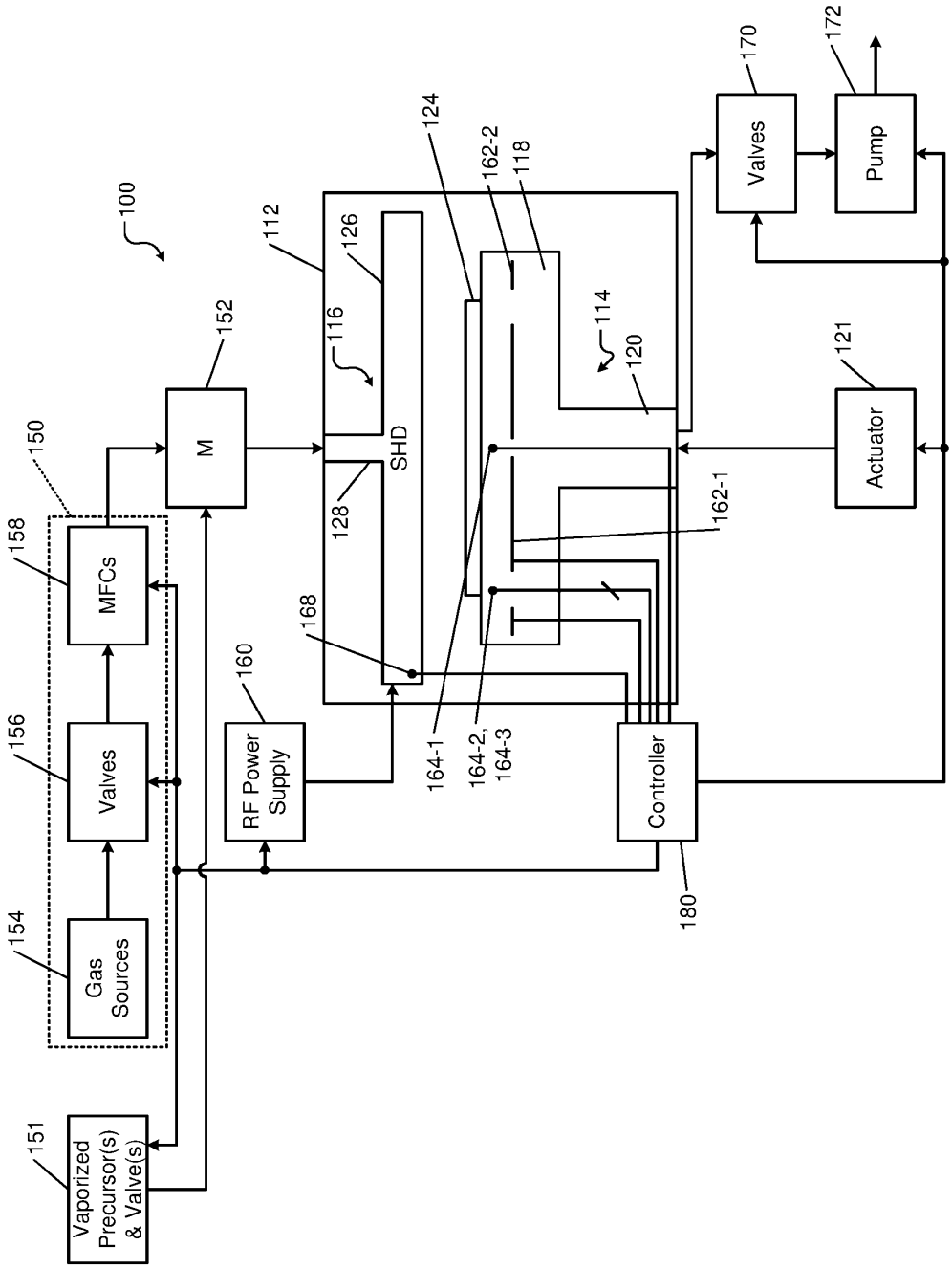

100
112
126
116
SHD
128
124
162-2
118
114
120
152
M
150
158
MFCs
156
Valves
154
Gas Sources
151
Vaporized Precursor(s) & Valve(s)
160
RF Power Supply
168
164-1
164-2, 164-3
162-1
Controller
180
170
Valves
172
Pump
121
Actuator

