05 JAN 2005

FIG. 1 (PRIOR ART)

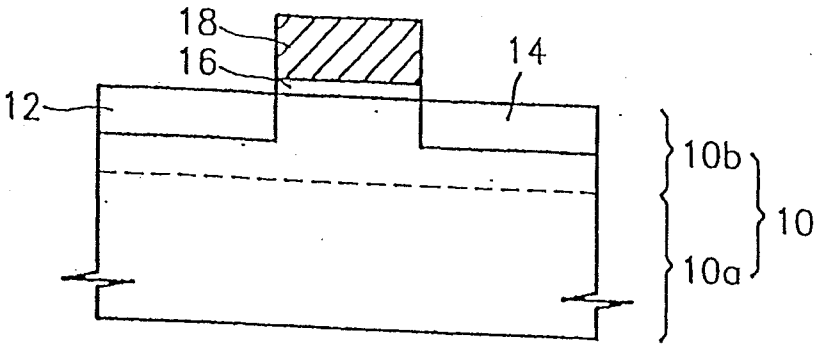


FIG. 2 (PRIOR ART)

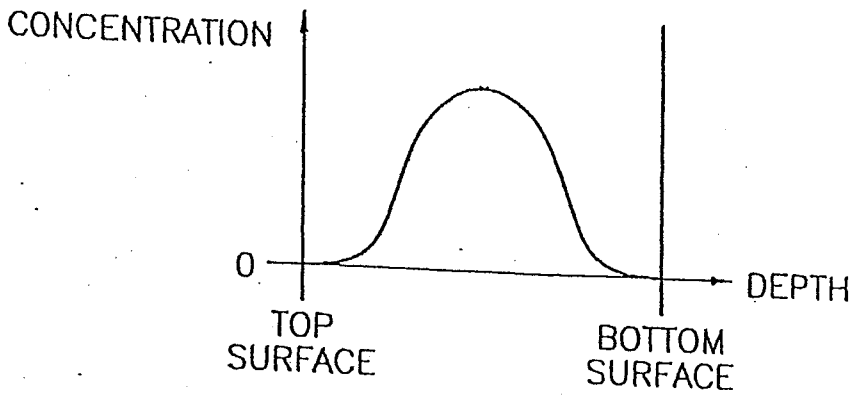


FIG. 3 (PRIOR ART)

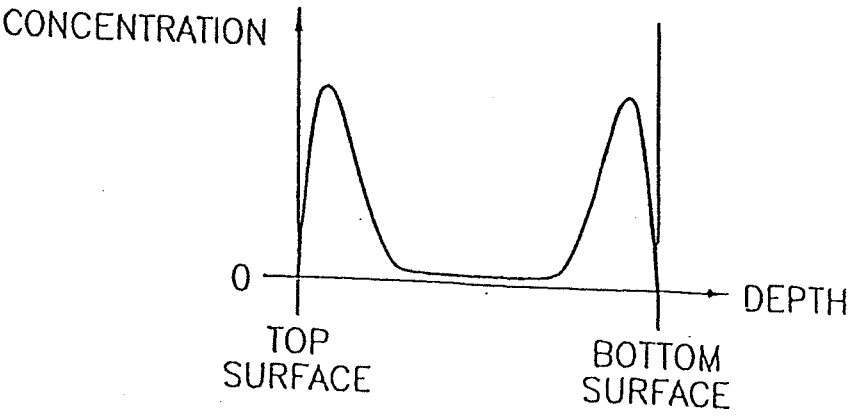


FIG. 4

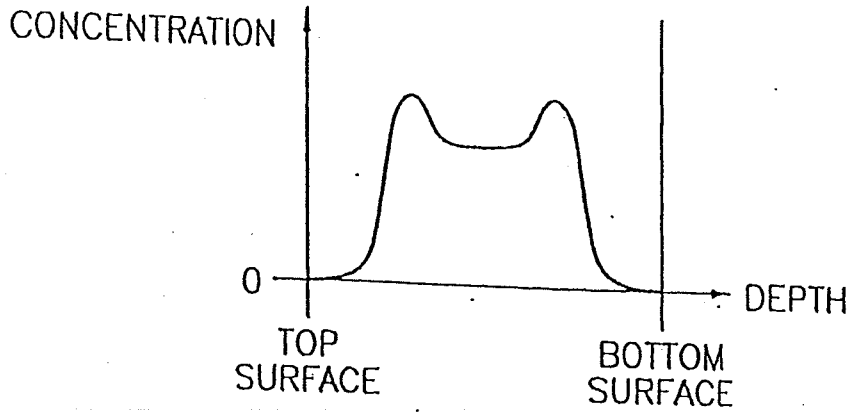

CONCENTRATION
0
DEPTH
TOP SURFACE
BOTTOM SURFACE

FIG. 5

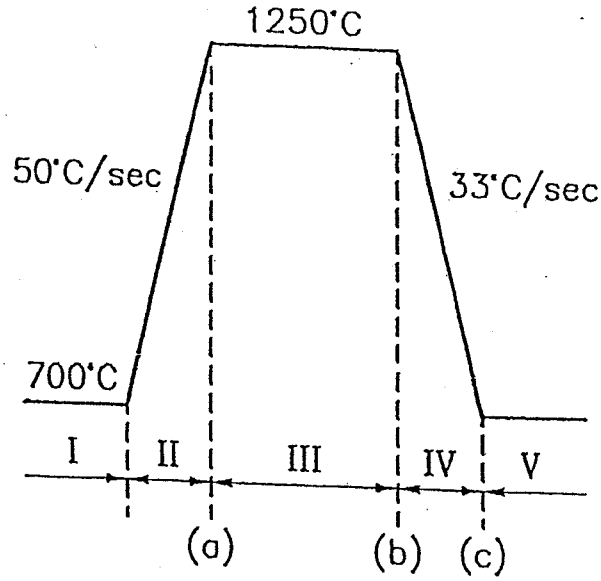

1250°C
50°C/sec
33°C/sec
700°C
I
II
III
IV
V
(a)
(b)
(c)

