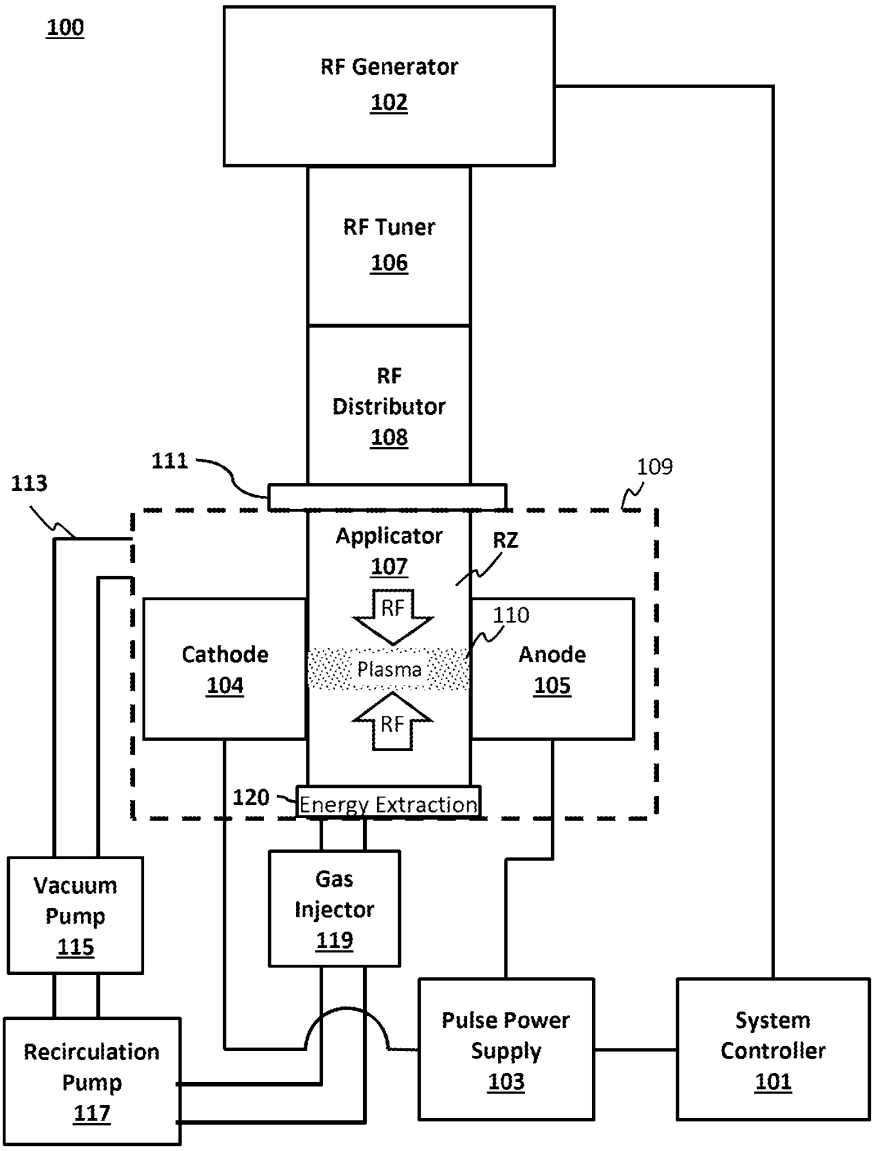

100
RF Generator
102
RF Tuner
106
RF
Distributor
108
111
109
113
Applicator
107
RZ
RF
110
Cathode
104
Plasma
Anode
105
RF
120
Energy Extraction
Vacuum
Pump
115
Gas
Injector
119
Recirculation
Pump
117
Pulse Power
Supply
103
System
Controller
101