FIG. 1

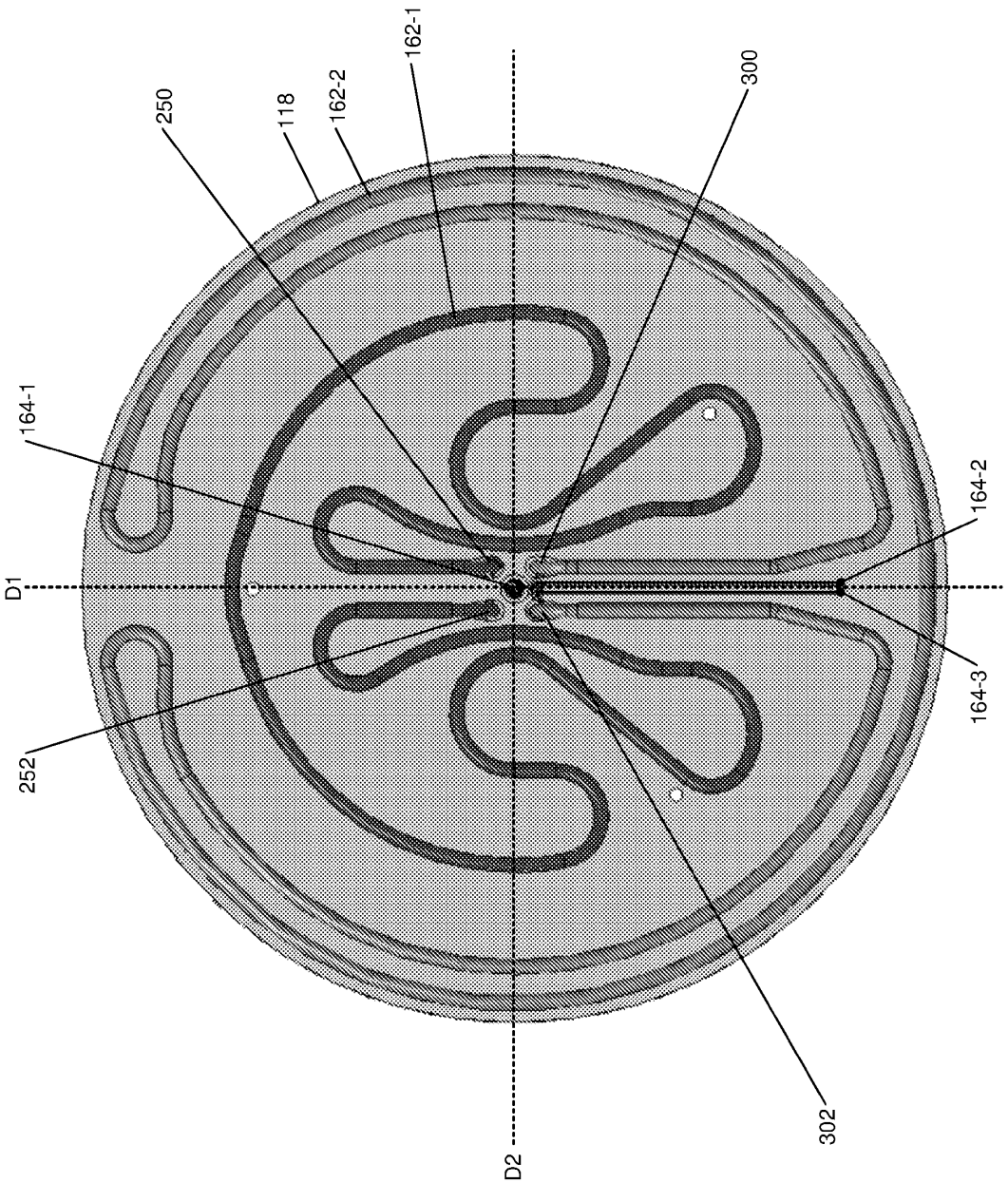


FIG. 2

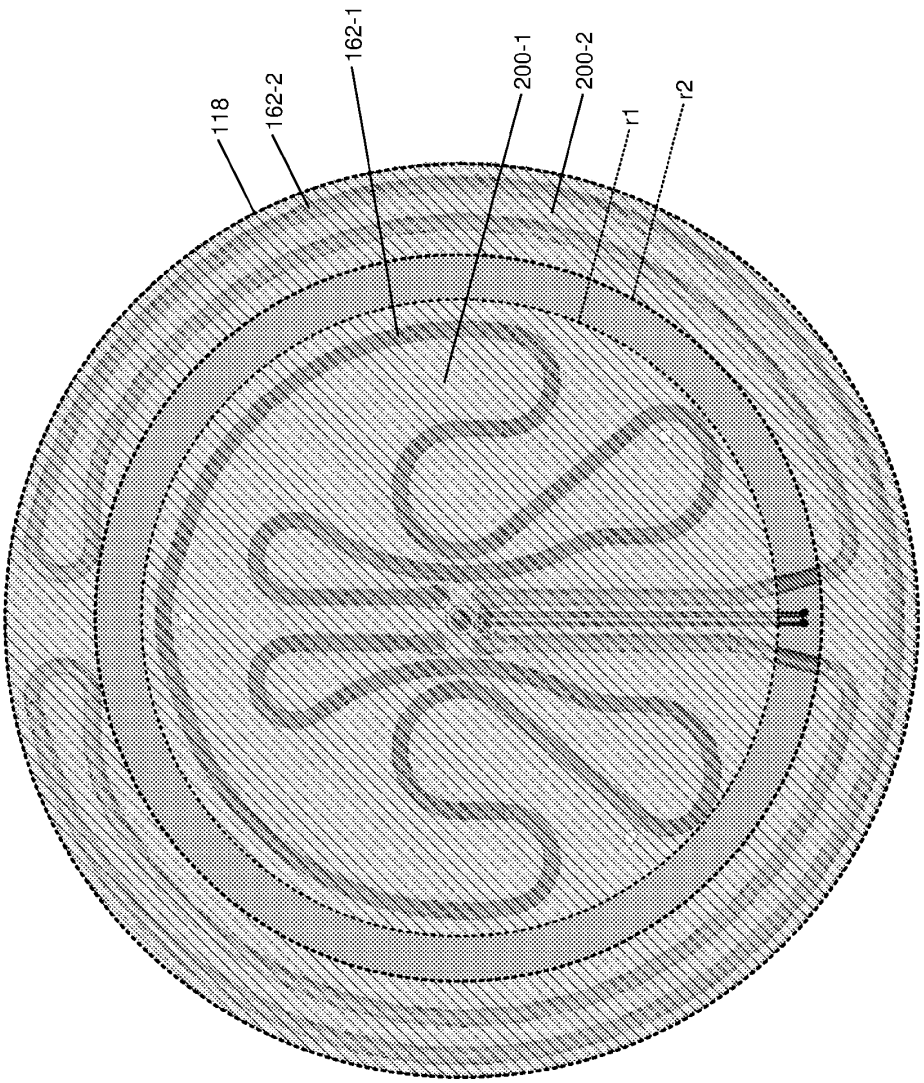


