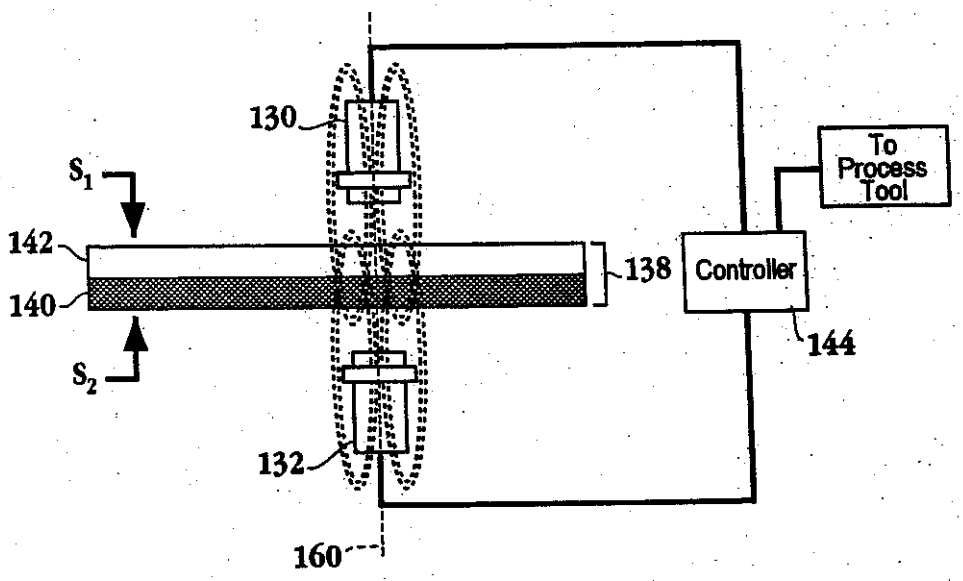


Fig. 5

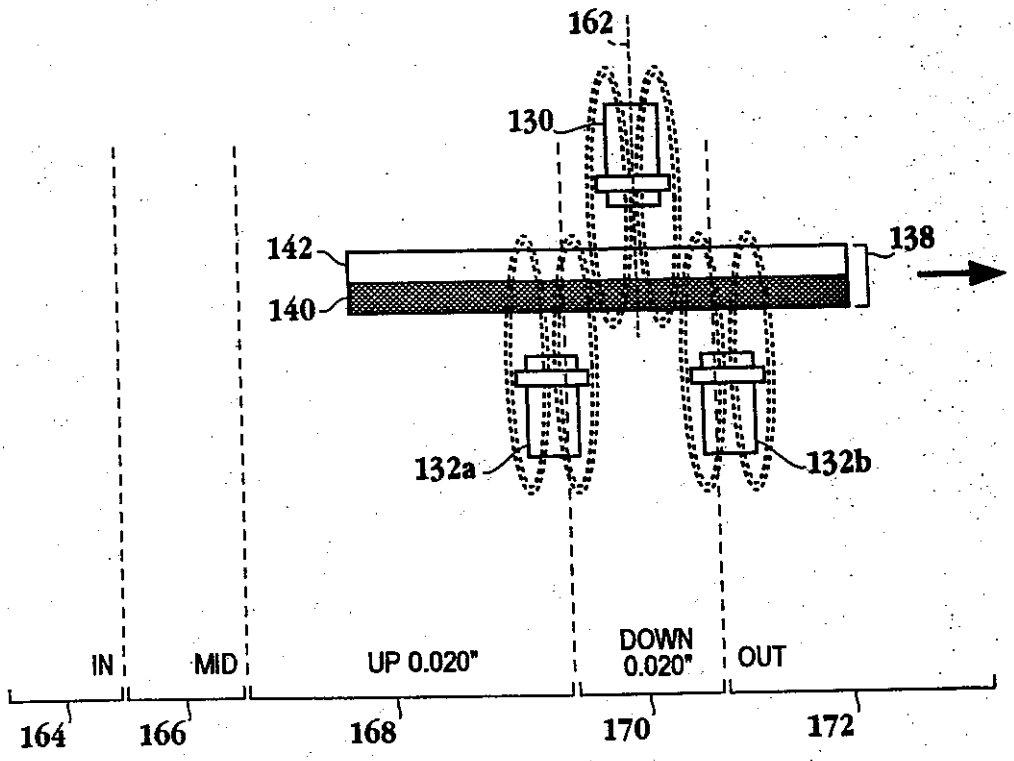

162
130
142
140
138
132a
132b
IN
MID
UP 0.020"
DOWN 0.020"
OUT
164
166
168
170
172

Fig. 6A

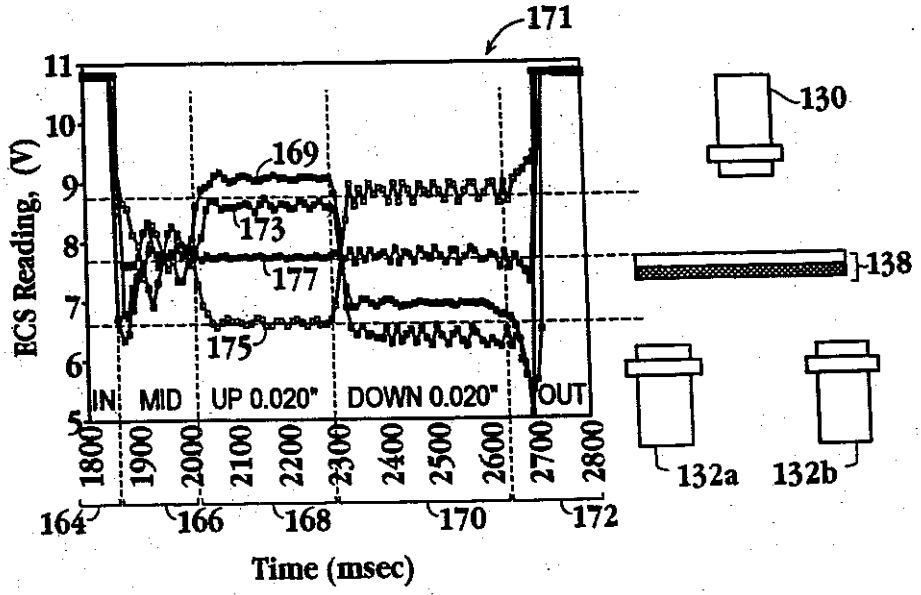

171
11
10
9
8
7
6
5
ECS Reading, (V)
169
173
177
175
IN
MID
UP 0.020"
DOWN 0.020"
OUT
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
164
166
168
170
172
Time (msec)
130
138
132a
132b