FIG. 6

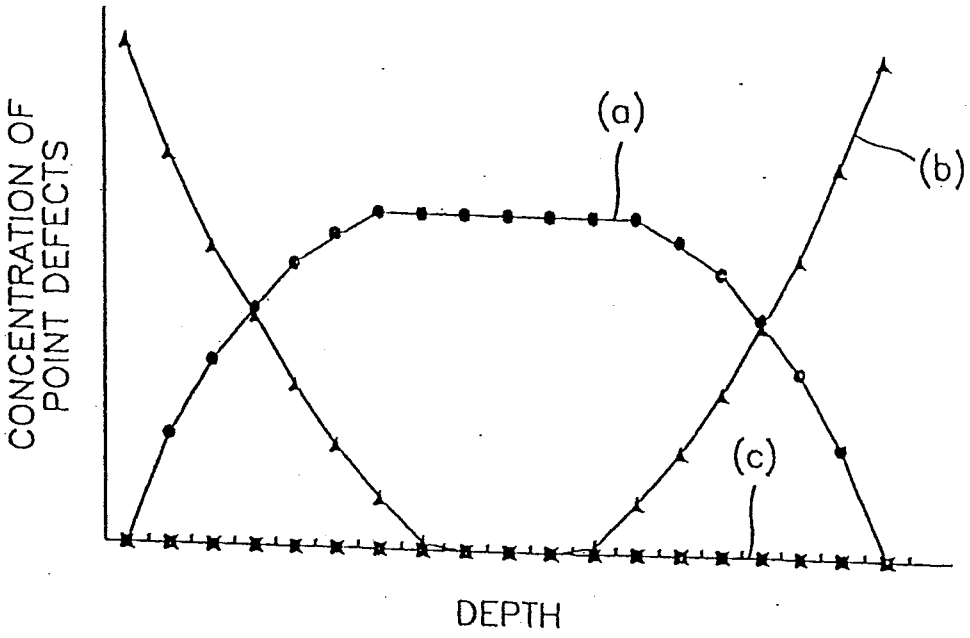

CONCENTRATION OF POINT DEFECTS
(a)
(b)
(c)
DEPTH

FIG. 7

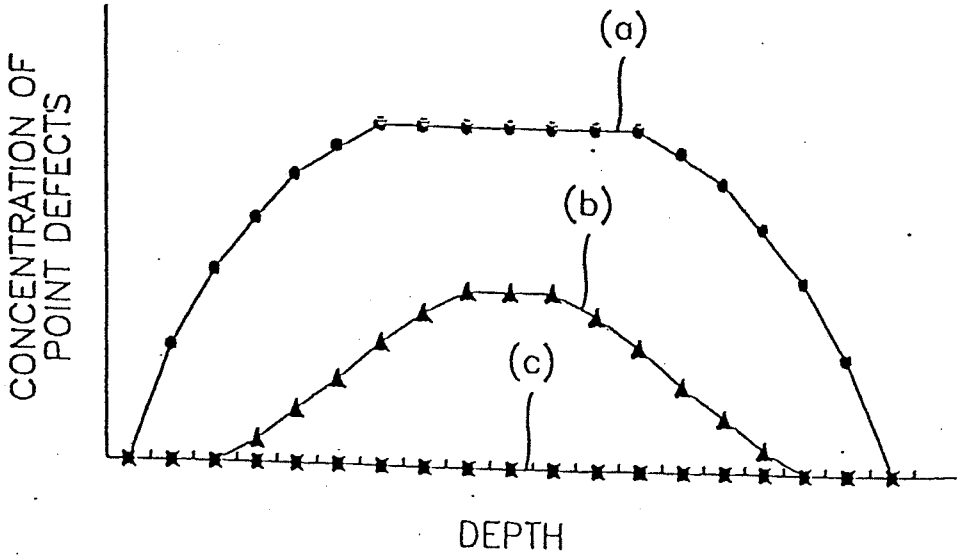

CONCENTRATION OF POINT DEFECTS
(a)
(b)
(c)
DEPTH

FIG. 8

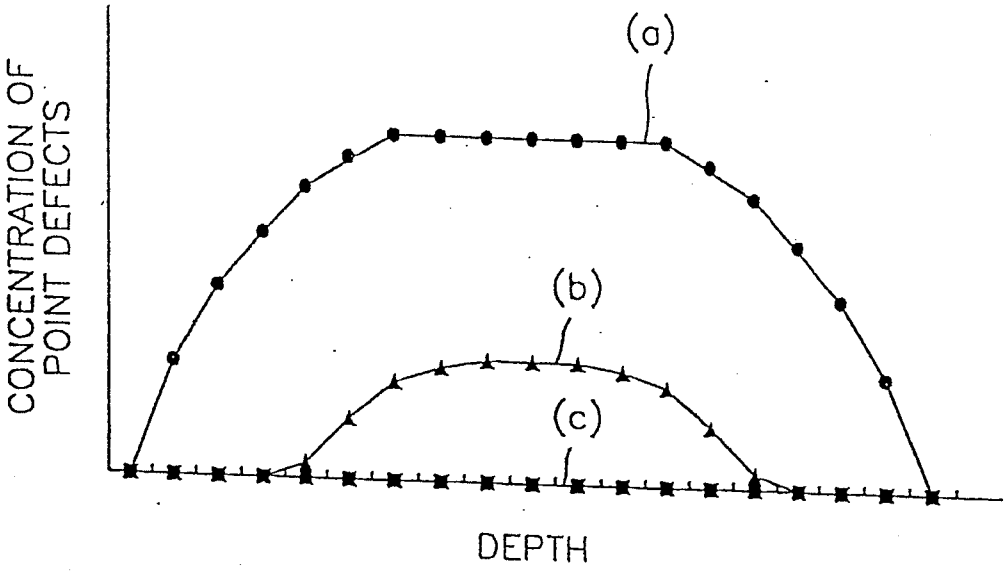

CONCENTRATION OF POINT DEFECTS
(a)
(b)
(c)
DEPTH

FIG. 9

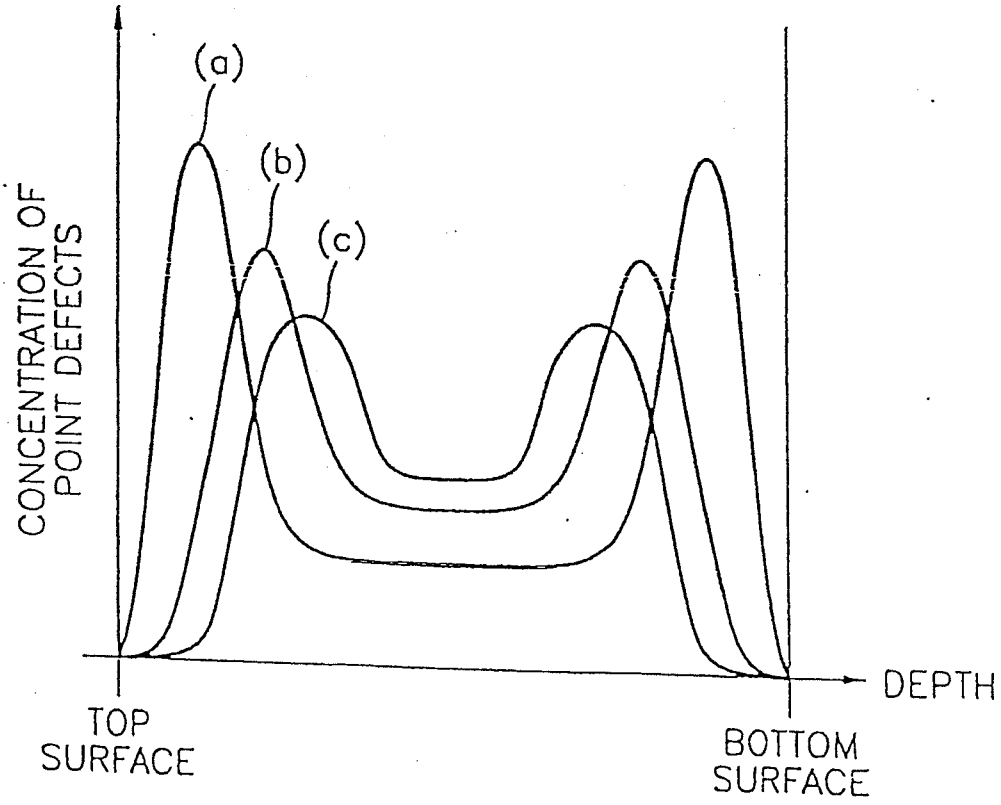

CONCENTRATION OF POINT DEFECTS
(a)
(b)
(c)
DEPTH
TOP SURFACE
BOTTOM SURFACE

FIG. 10

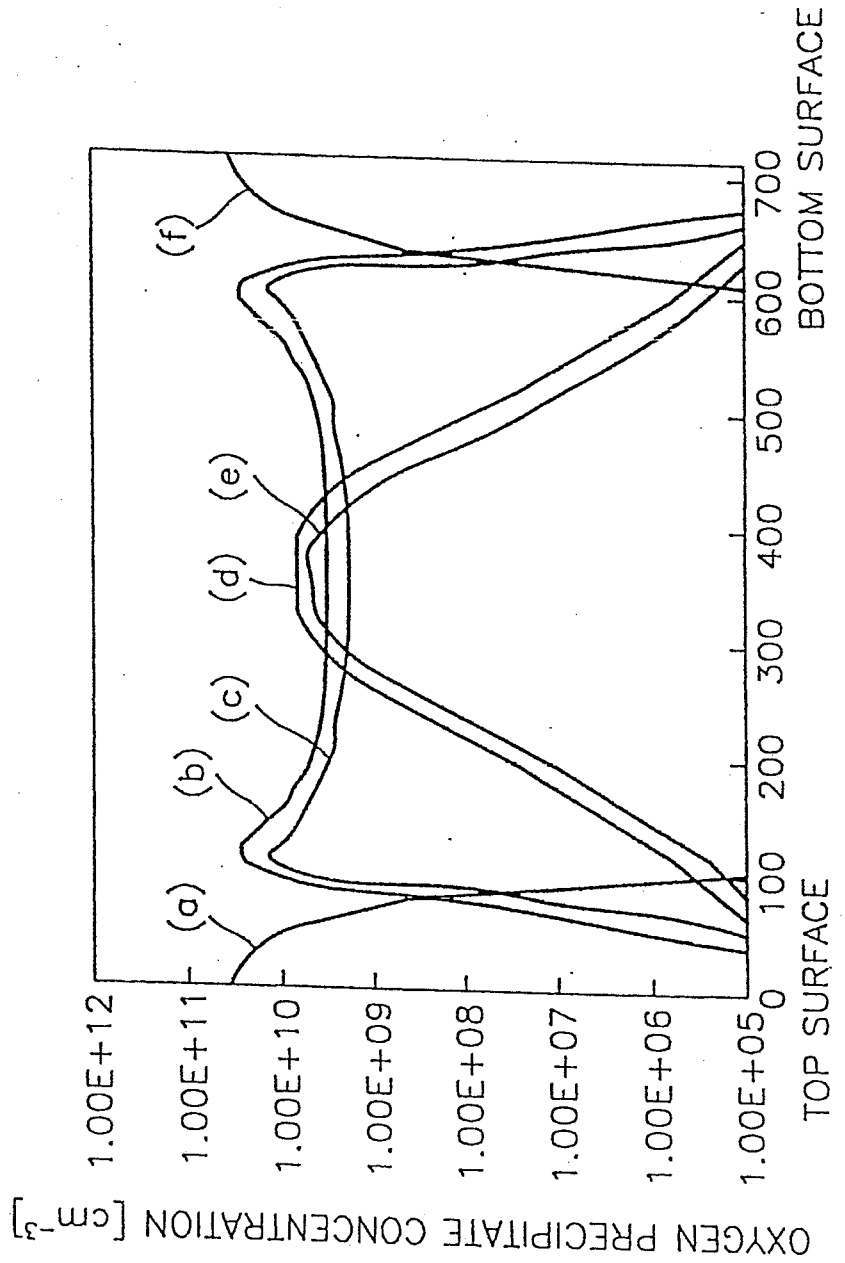

OXYGEN PRECIPITATE CONCENTRATION [cm⁻³]
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
(a)
(b)
(c)
(d)
(e)
(f)
0
100
200
300
400
500
600
700
TOP SURFACE
BOTTOM SURFACE
DEPTH (μm)