FIG. 3

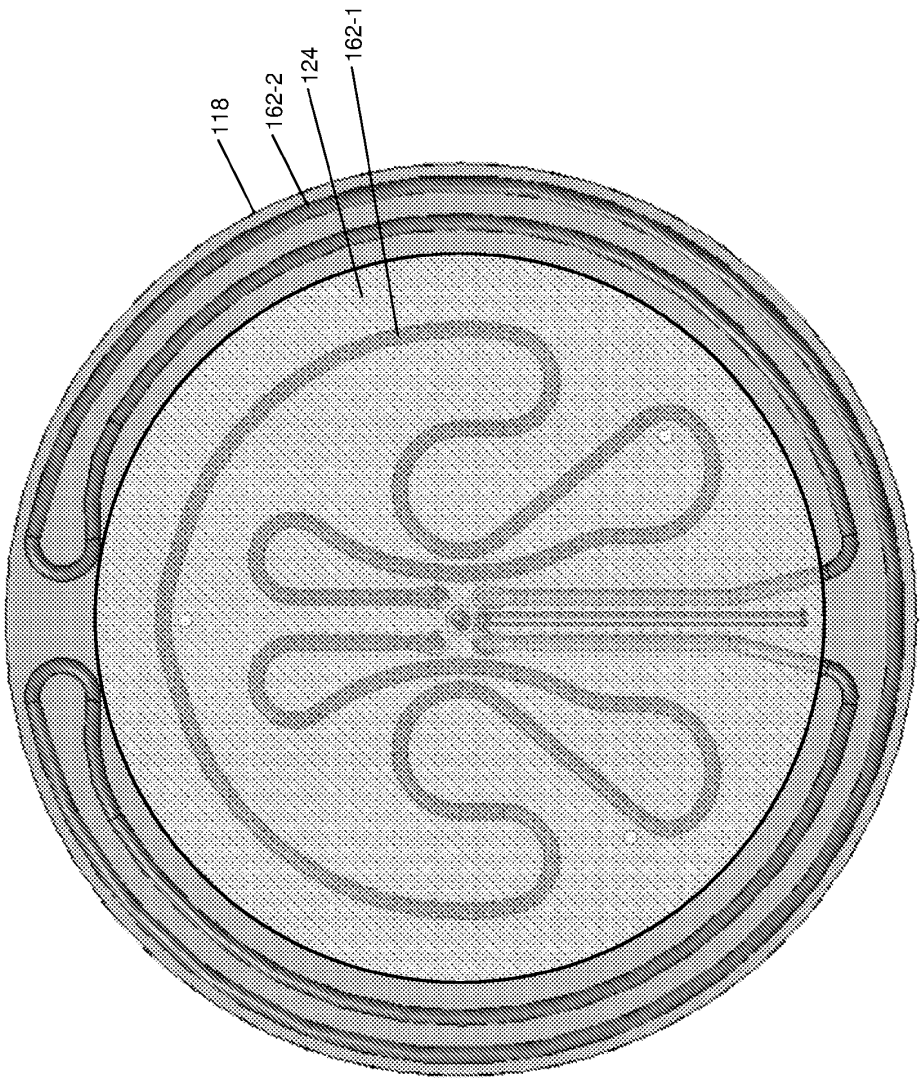


FIG. 4

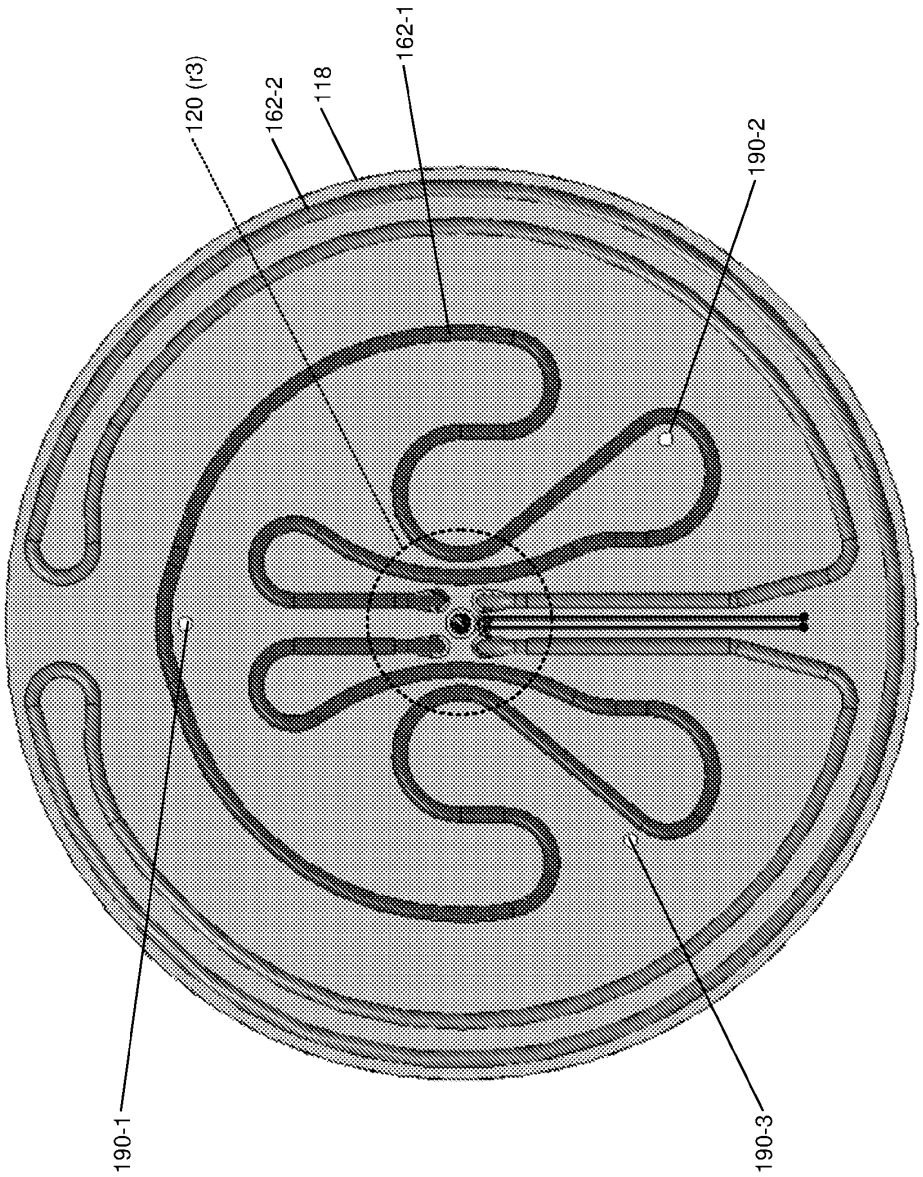