Fig. 6B

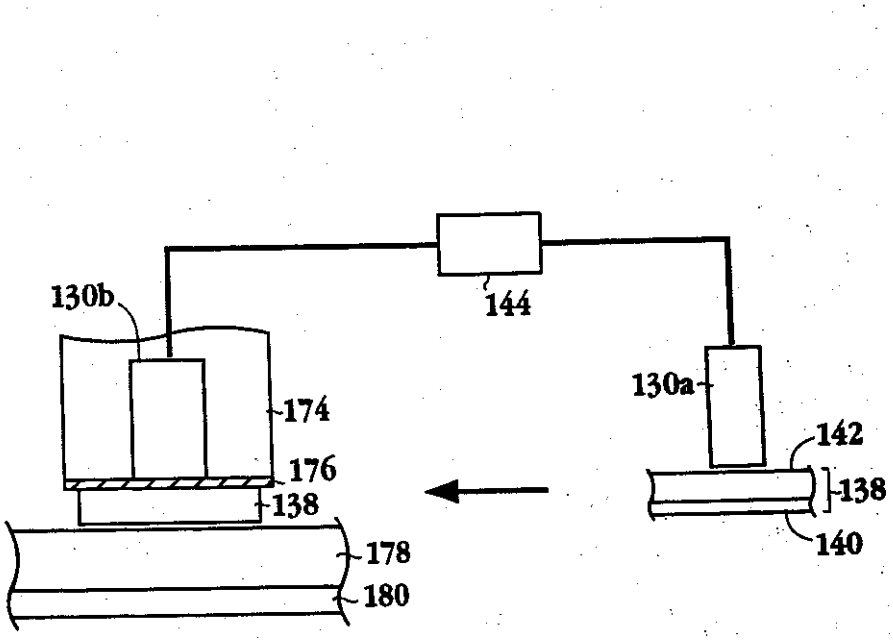

144
130b
174
176
138
178
180
130a
142
138
140

Fig. 7A

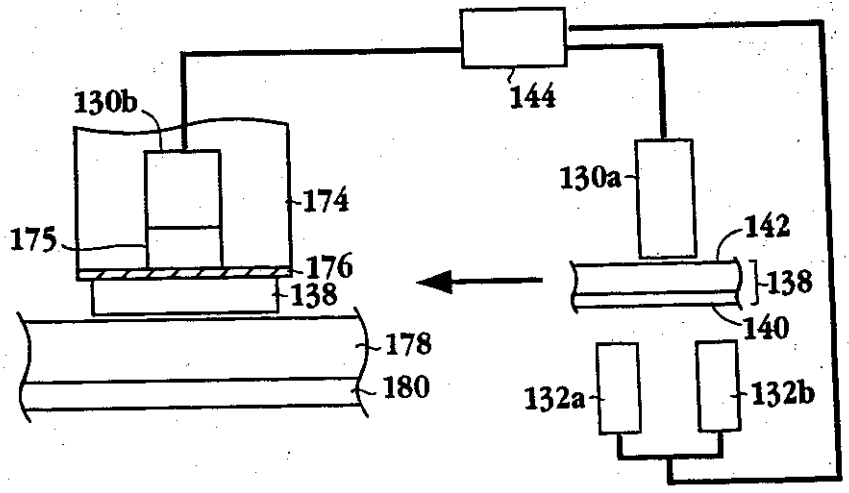

144
130b
174
175
176
138
178
180
130a
142
138
140
132a
132b

Fig. 7B

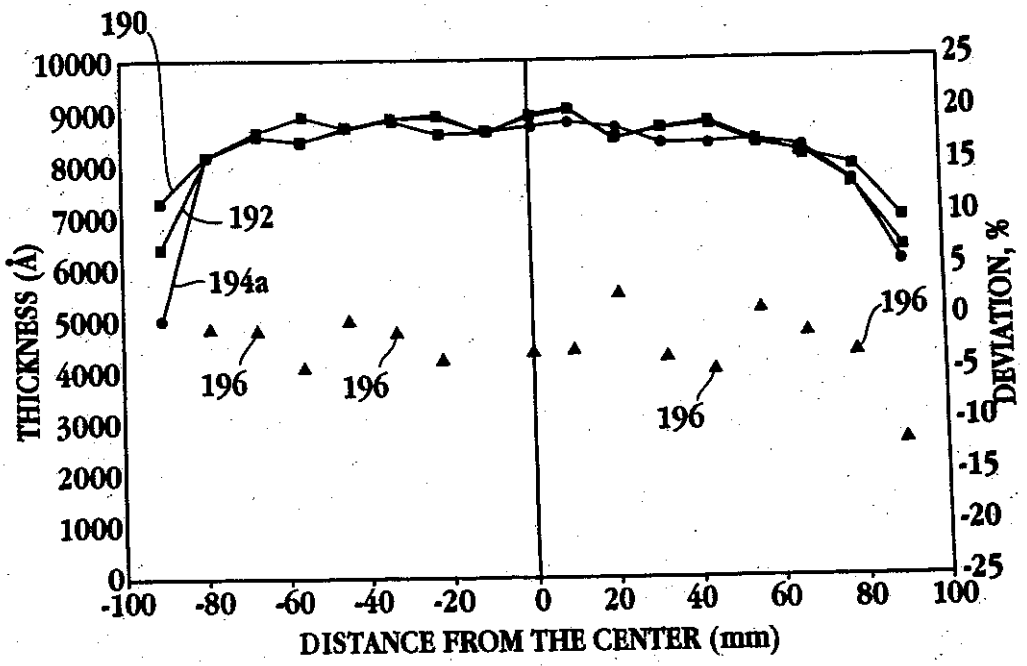

190
192
194a
196
196
196
196
THICKNESS (Å)
DEVIATION, %
DISTANCE FROM THE CENTER (mm)

