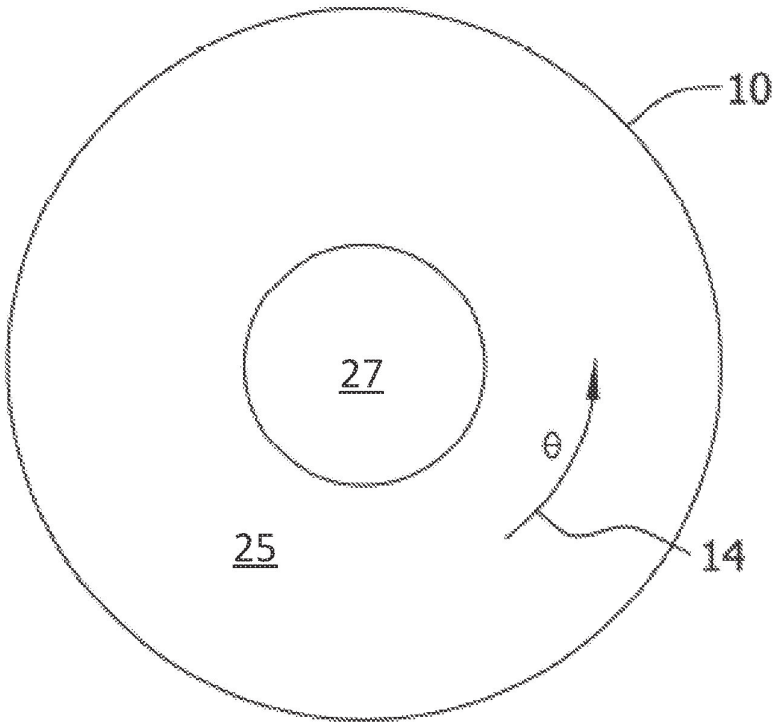


FIG. 1

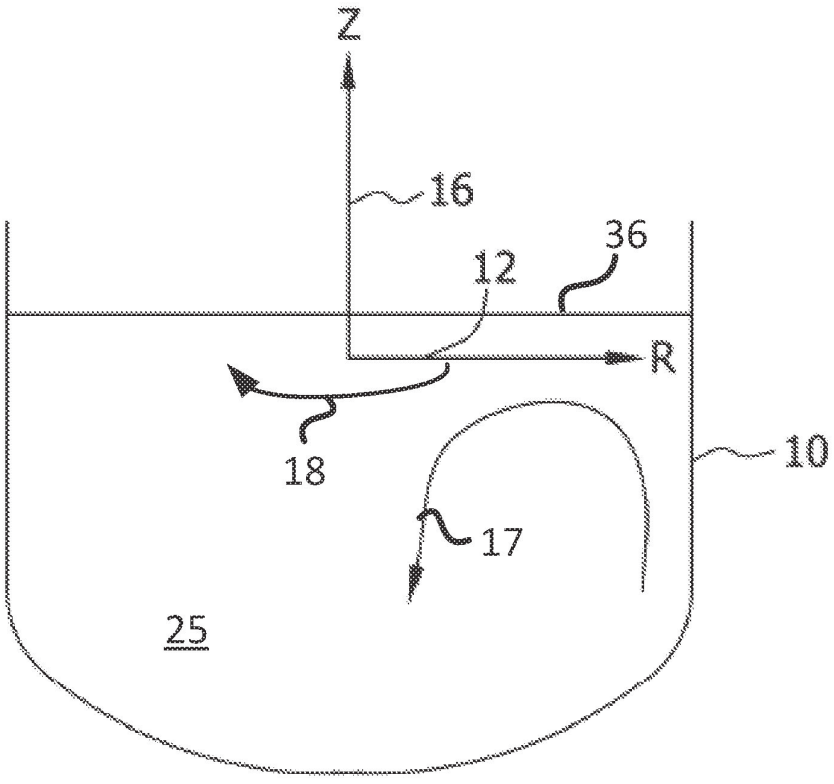


FIG. 2

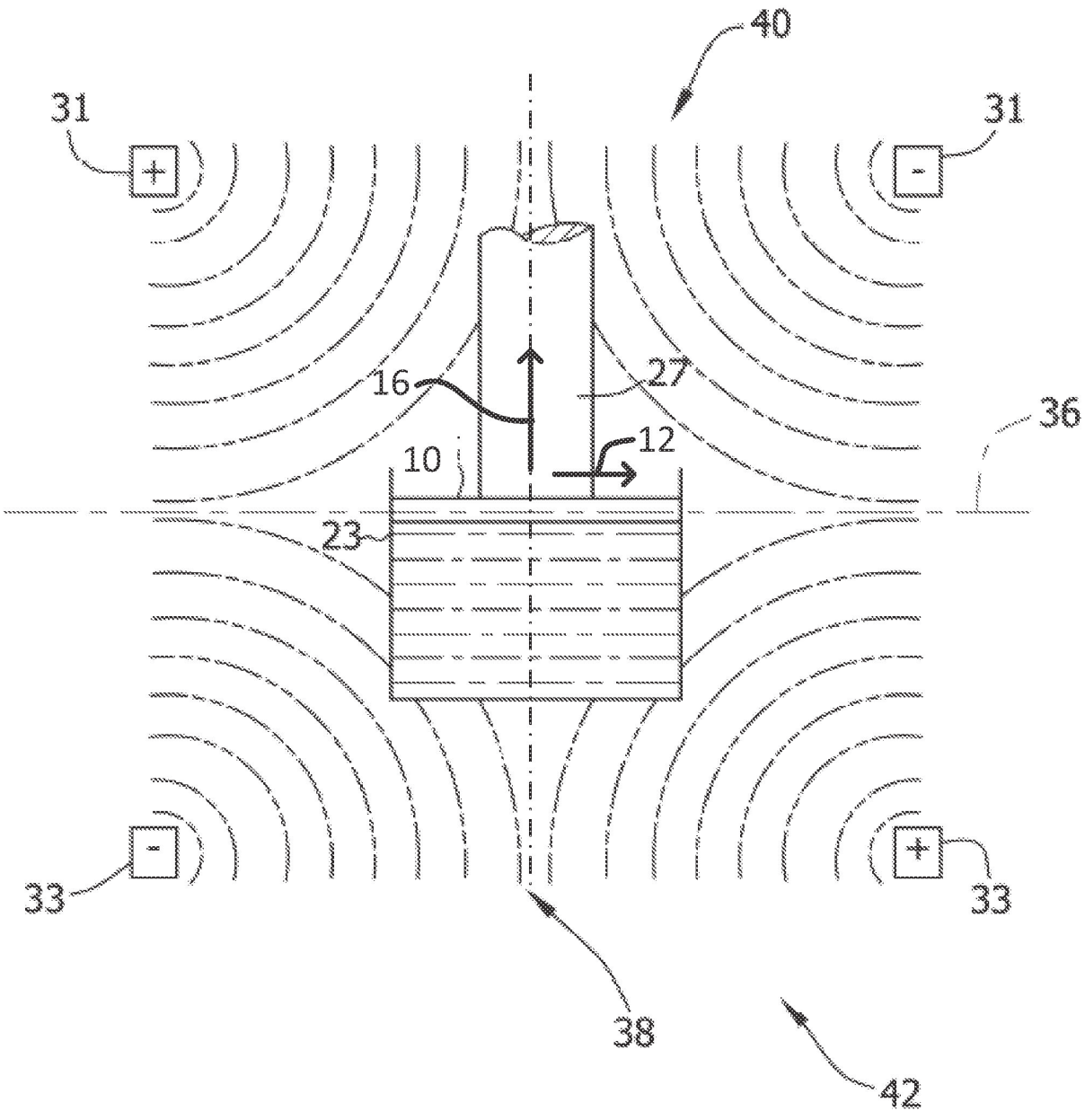


FIG. 3

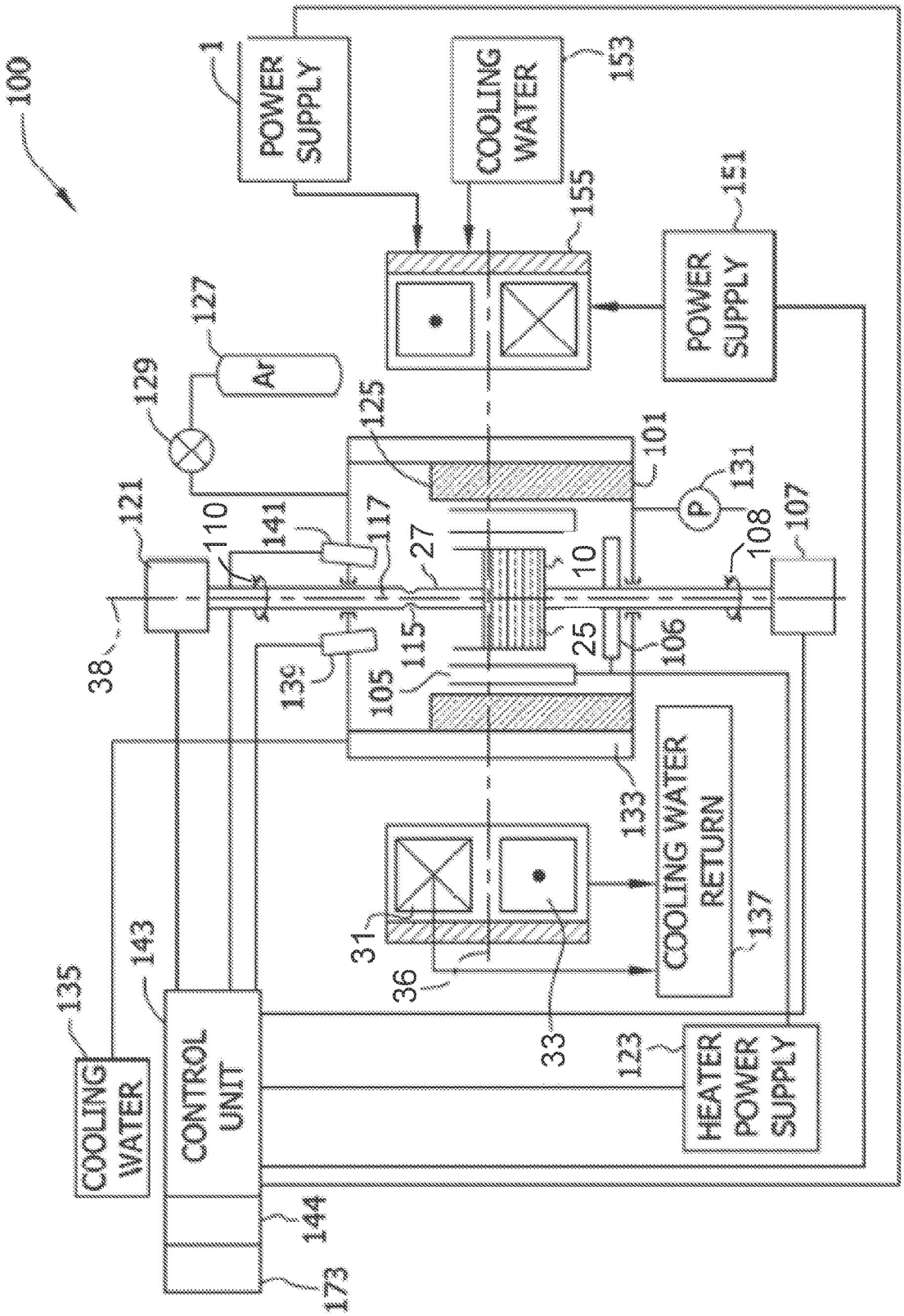

100
1
POWER SUPPLY
153
COOLING WATER
155
151
POWER SUPPLY
127
Ar
129
125
101
131
P
121
110
141
117
27
10
108
107
38
115
25
105
139
105
106
133
COOLING WATER RETURN
137
31
36
33
123
HEATER POWER SUPPLY
135
COOLING WATER
143
CONTROL UNIT
144
173