FIG. 11

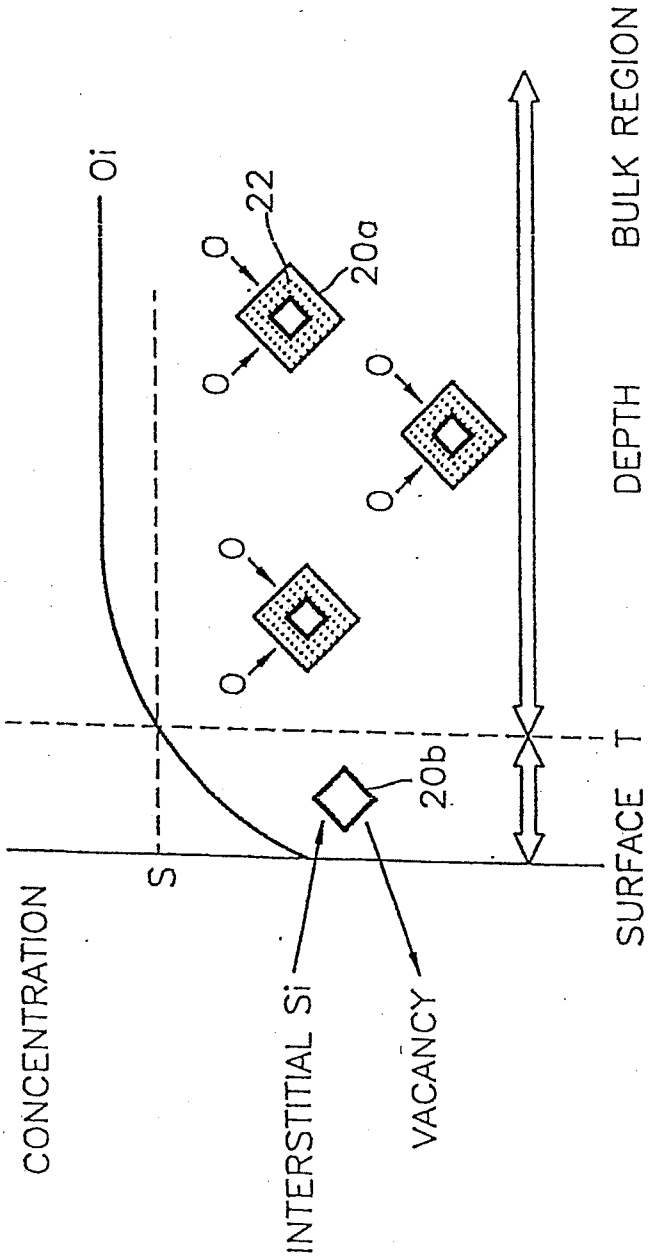

Oi
O
22
20a
O
O
O
O
O
O
20b
S
T
CONCENTRATION
DEPTH
BULK REGION
SURFACE
INTERSTITIAL Si
VACANCY

FIG. 12

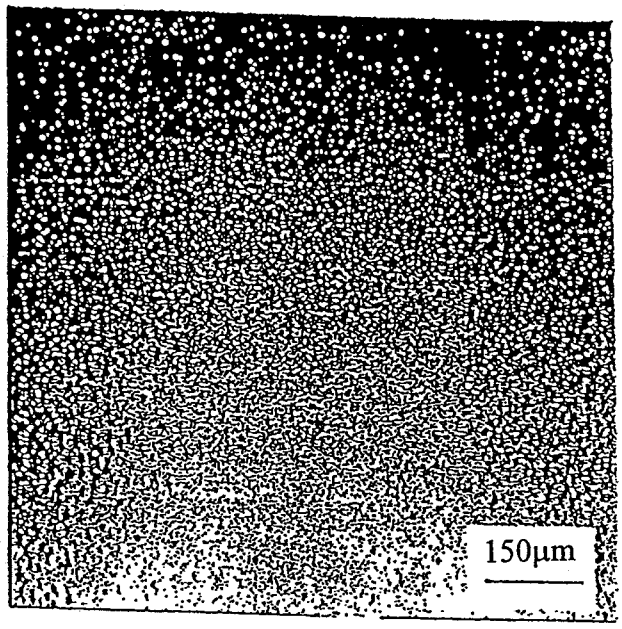


FIG. 13

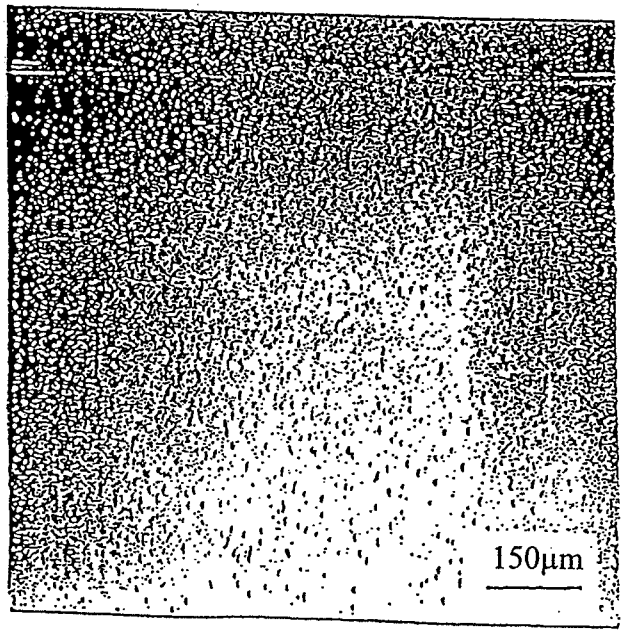


FIG. 14

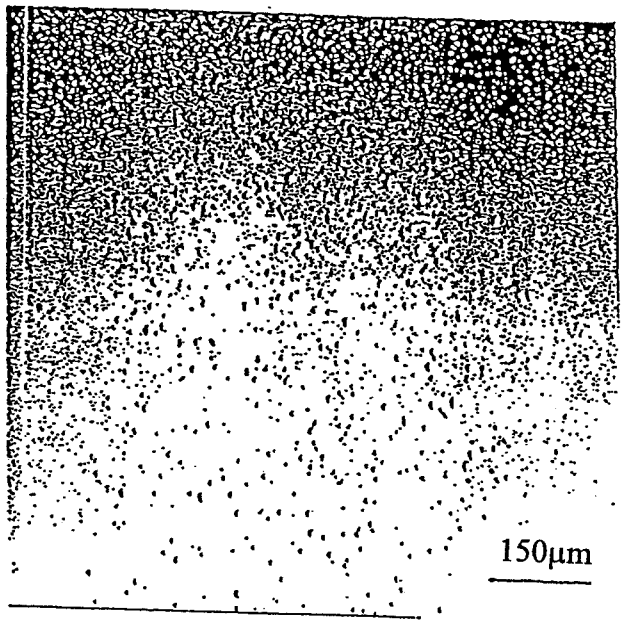


FIG. 15

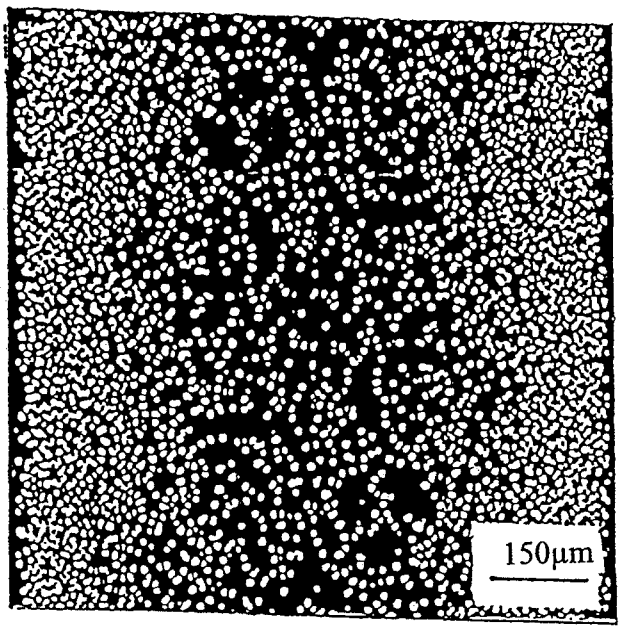


FIG. 16

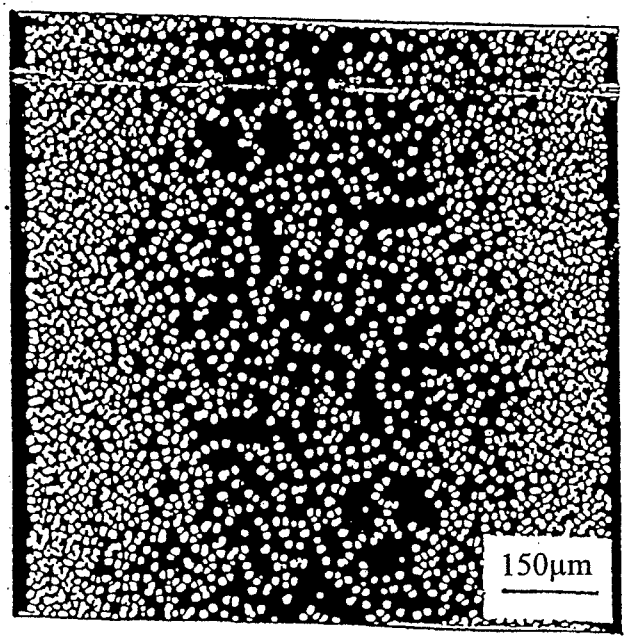


FIG. 17

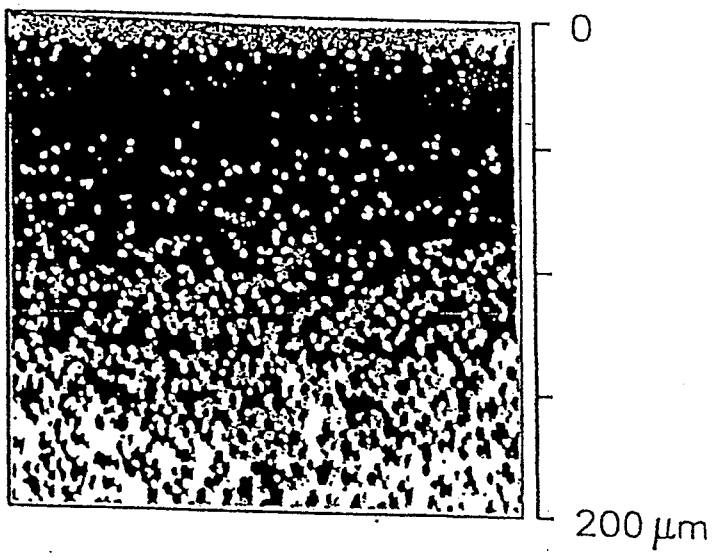