Fig. 8A

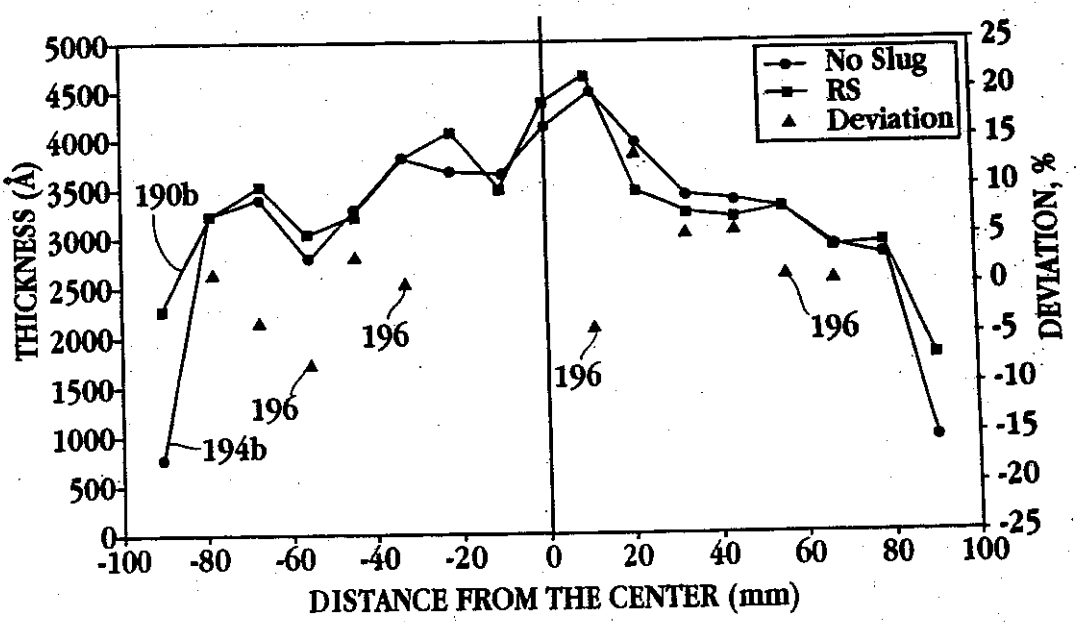

No Slug
RS
Deviation
190b
194b
196
196
196
196
THICKNESS (Å)
DEVIATION, %
DISTANCE FROM THE CENTER (mm)