Fig. 1A

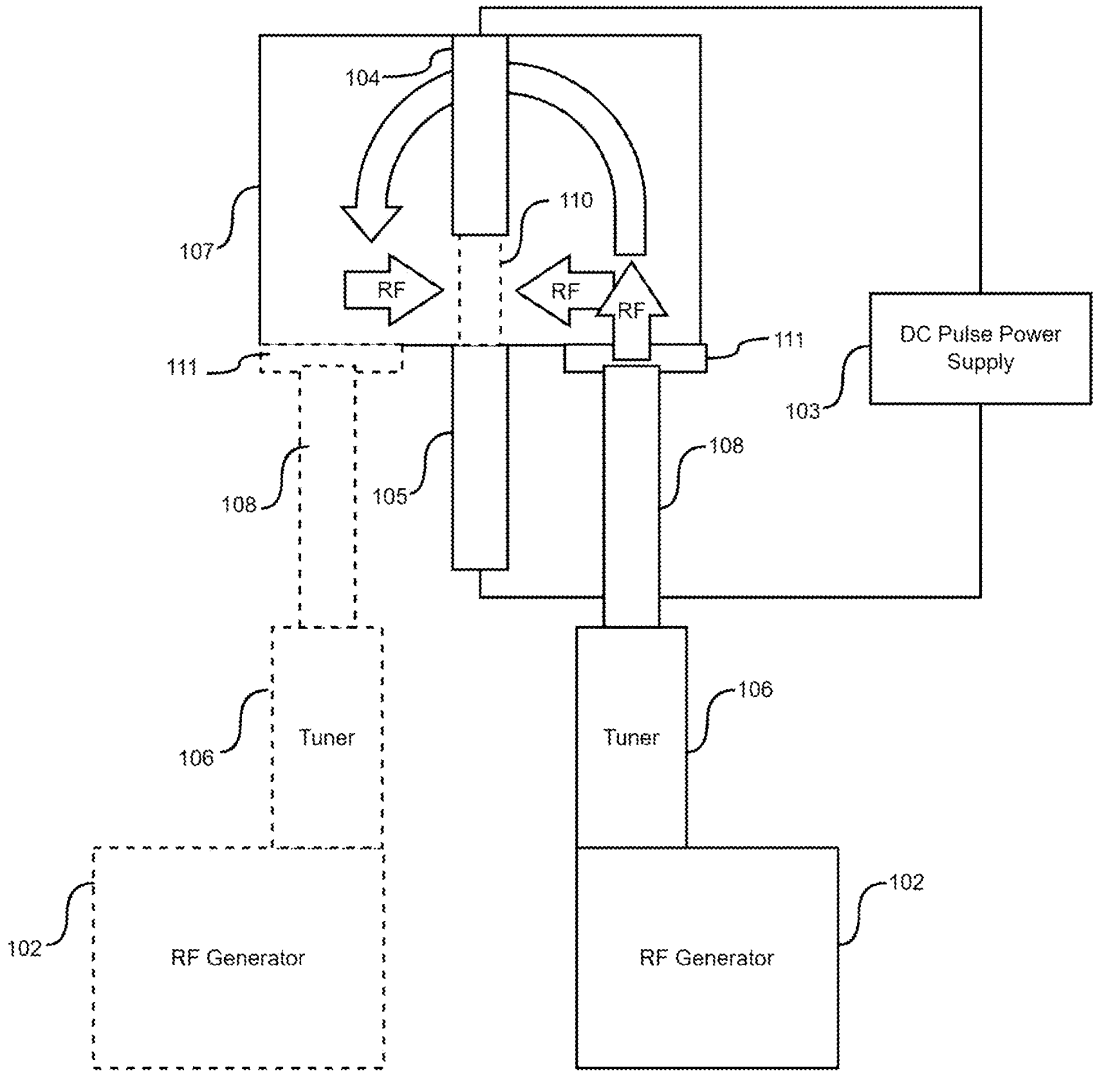

104
107
110
RF
RF
RF
111
111
DC Pulse Power Supply
103
108
105
108
Tuner
106
106
Tuner
102
RF Generator
102
RF Generator