FIG. 18

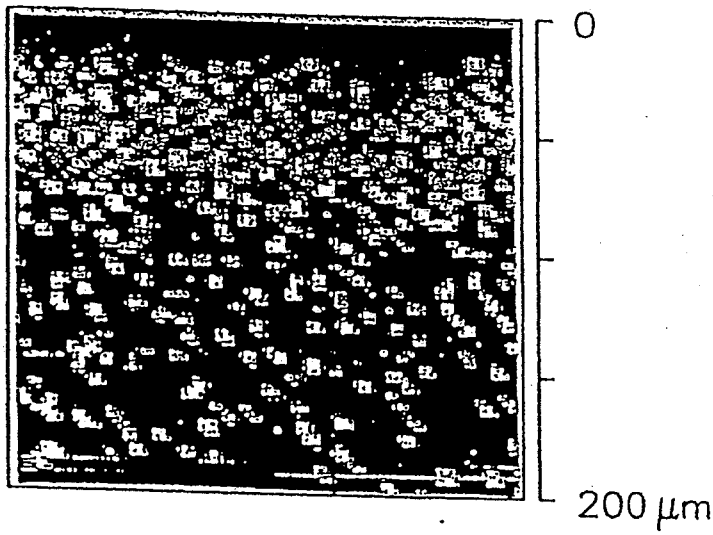


FIG. 19

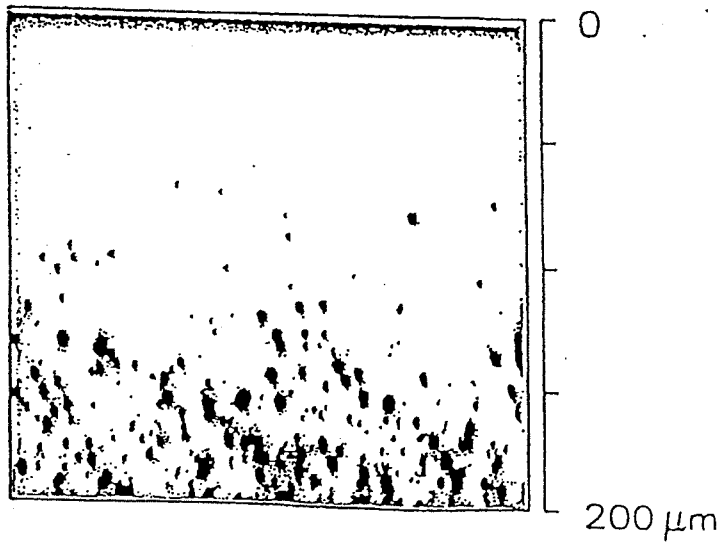


FIG. 20

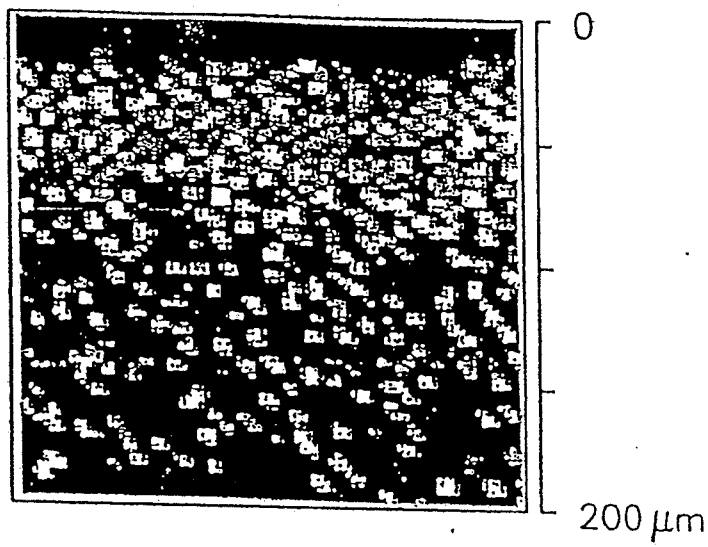


FIG. 21

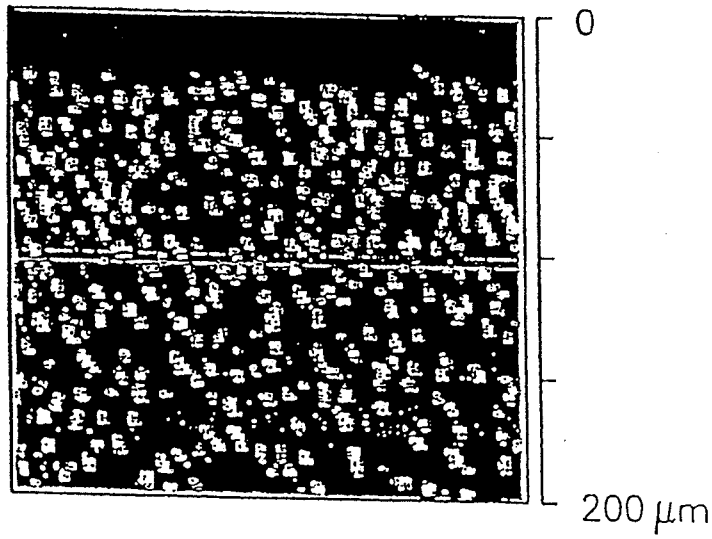


FIG. 22A

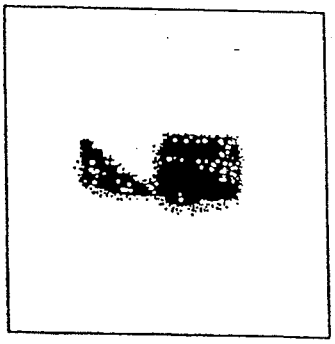


FIG. 22B

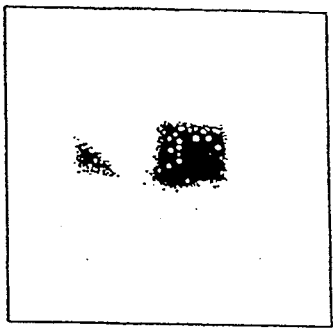


FIG. 23A

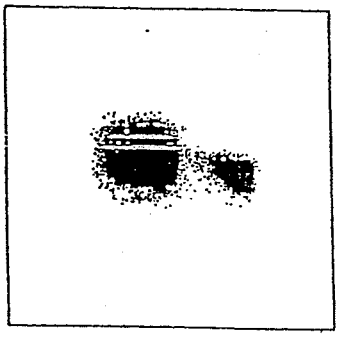


FIG. 23B

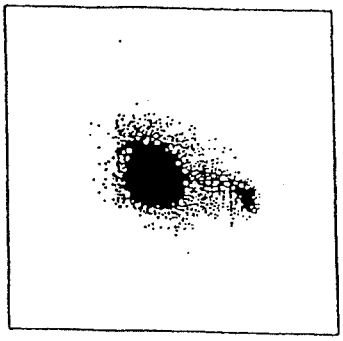


FIG. 24A

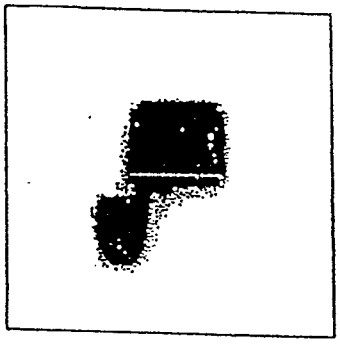