Fig. 8B

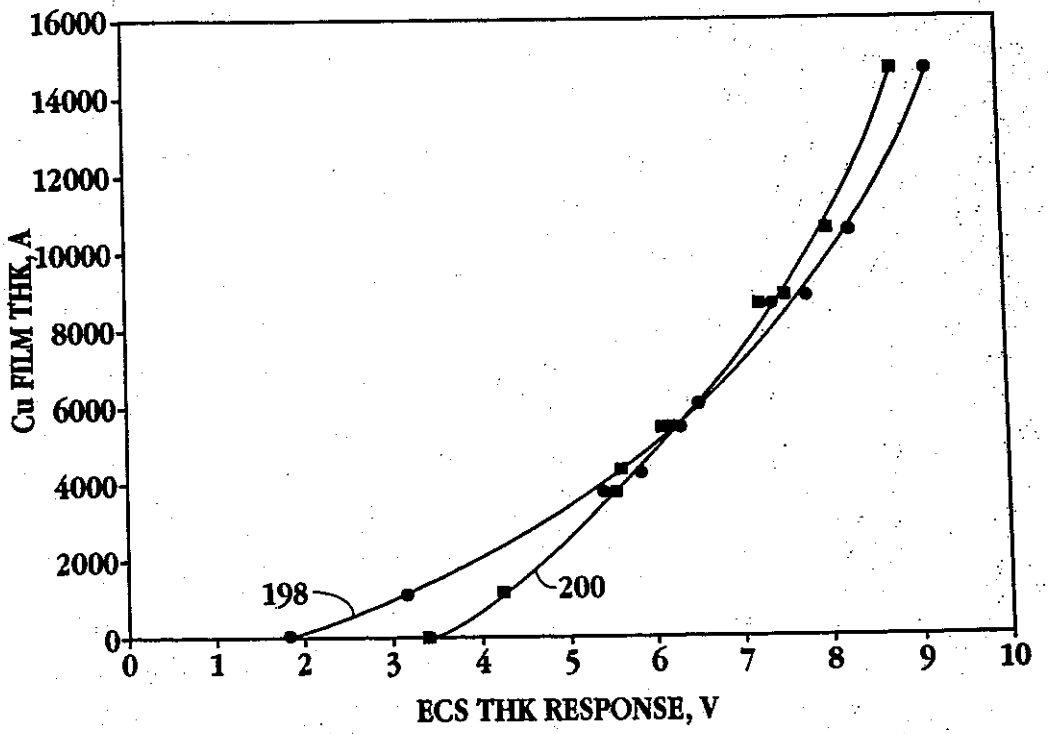

16000
14000
12000
10000
8000
6000
4000
2000
0
Cu FILM THK, A
0
1
2
3
4
5
6
7
8
9
10
ECS THK RESPONSE, V
198
200

Fig. 9

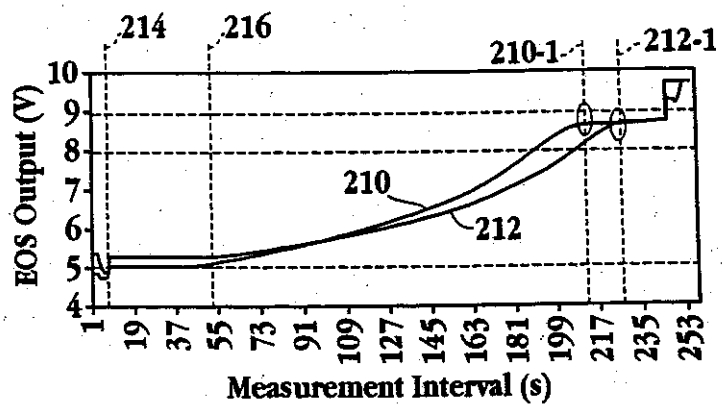


Fig. 10

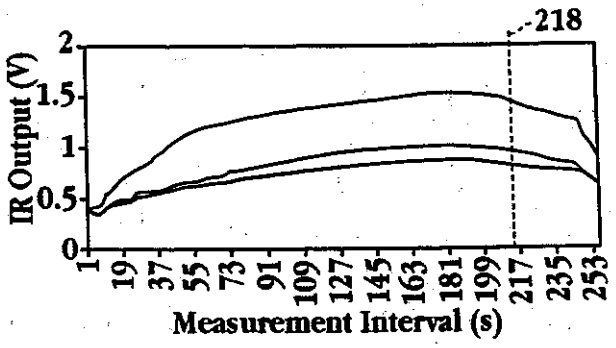


Fig. 11A

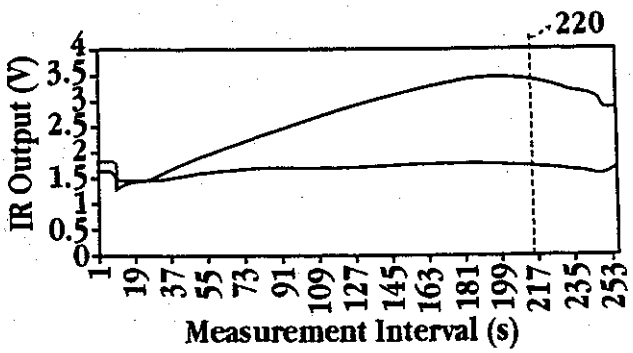


Fig. 11B

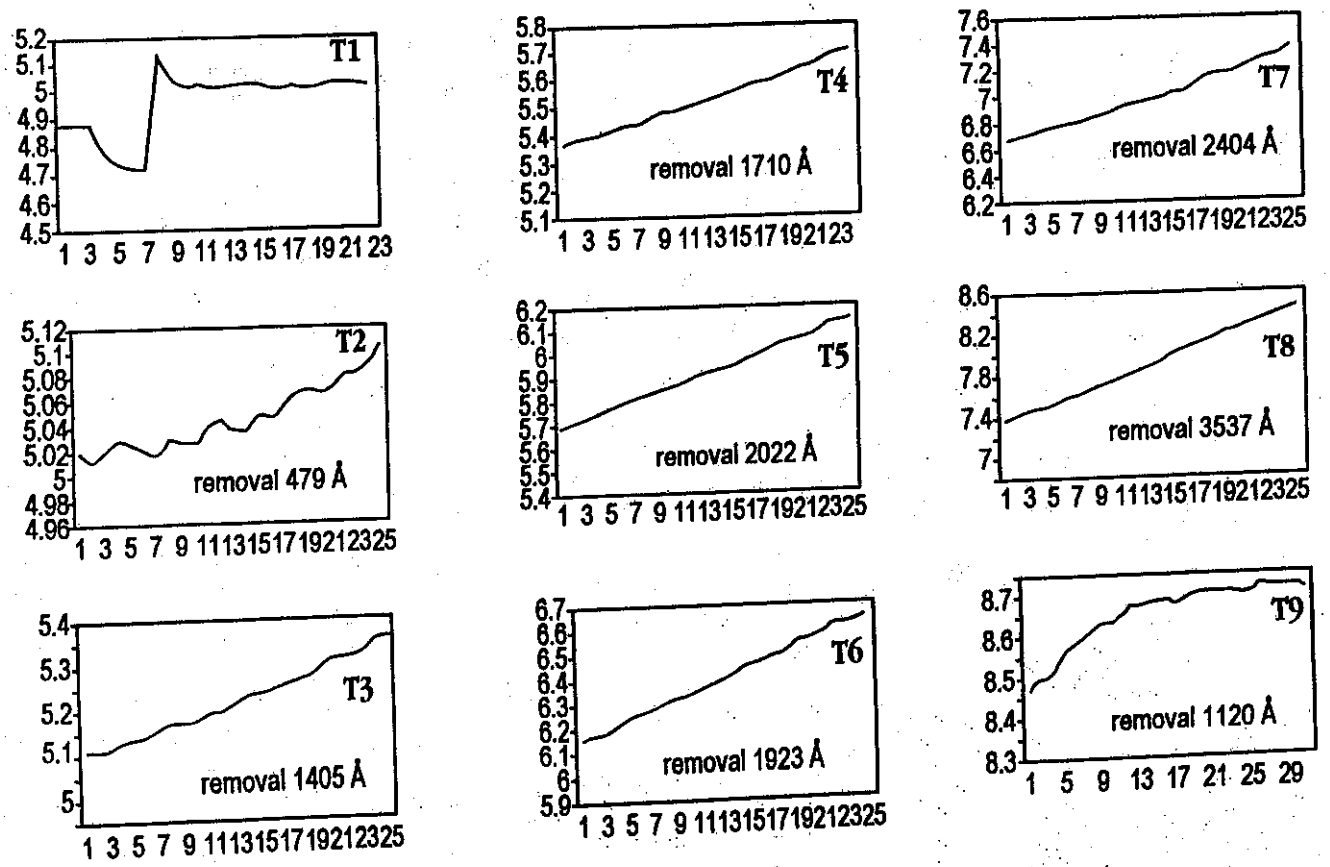

T1
5.2 5.1 5 4.9 4.8 4.7 4.6 4.5
1 3 5 7 9 11 13 15 17 19 21 23
T2
removal 479 Å
5.12 5.1 5.08 5.06 5.04 5.02 5 4.98 4.96
1 3 5 7 9 1113151719212325
T3
removal 1405 Å
5.4 5.3 5.2 5.1 5
1 3 5 7 9 1113151719212325
T4
removal 1710 Å
5.8 5.7 5.6 5.5 5.4 5.3 5.2 5.1
1 3 5 7 9 1113151719212325
T5
removal 2022 Å
6.2 6.1 6 5.9 5.8 5.7 5.6 5.5 5.4
1 3 5 7 9 1113151719212325
T6
removal 1923 Å
6.7 6.6 6.5 6.4 6.3 6.2 6.1 6 5.9
1 3 5 7 9 1113151719212325
T7
removal 2404 Å
7.6 7.4 7.2 7 6.8 6.6 6.4 6.2
1 3 5 7 9 1113151719212325
T8
removal 3537 Å
8.6 8.2 7.8 7.4 7
1 3 5 7 9 1113151719212325
T9
removal 1120 Å
8.7 8.6 8.5 8.4 8.3
1 5 9 13 17 21 25 29