FIG. 5

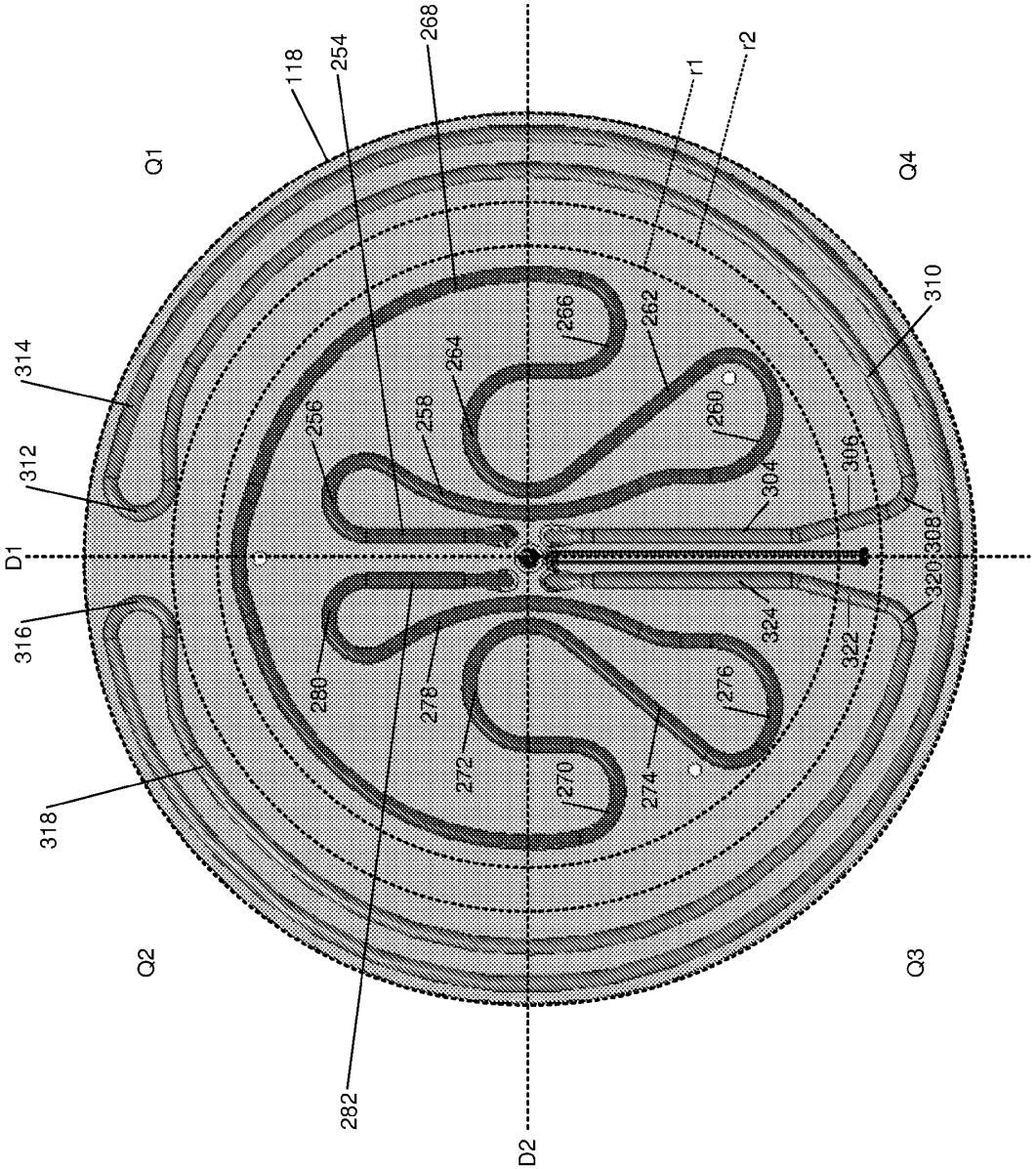

Q1
Q2
Q3
Q4
D1
D2
118
254
268
r1
r2
310
314
312
316
318
282
256
258
264
266
262
260
304
306
308
320
322
324
280
278
272
270
274
276