FIG. 24B

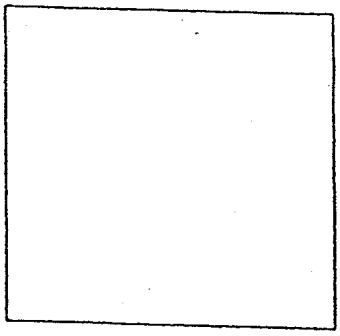


FIG. 25

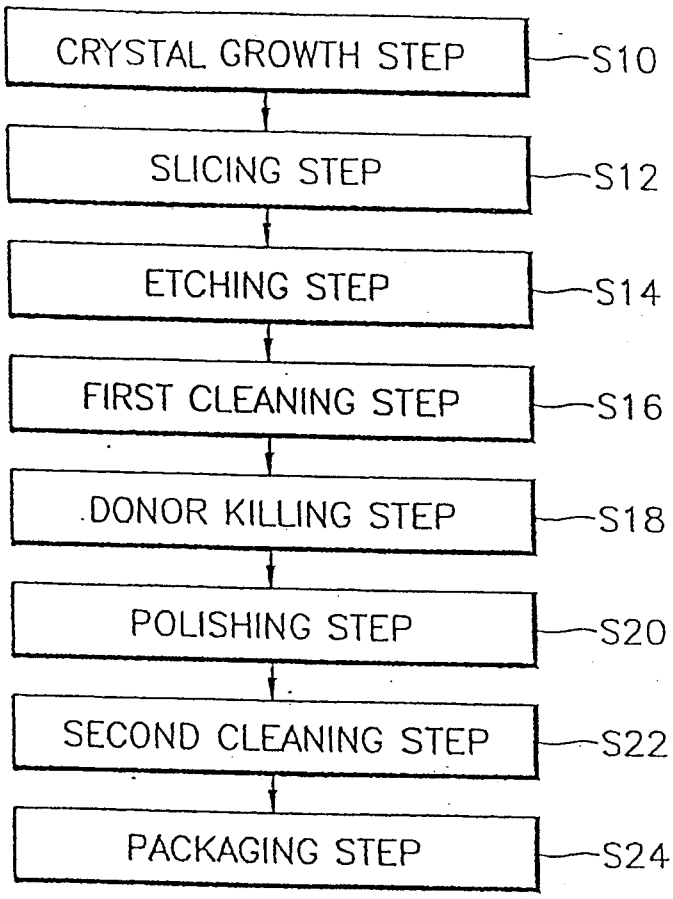

CRYSTAL GROWTH STEP
S10
SLICING STEP
S12
ETCHING STEP
S14
FIRST CLEANING STEP
S16
DONOR KILLING STEP
S18
POLISHING STEP
S20
SECOND CLEANING STEP
S22
PACKAGING STEP
S24

FIG. 26

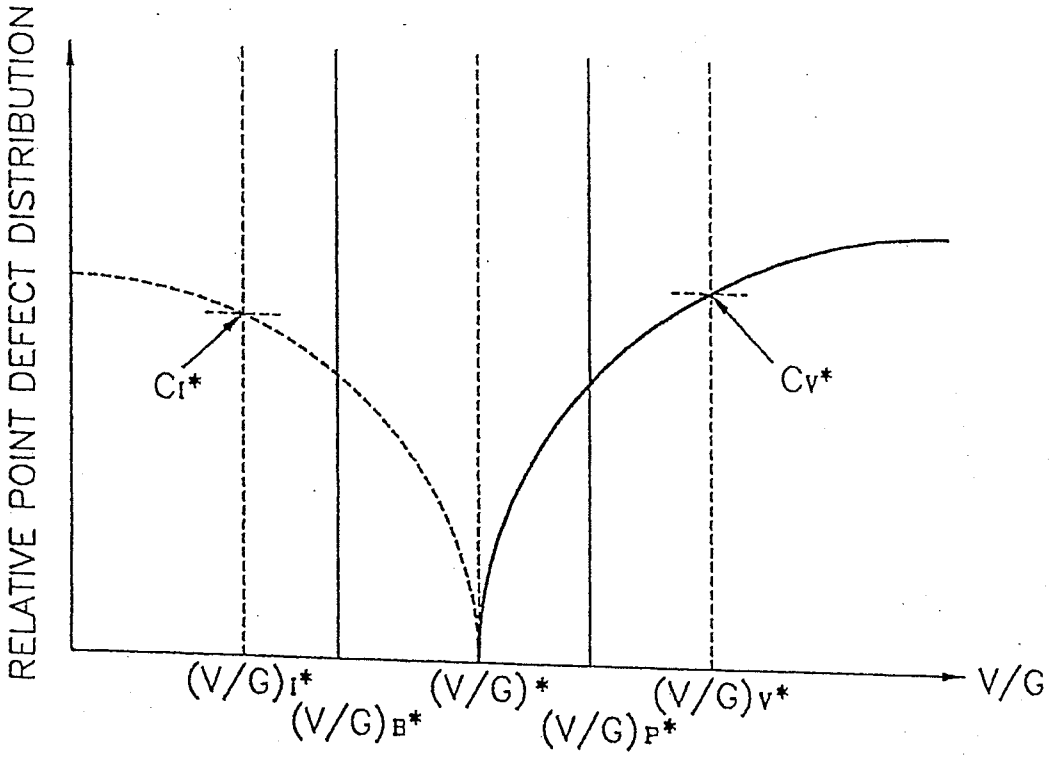

RELATIVE POINT DEFECT DISTRIBUTION
C_I^*
C_V^*
$(V/G)_I^*$
$(V/G)_B^*$
$(V/G)^*$
$(V/G)_P^*$
$(V/G)_V^*$
V/G

FIG. 27 (PRIOR ART)