FIG. 4

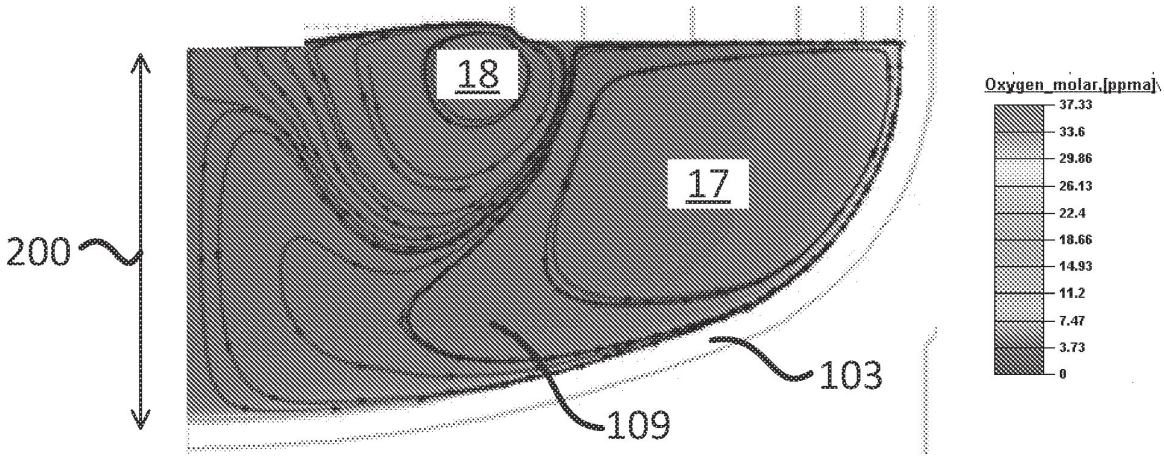


FIG. 5A

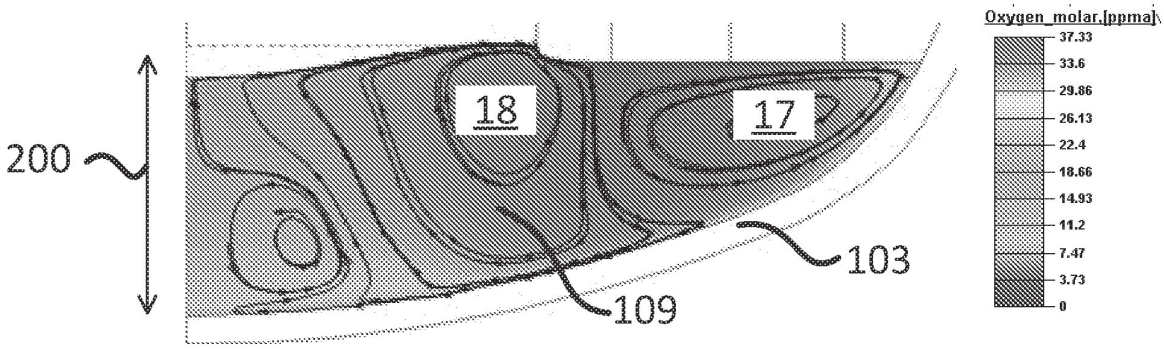


FIG. 5B

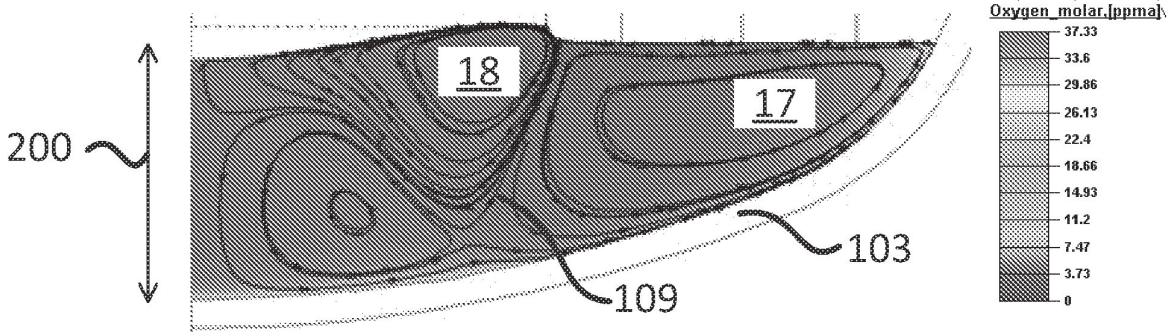


FIG. 5C