Fig. 12

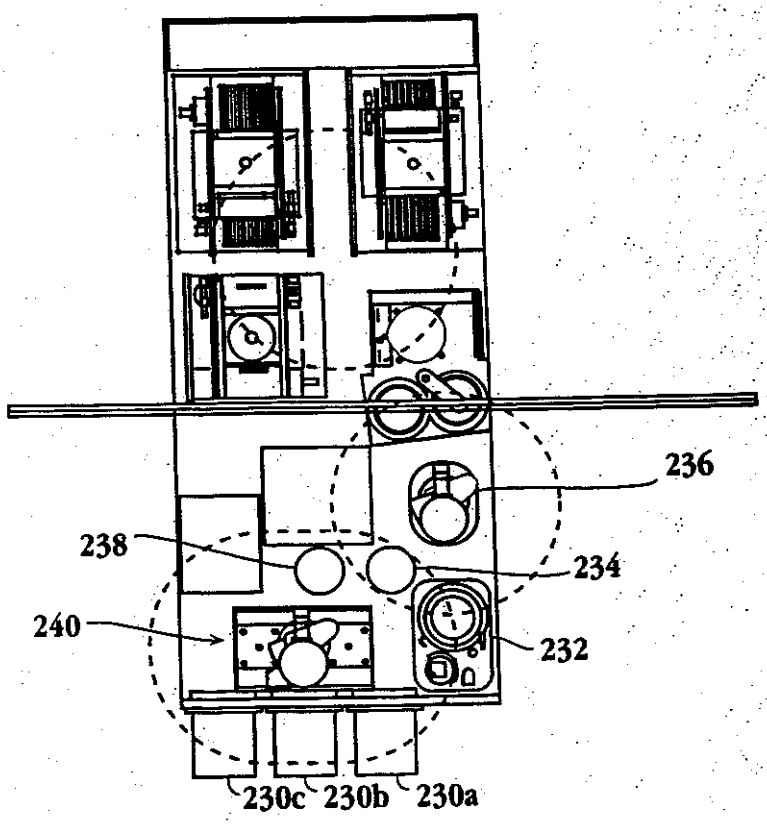


Fig. 13

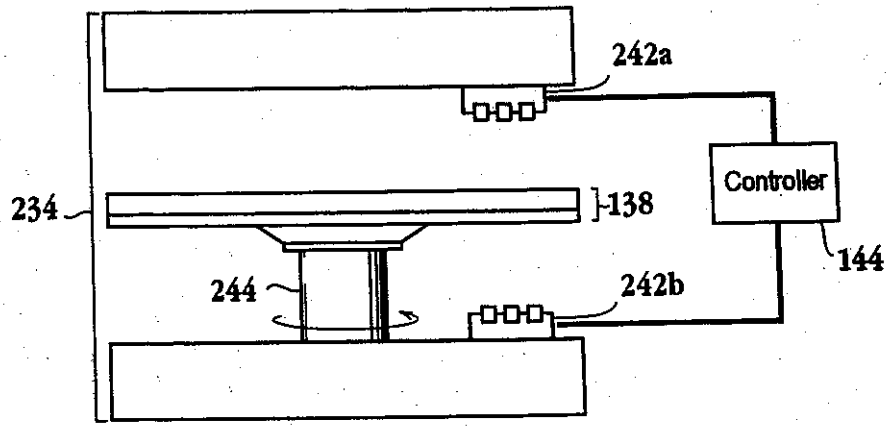


Fig. 14

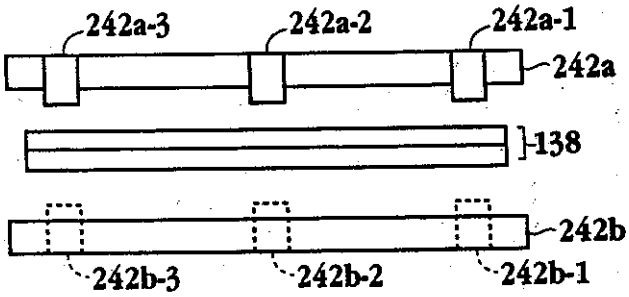

242a-3
242a-2
242a-1
242a
138
242b
242b-3
242b-2
242b-1

Fig. 15

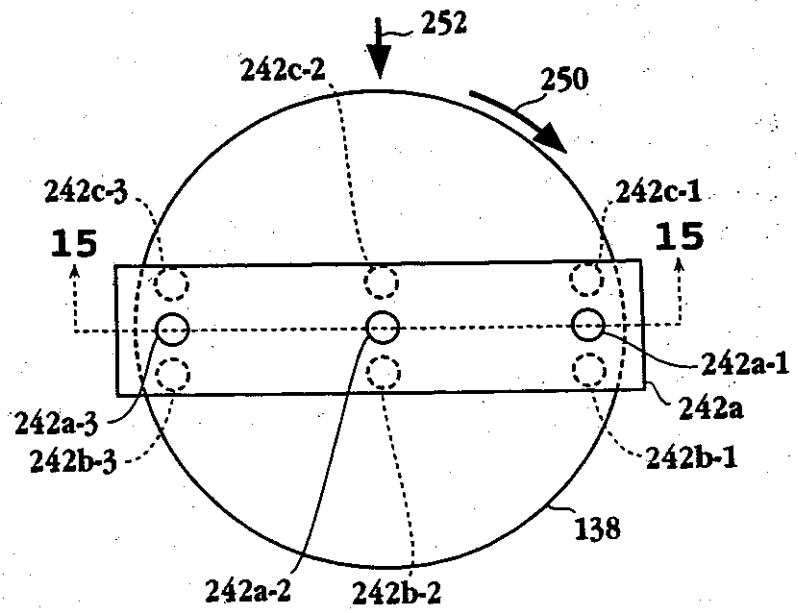

252
242c-2
250
242c-3
242c-1
15
15
242a-1
242a
242a-3
242b-3
242b-1
138
242a-2
242b-2