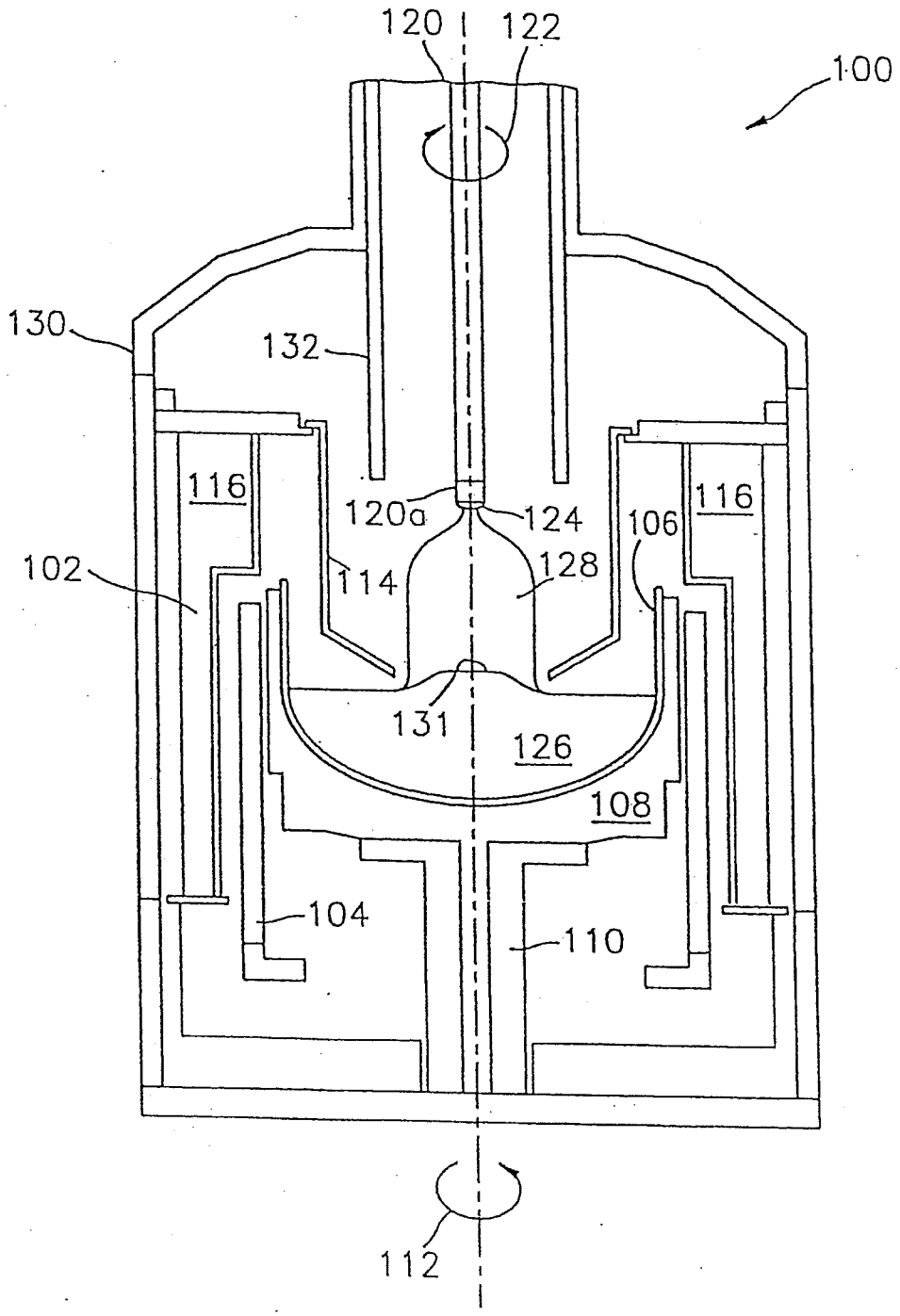


FIG. 28

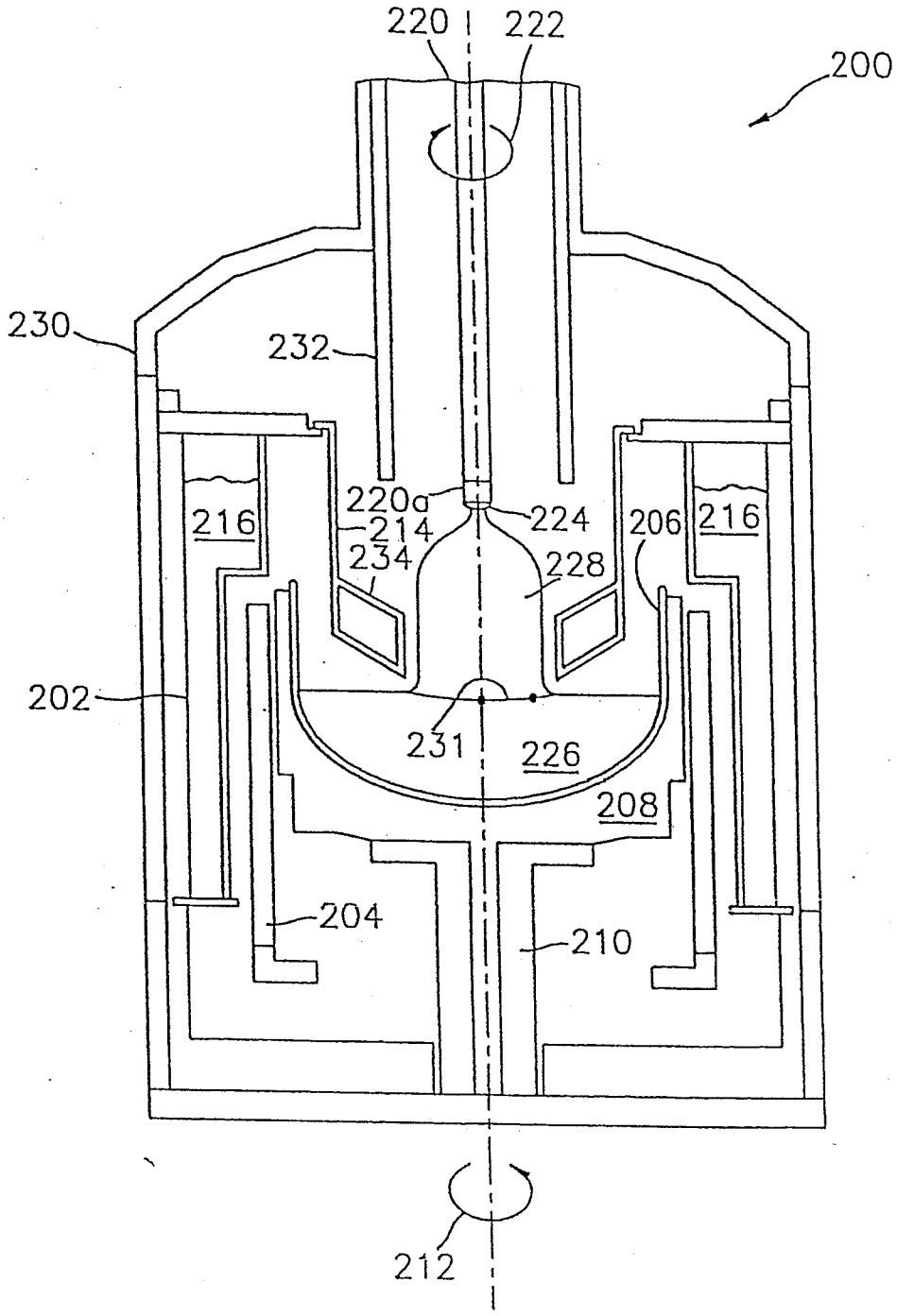

220
222
200
230
232
216
220a
214
234
224
206
216
228
202
231
226
208
204
210
212

FIG. 29

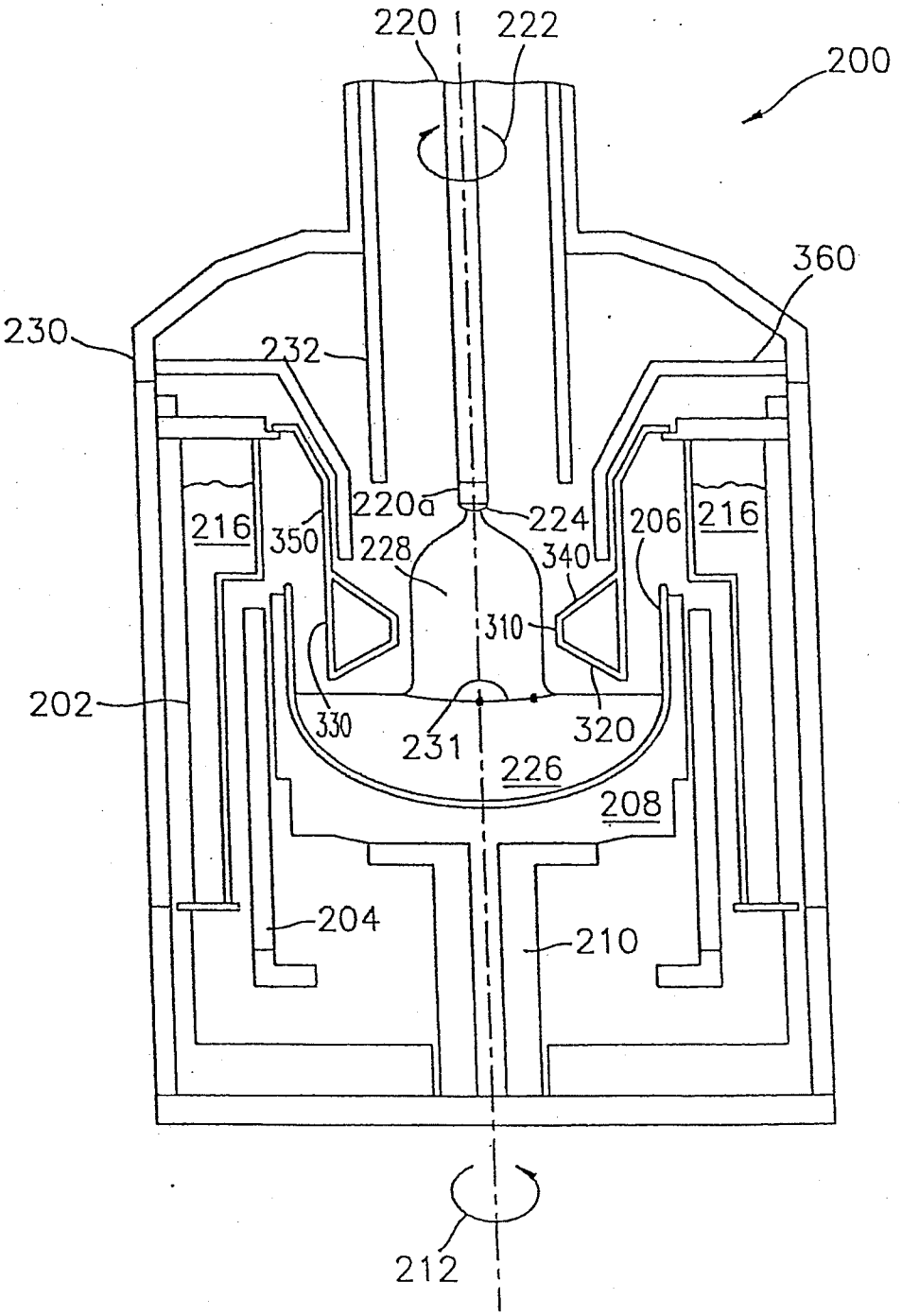

220
222
200
360
230
232
216
350
220a
224
206
216
228
340
310
202
330
231
320
226
208
204
210
212

FIG. 30

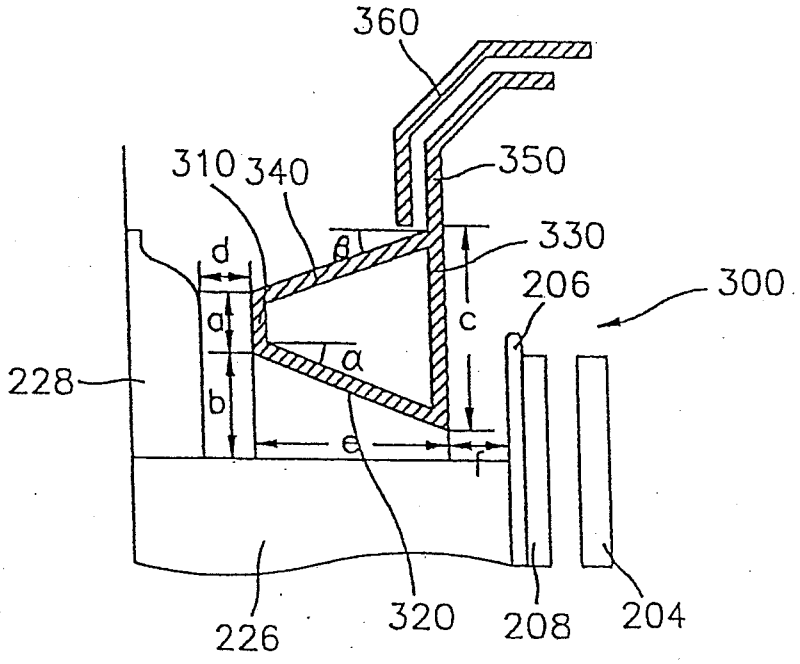