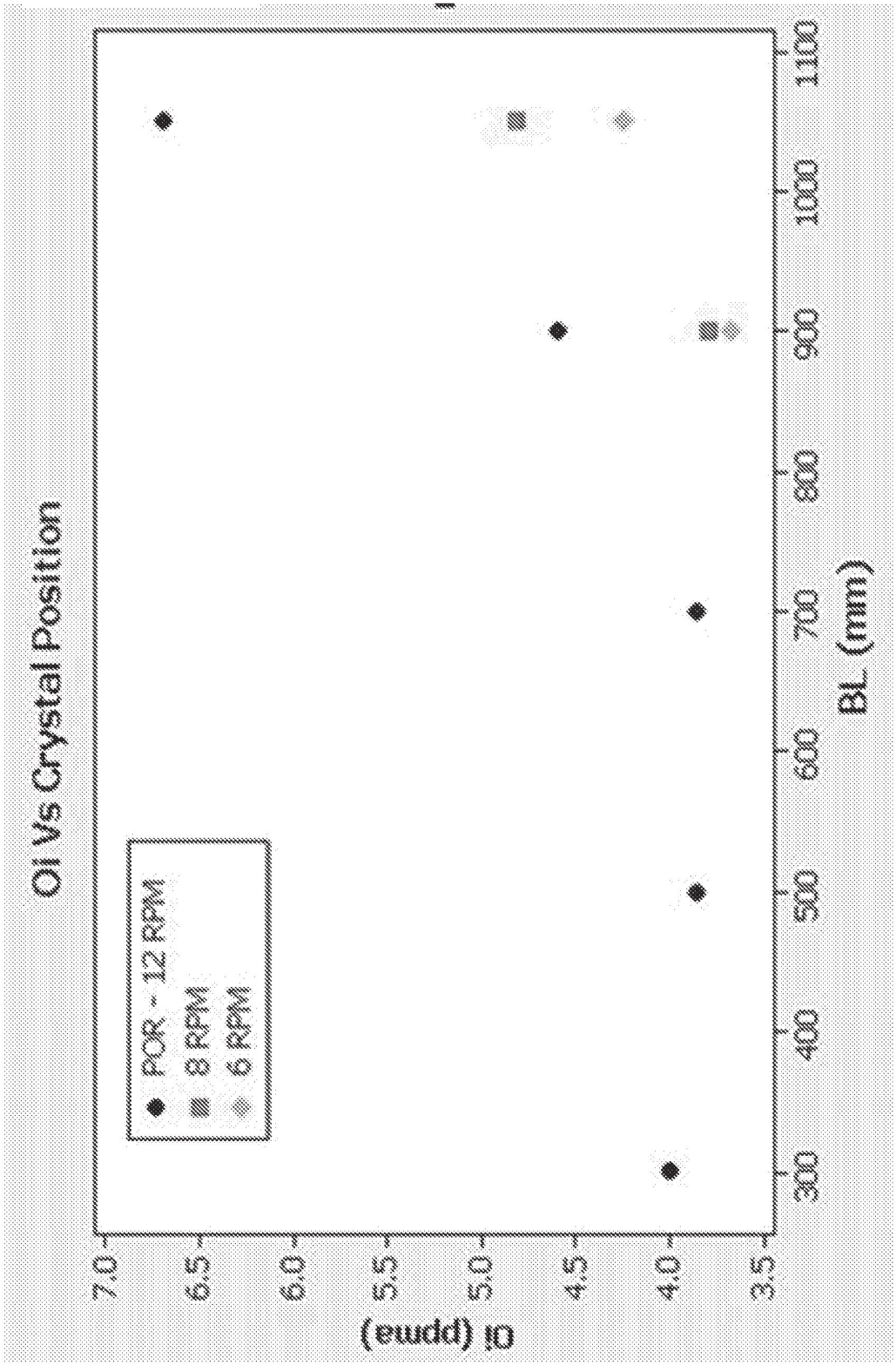

Oi Vs Crystal Position
POR - 12 RPM
8 RPM
6 RPM
Oi (ppma)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
300
400
500
600
700
800
900
1000
1100
BL (mm)