Fig. 16

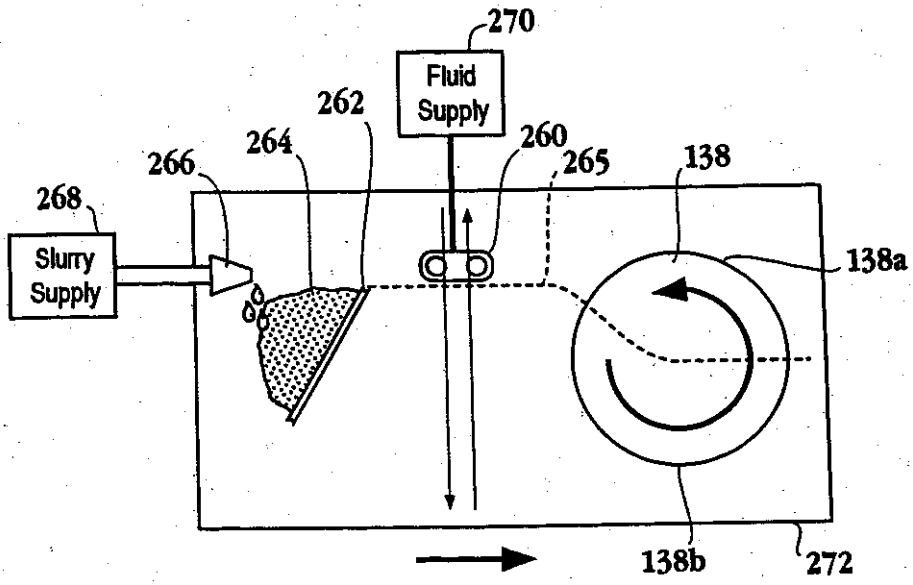


Fig. 17A

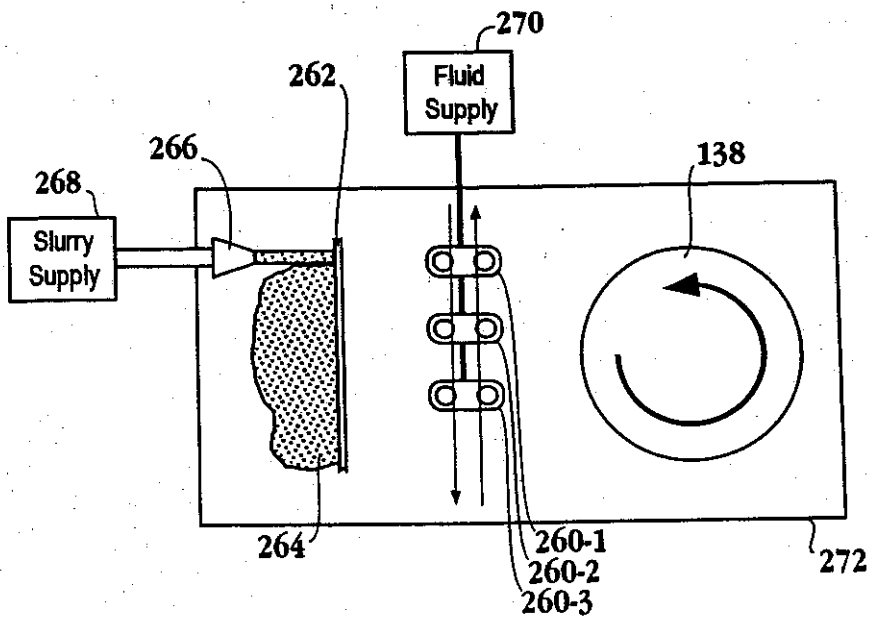


Fig. 17B

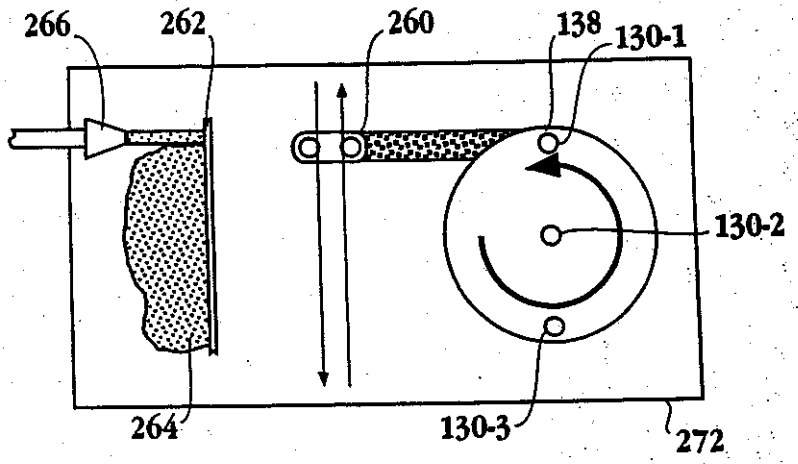


Fig. 17C

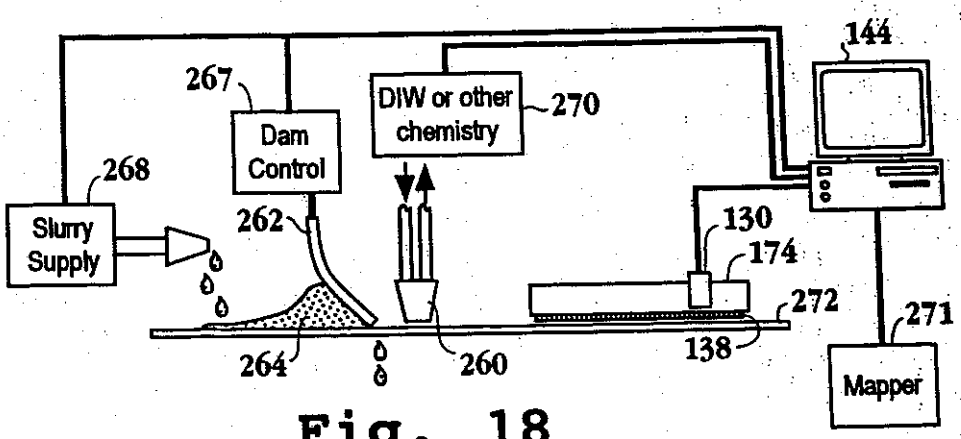


Fig. 18

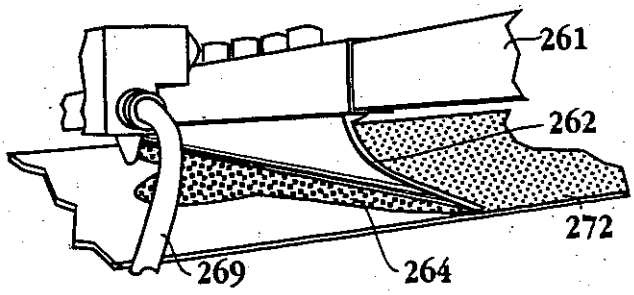


Fig. 19

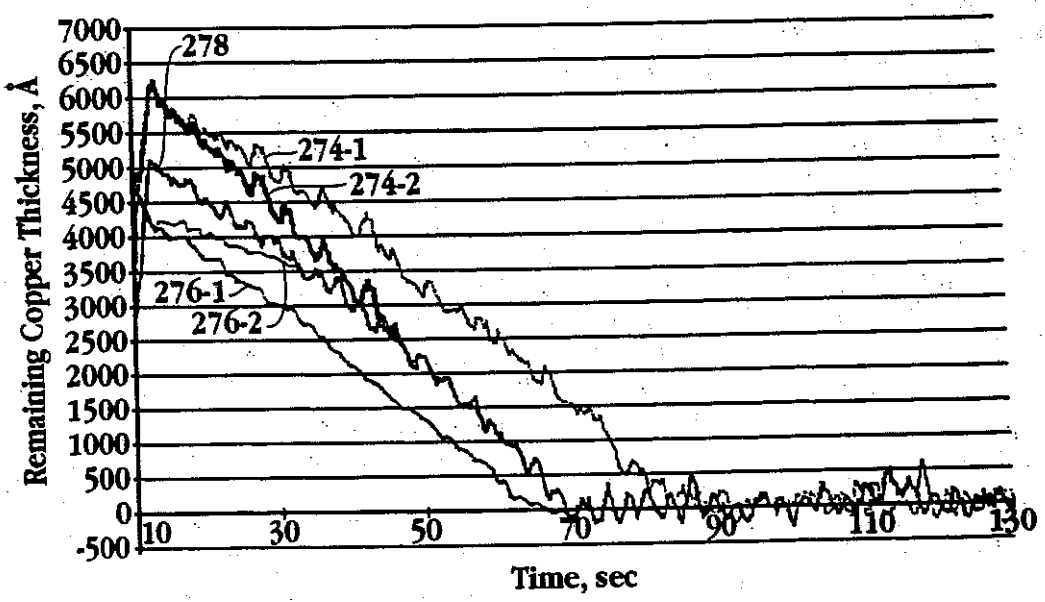