FIG. 31

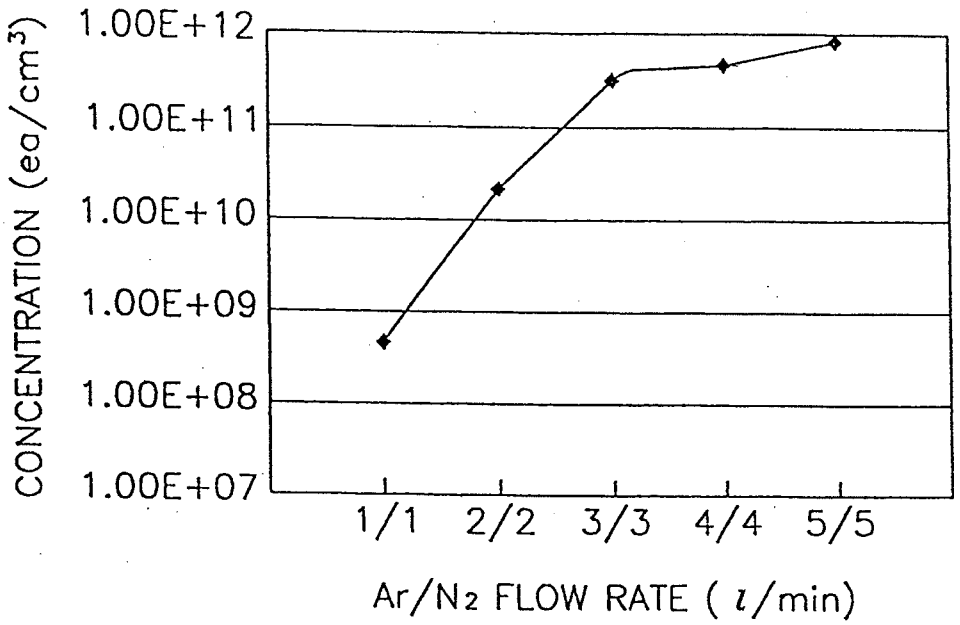

CONCENTRATION (ea/cm³)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
1/1
2/2
3/3
4/4
5/5
Ar/N2 FLOW RATE (ℓ/min)

FIG. 32

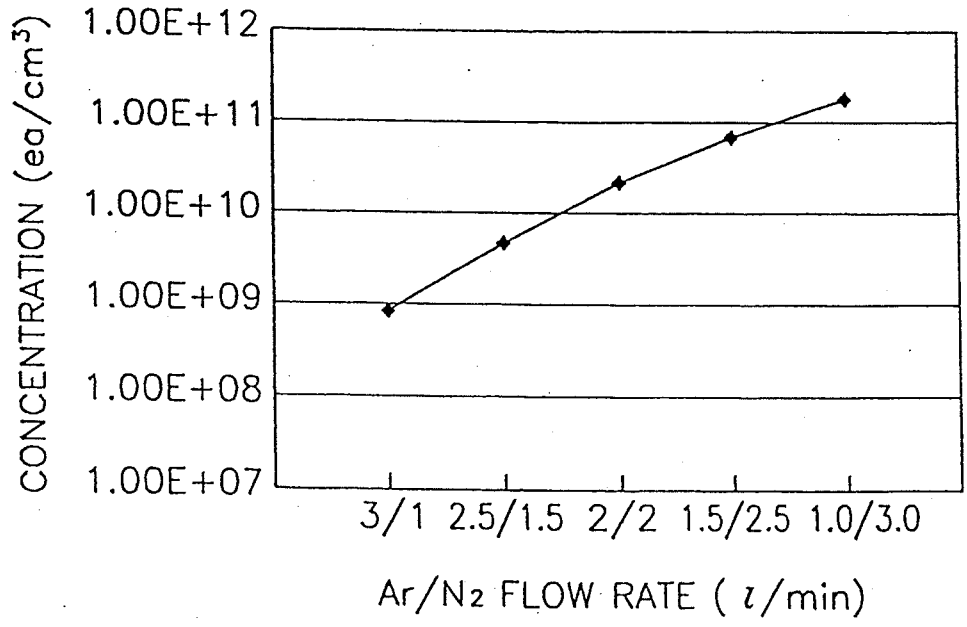

CONCENTRATION (ea/cm³)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
3/1
2.5/1.5
2/2
1.5/2.5
1.0/3.0
Ar/N2 FLOW RATE (ℓ/min)