FIG. 6

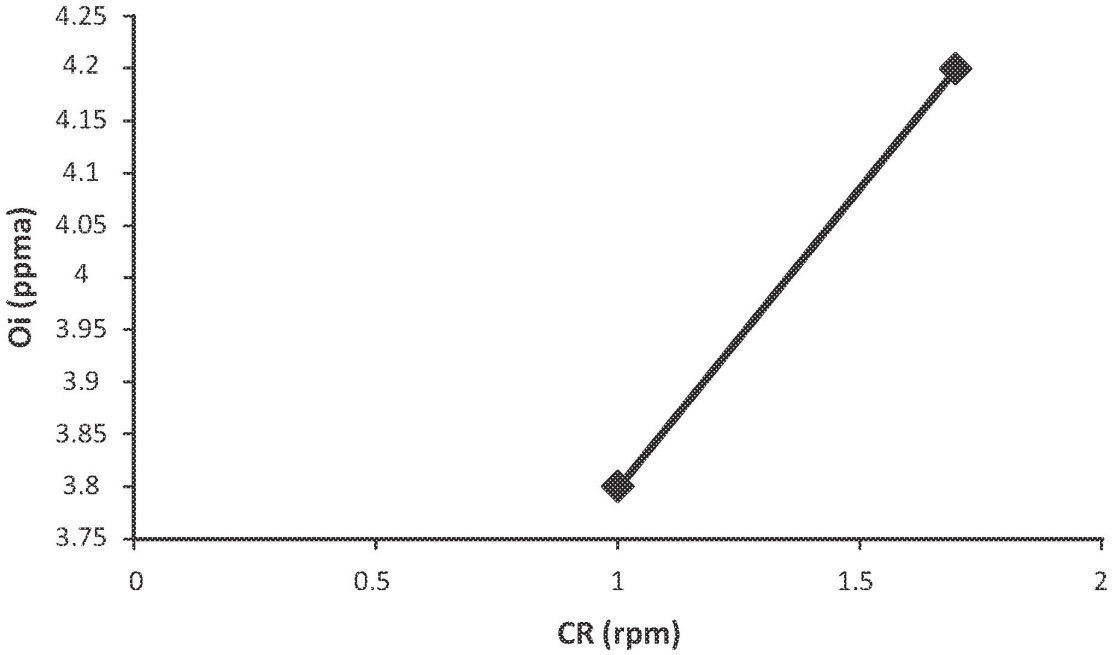

4.25
4.2
4.15
4.1
4.05
4
3.95
3.9
3.85
3.8
3.75
Oi (ppma)
0
0.5
1
1.5
2
CR (rpm)

FIG. 7A

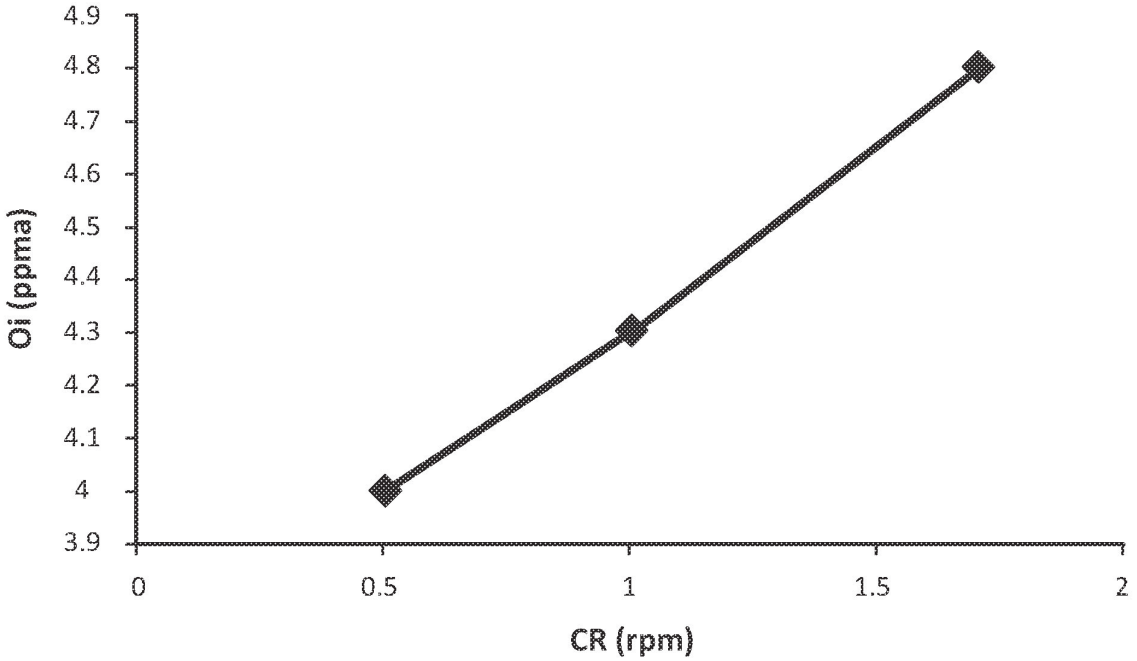

4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
Oi (ppma)
0
0.5
1
1.5
2
CR (rpm)