Remaining Copper Thickness, Å
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
278
274-1
274-2
276-1
276-2
10
30
50
70
90
110
130
Time, sec

Fig. 20

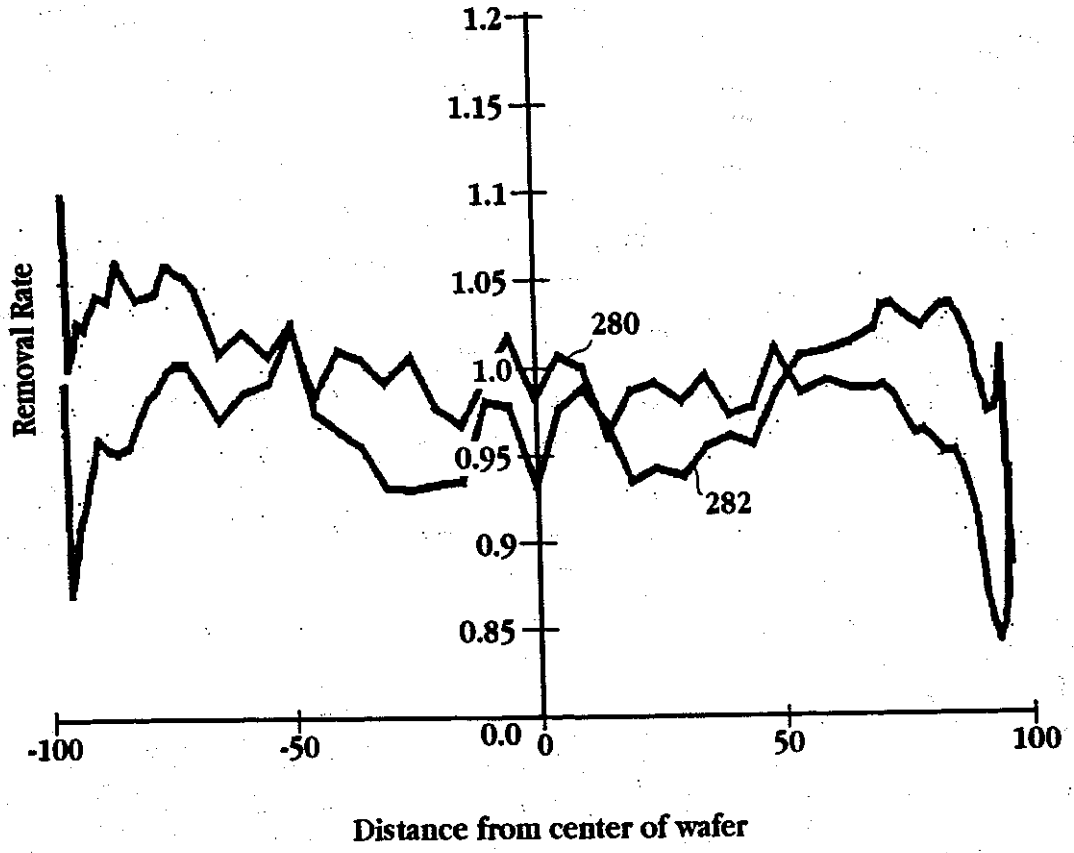

1.2
1.15
1.1
1.05
1.0
0.95
0.9
0.85
Removal Rate
280
282
-100
-50
0.0
0
50
100
Distance from center of wafer