Fig. 1B

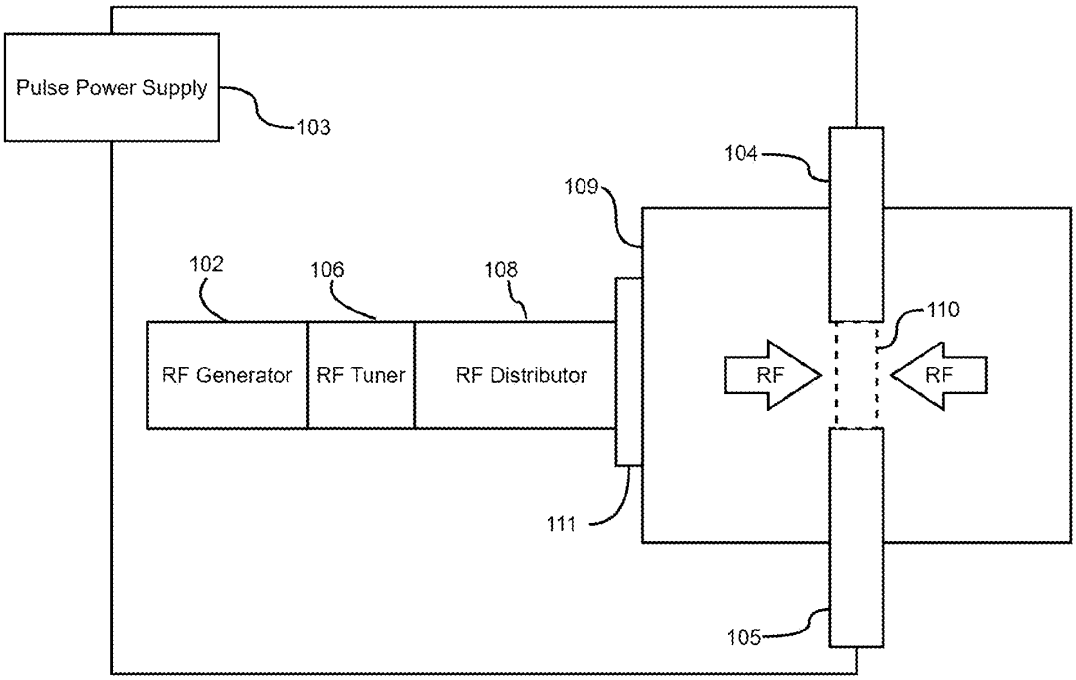

Pulse Power Supply
103
104
109
102
106
108
110
RF Generator
RF Tuner
RF Distributor
RF
RF
111
105