FIG. 7B

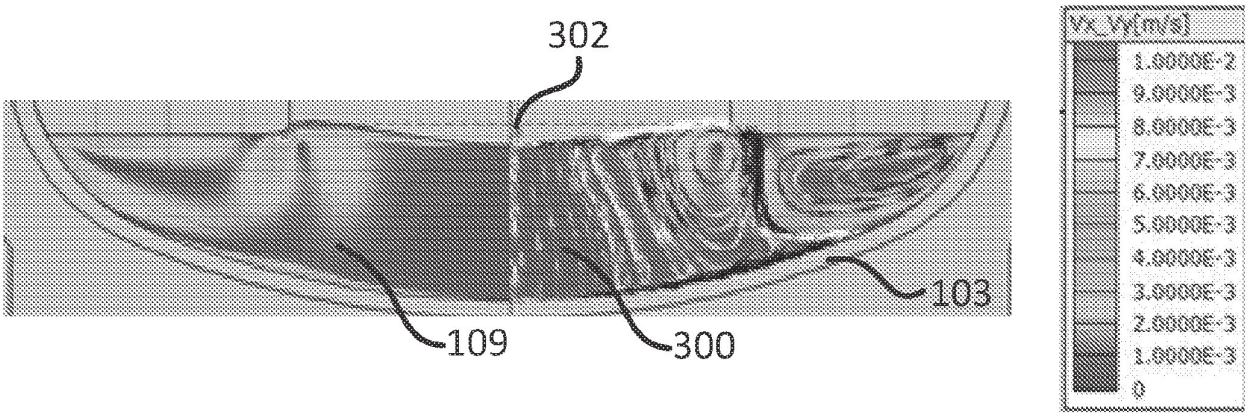


FIG. 8A

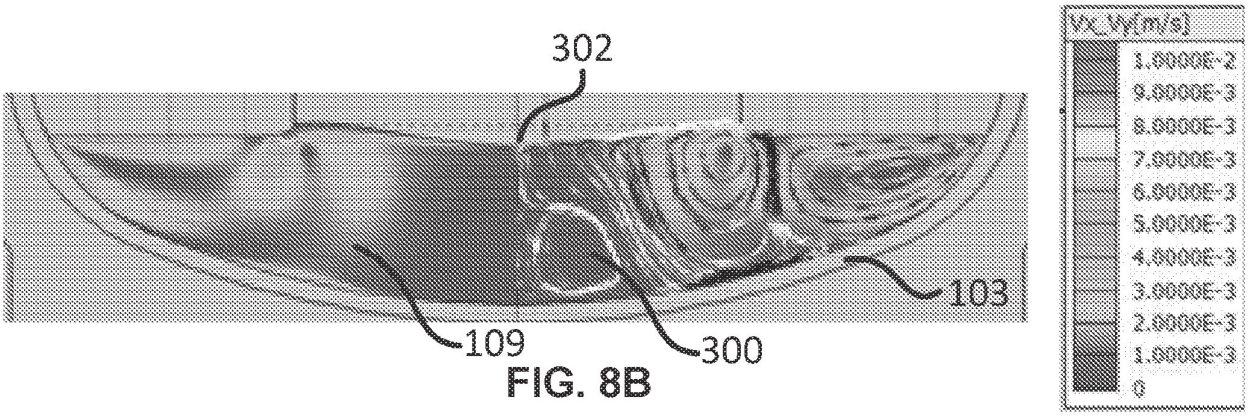


FIG. 8B

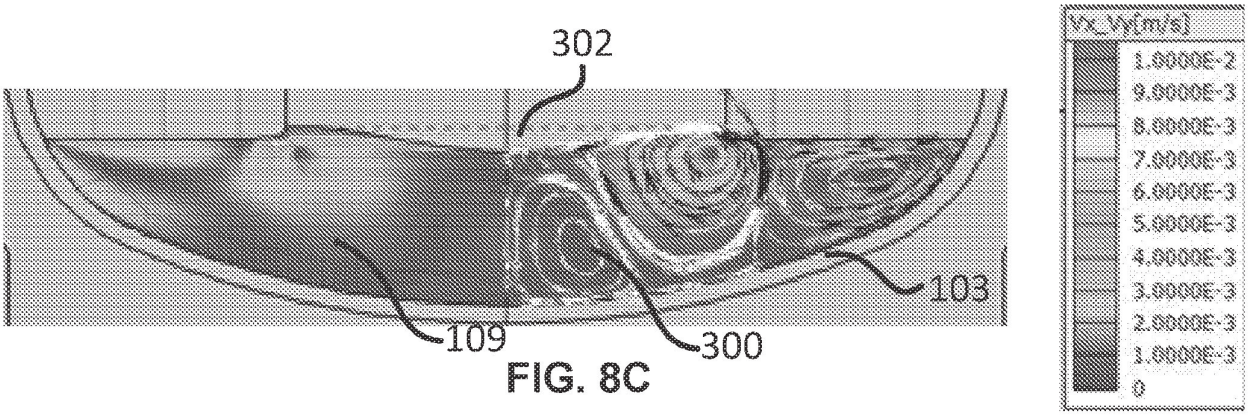


FIG. 8C

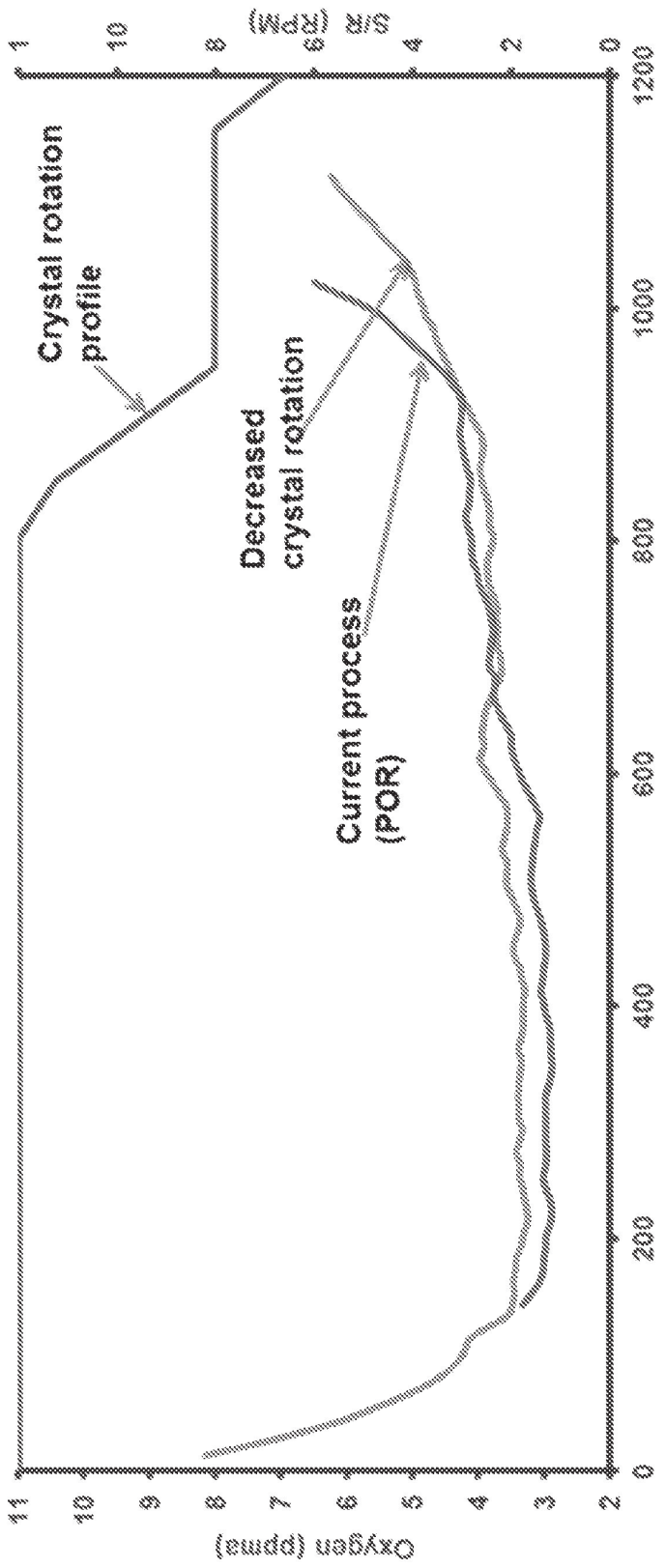

Crystal rotation profile
Decreased crystal rotation
Current process (POR)
S/R (RPM)
Oxygen (ppma)
Body Length (mm)
0
2
4
6
8
10
1
0
200
400
600
800
1000
1200
2
3
4
5
6
7
8
9
10
11