Fig. 21

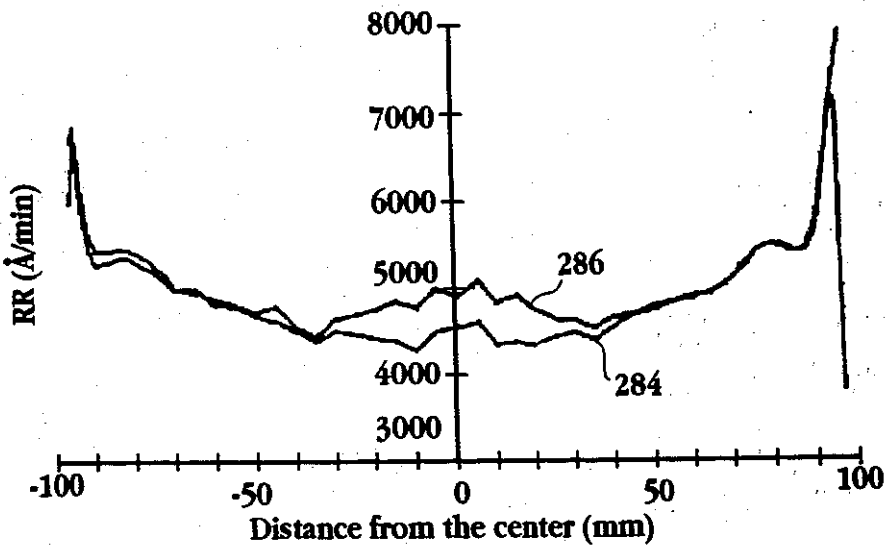


Fig. 22A

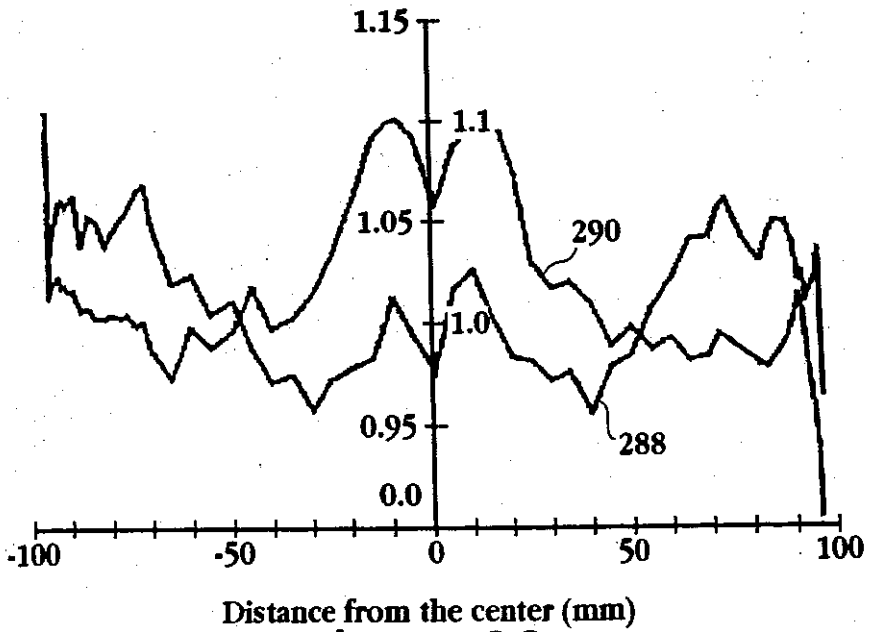


Fig. 22B

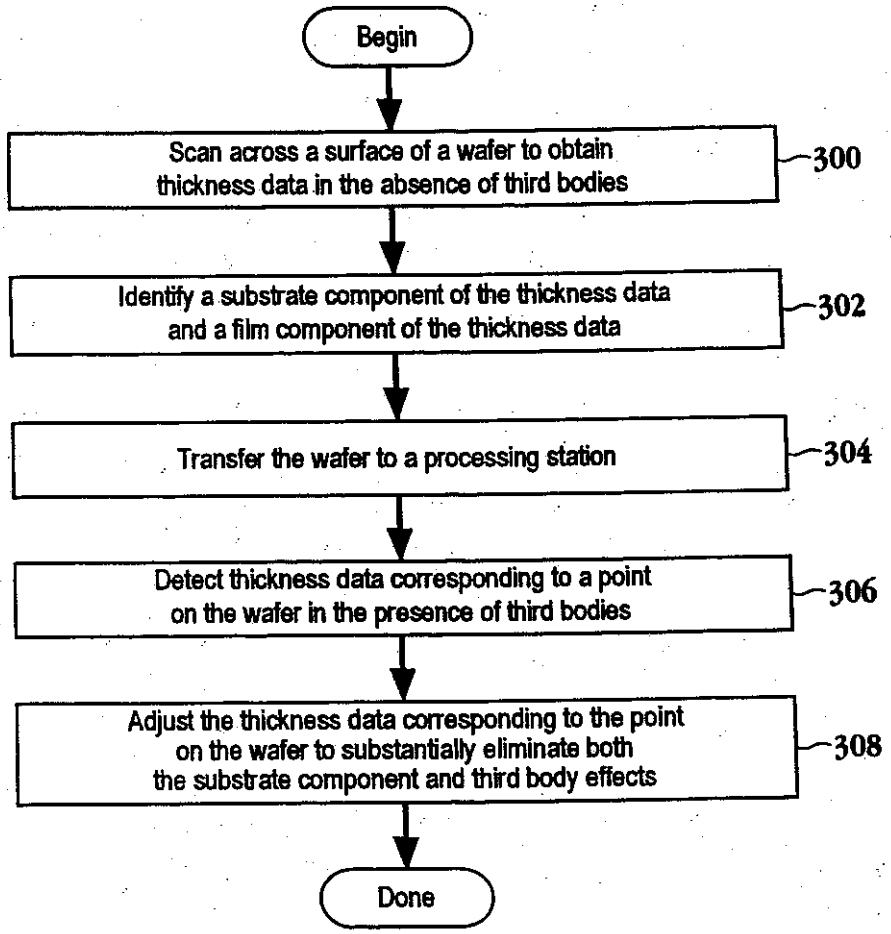

Begin
Scan across a surface of a wafer to obtain thickness data in the absence of third bodies
300
Identify a substrate component of the thickness data and a film component of the thickness data
302
Transfer the wafer to a processing station
304
Detect thickness data corresponding to a point on the wafer in the presence of third bodies
306
Adjust the thickness data corresponding to the point on the wafer to substantially eliminate both the substrate component and third body effects
308
Done

Fig. 23

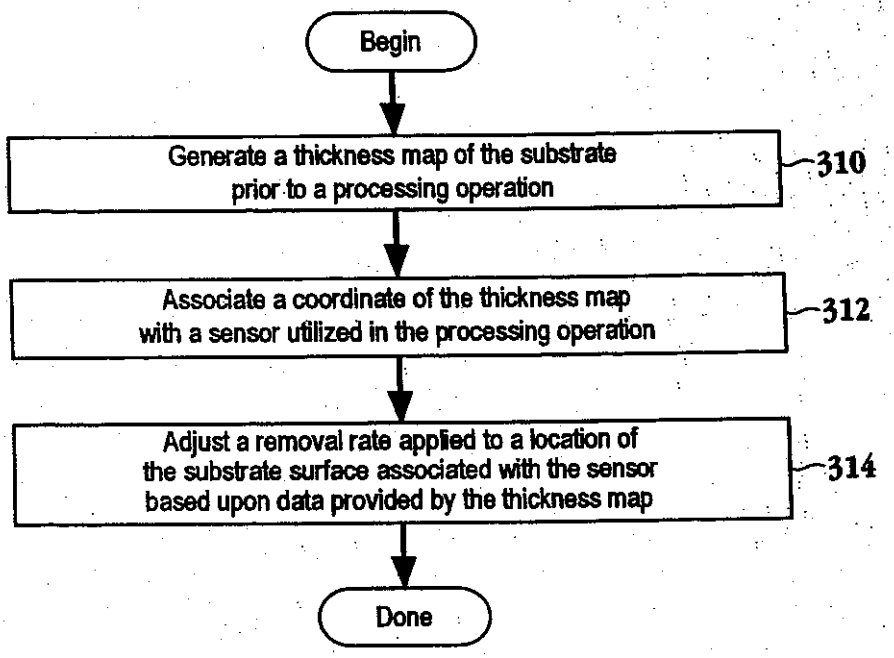

Begin
Generate a thickness map of the substrate prior to a processing operation
310
Associate a coordinate of the thickness map with a sensor utilized in the processing operation
312
Adjust a removal rate applied to a location of the substrate surface associated with the sensor based upon data provided by the thickness map
314
Done

Fig. 24