FIG. 6A

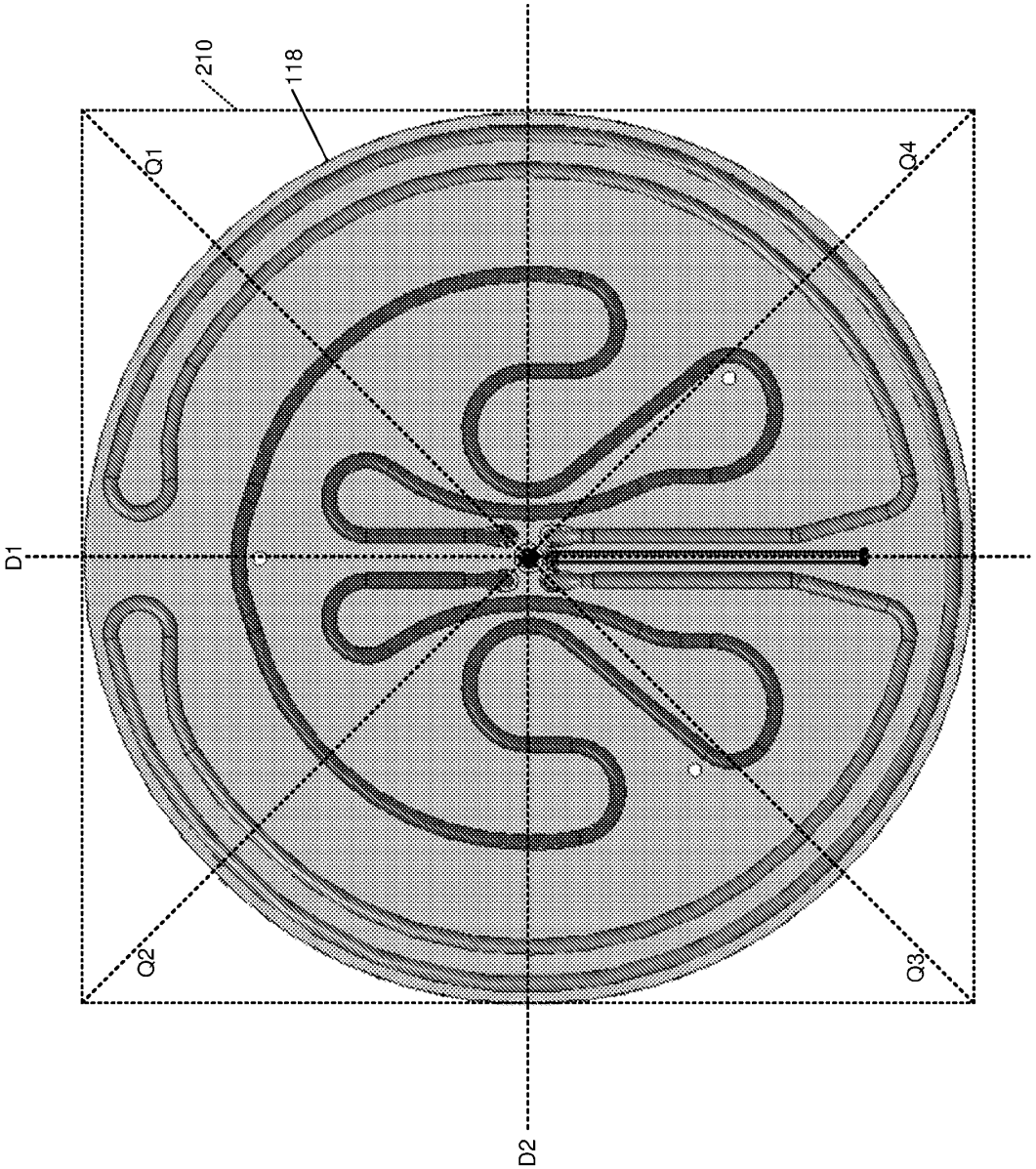


FIG. 6B

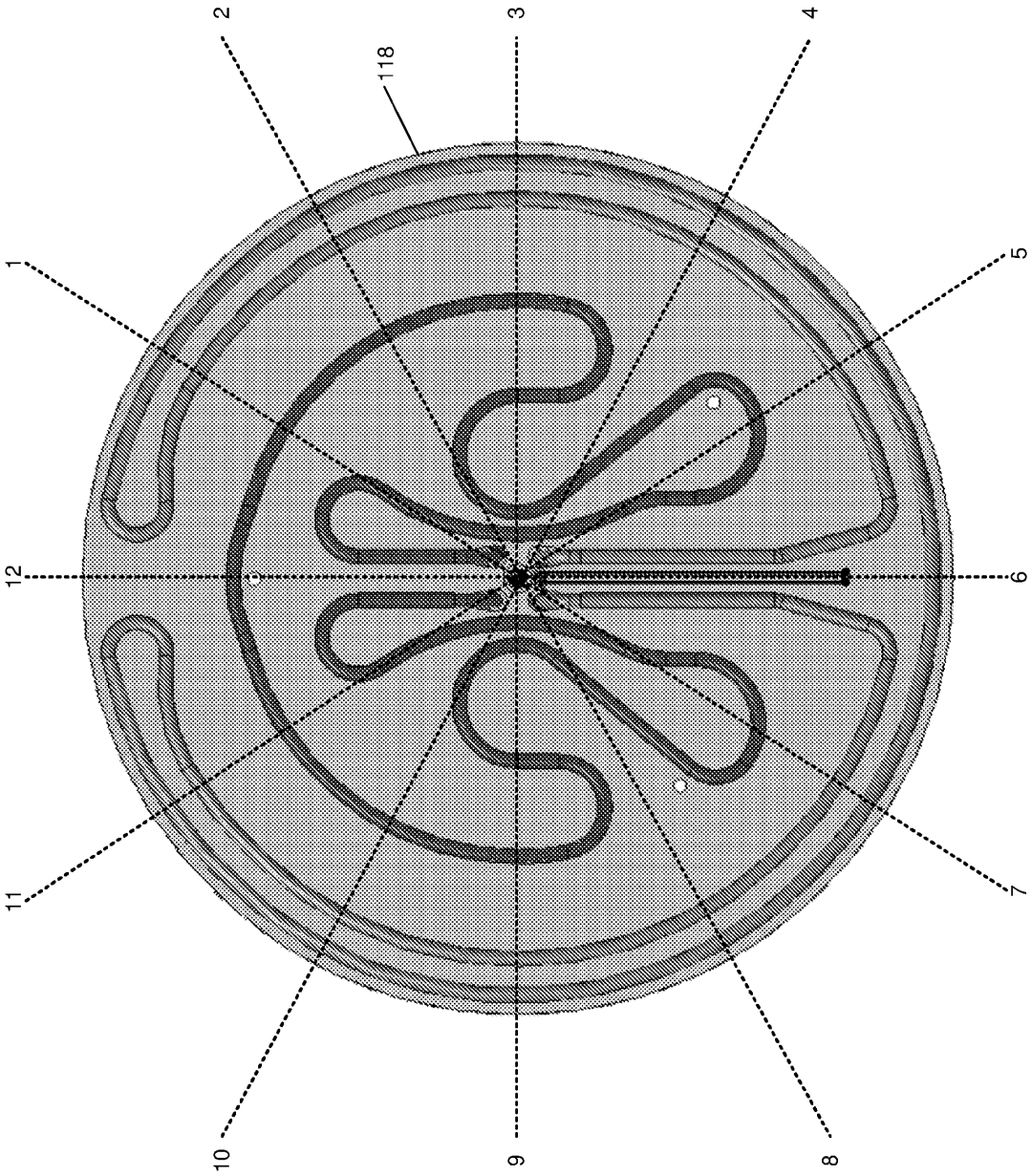


FIG. 6C

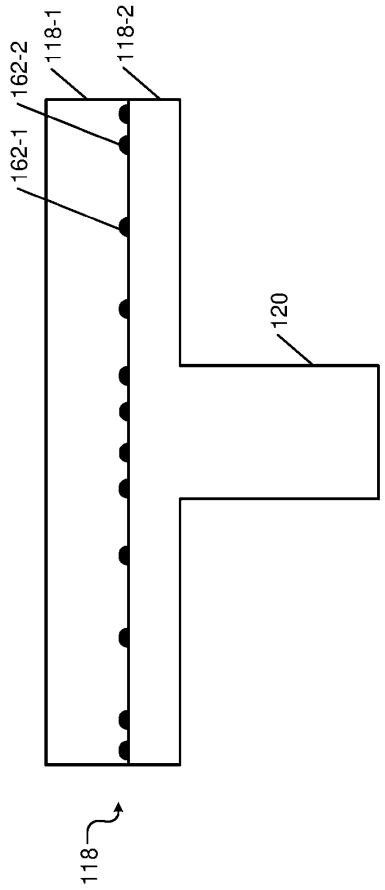


FIG. 7A

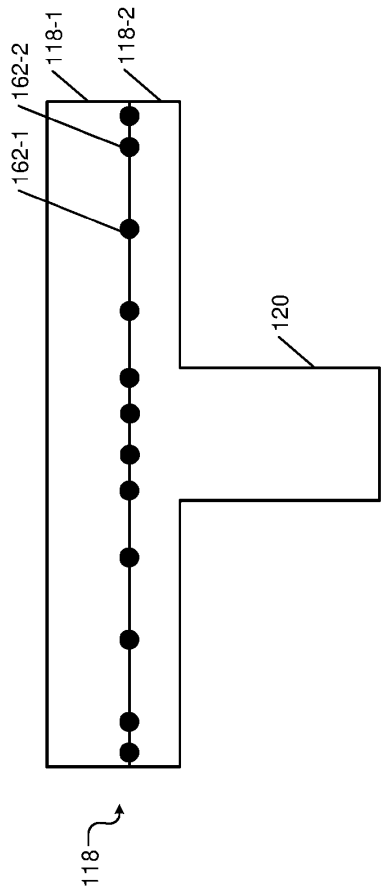


FIG. 7B

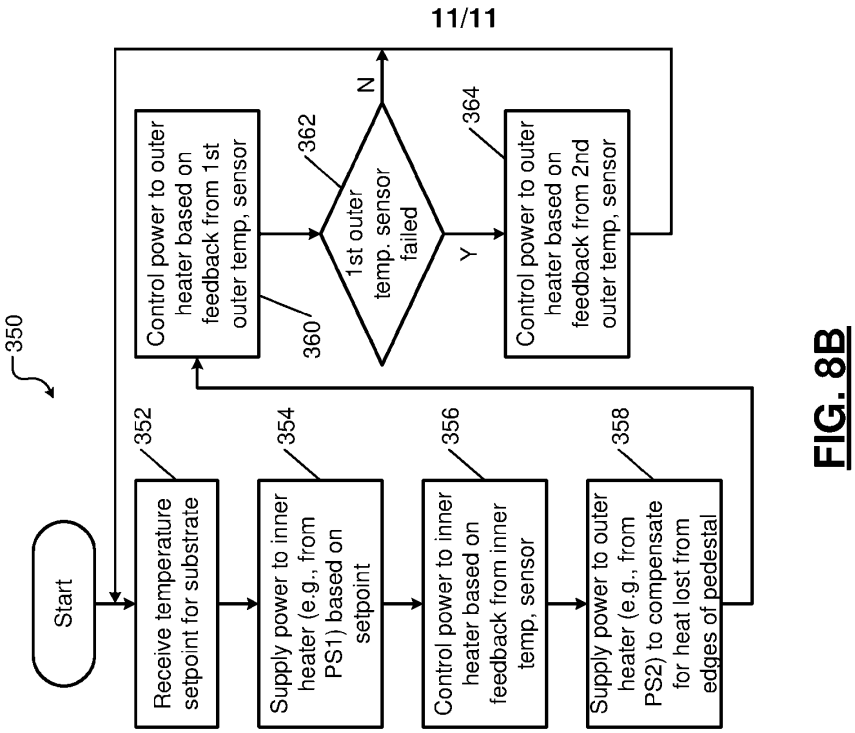

350
Start
352
Receive temperature setpoint for substrate
354