FIG. 9

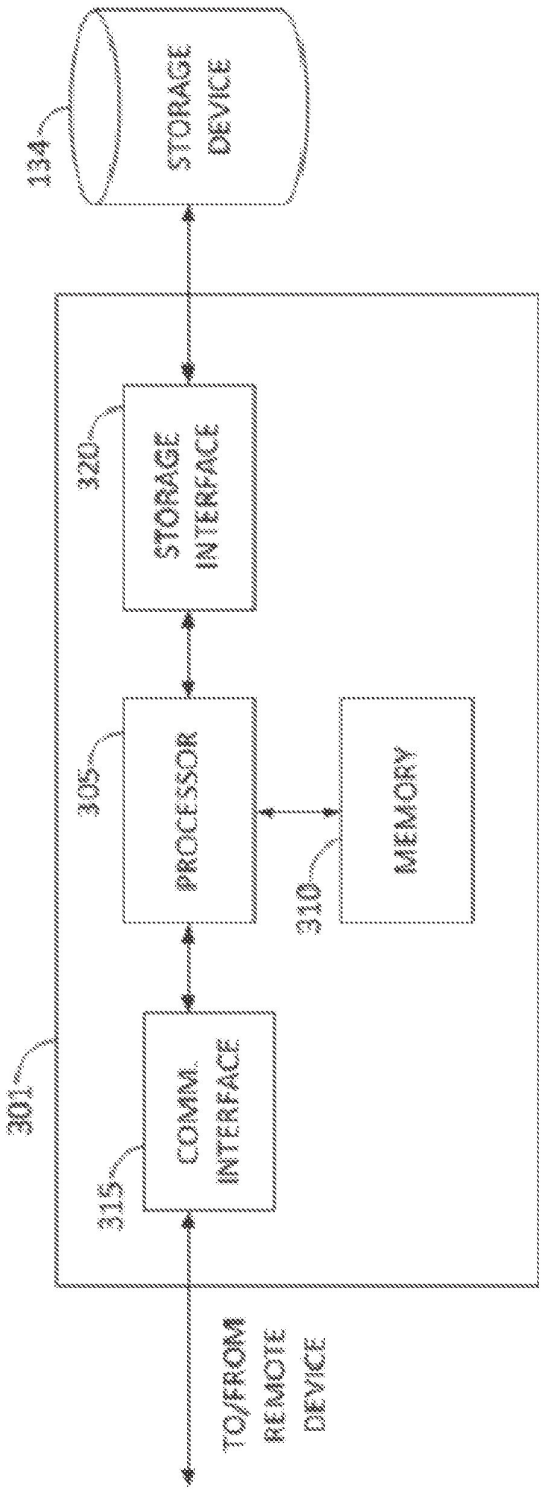

134
STORAGE DEVICE
320
STORAGE INTERFACE
305
PROCESSOR
310
MEMORY
301
315
COMM. INTERFACE
TO/FROM REMOTE DEVICE

FIG. 10

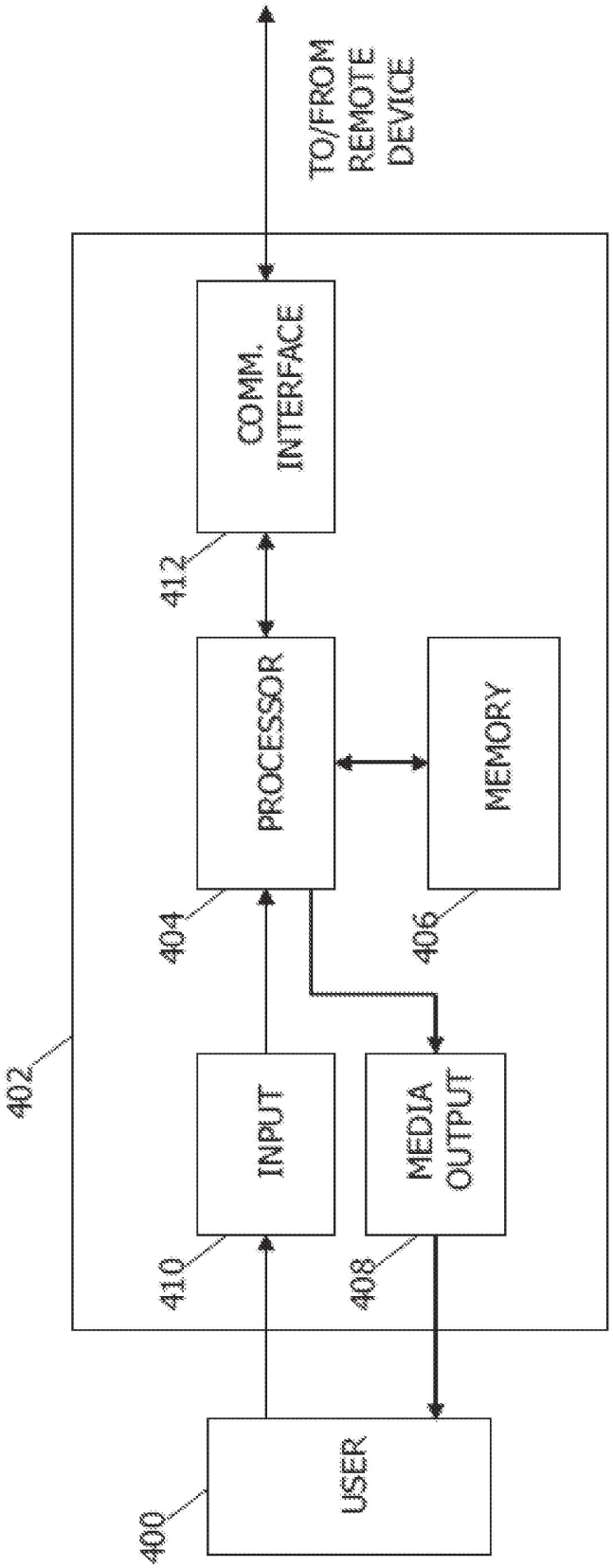

TO/FROM REMOTE DEVICE
COMM. INTERFACE
412
PROCESSOR
MEMORY
404
406
402
INPUT
MEDIA OUTPUT
410
408
USER
400

FIG. 11