FIG. 33

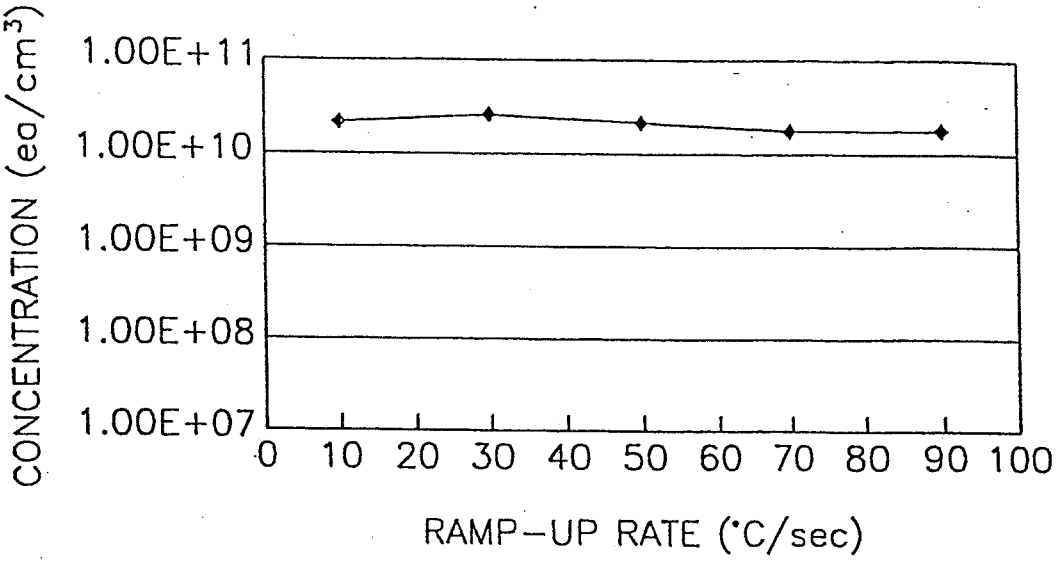

CONCENTRATION (ea/cm3)
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
0
10
20
30
40
50
60
70
80
90
100
RAMP-UP RATE (°C/sec)

FIG. 34

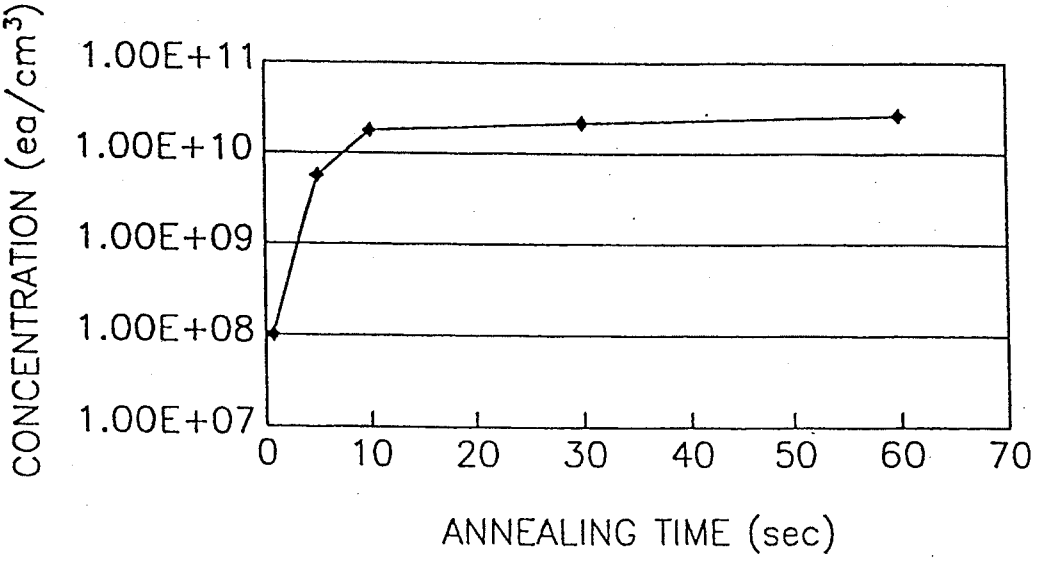

CONCENTRATION (ea/cm3)
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
0
10
20
30
40
50
60
70
ANNEALING TIME (sec)

FIG. 35

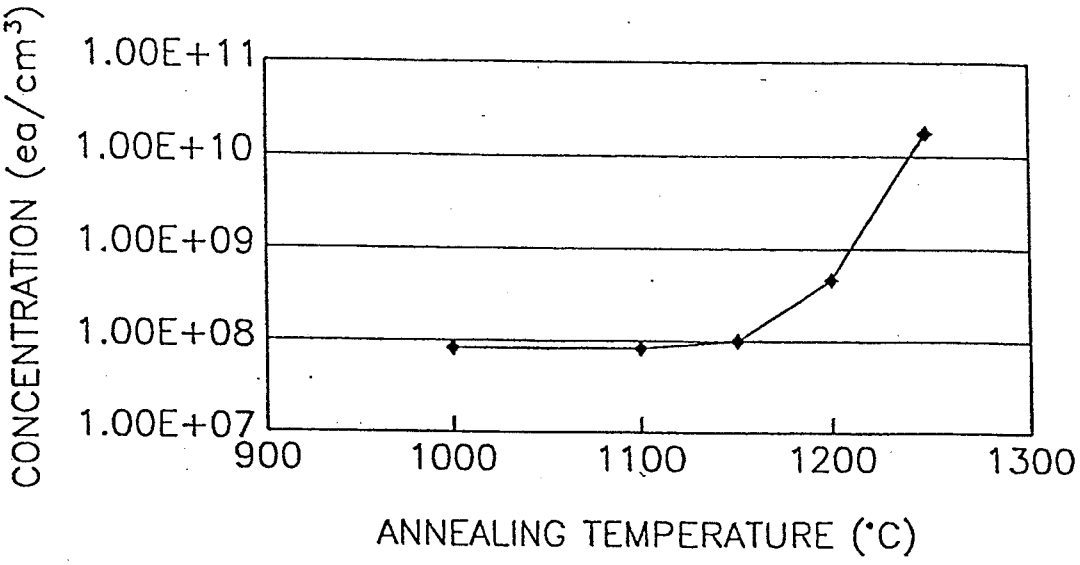
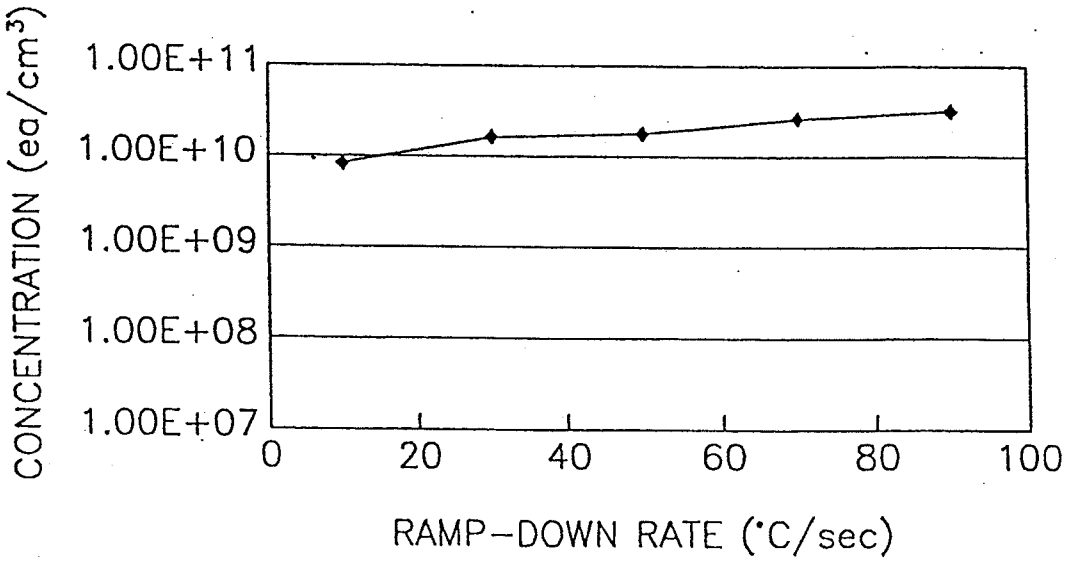

CONCENTRATION (ea/cm³)
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
900
1000
1100
1200
1300
ANNEALING TEMPERATURE (°C)

FIG. 36


CONCENTRATION (ea/cm³)
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
0
20
40
60
80
100
RAMP-DOWN RATE (°C/sec)