Supply power to inner heater (e.g., from PS1) based on setpoint
356
Control power to inner heater based on feedback from inner temp, sensor
358
Supply power to outer heater (e.g., from PS2) to compensate for heat lost from edges of pedestal
360
Control power to outer heater based on feedback from 1st outer temp, sensor
362
1st outer temp. sensor failed
N
Y
364
Control power to outer heater based on feedback from 2nd outer temp, sensor

FIG. 8B

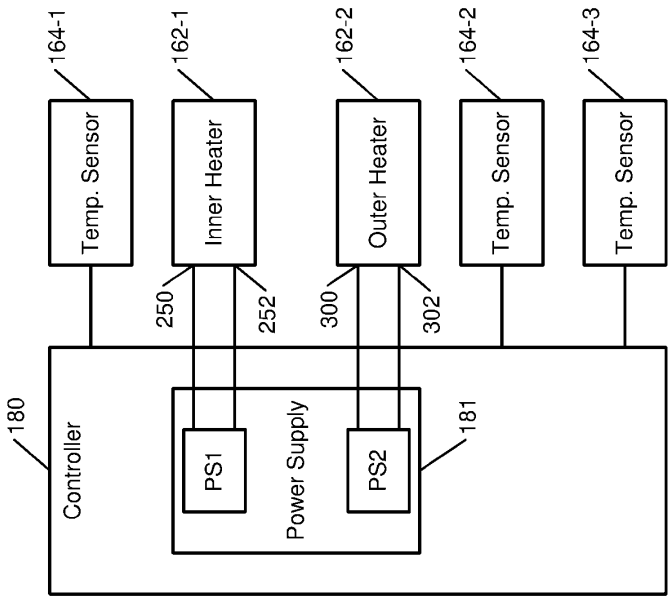

164-1
Temp. Sensor
162-1
Inner Heater
162-2
Outer Heater
164-2
Temp. Sensor
164-3
Temp. Sensor
250
252
300
302
180
Controller
Power Supply
PS1
PS2
181

FIG. 8A