Fig. 1C

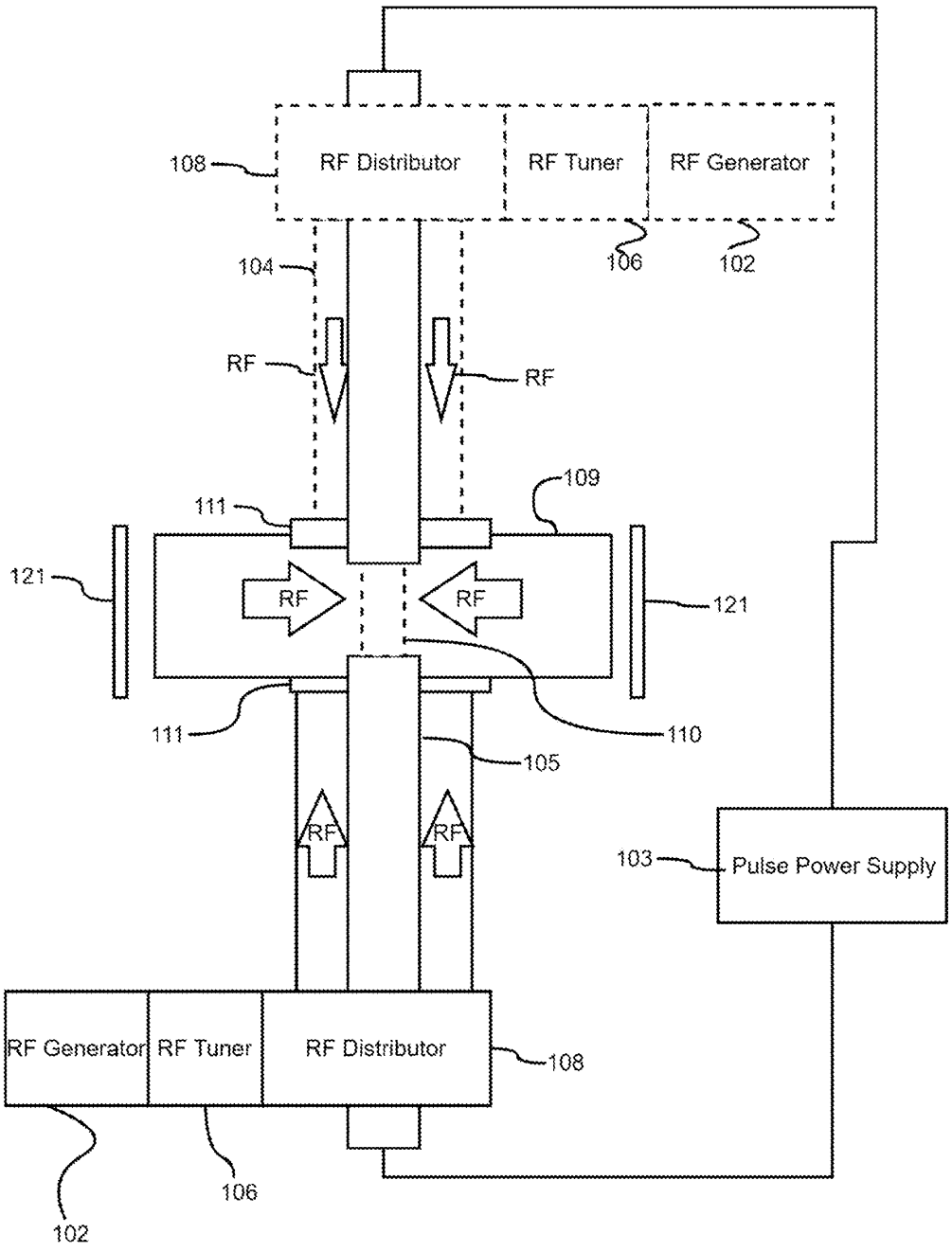

RF Distributor
RF Tuner
RF Generator
108
106
102
104
RF
RF
109
111
121
RF
RF
121
111
110
105
RF
RF
103
Pulse Power Supply
RF Generator
RF Tuner
RF Distributor
108
106
102

Fig. 1D

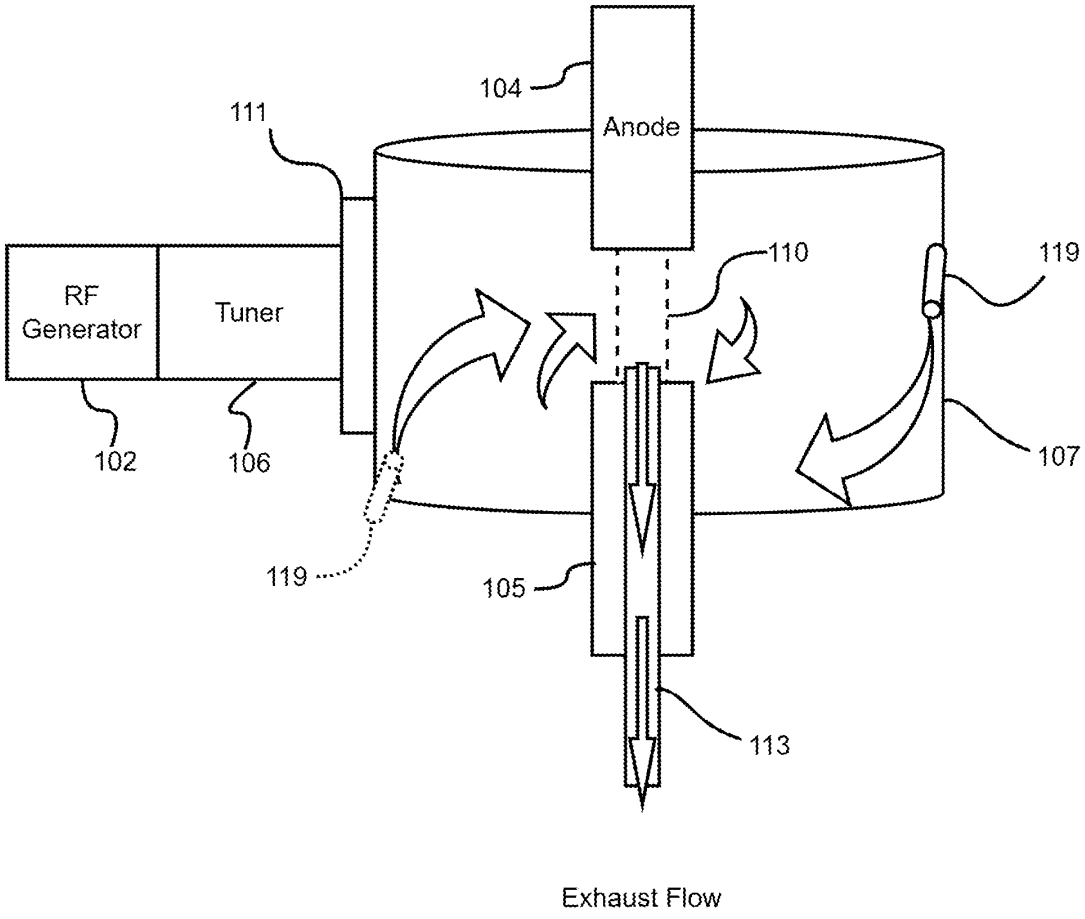

104
Anode
111
110
119
RF Generator
Tuner
102
106
107
119
105
113
Exhaust Flow

Fig. 1E

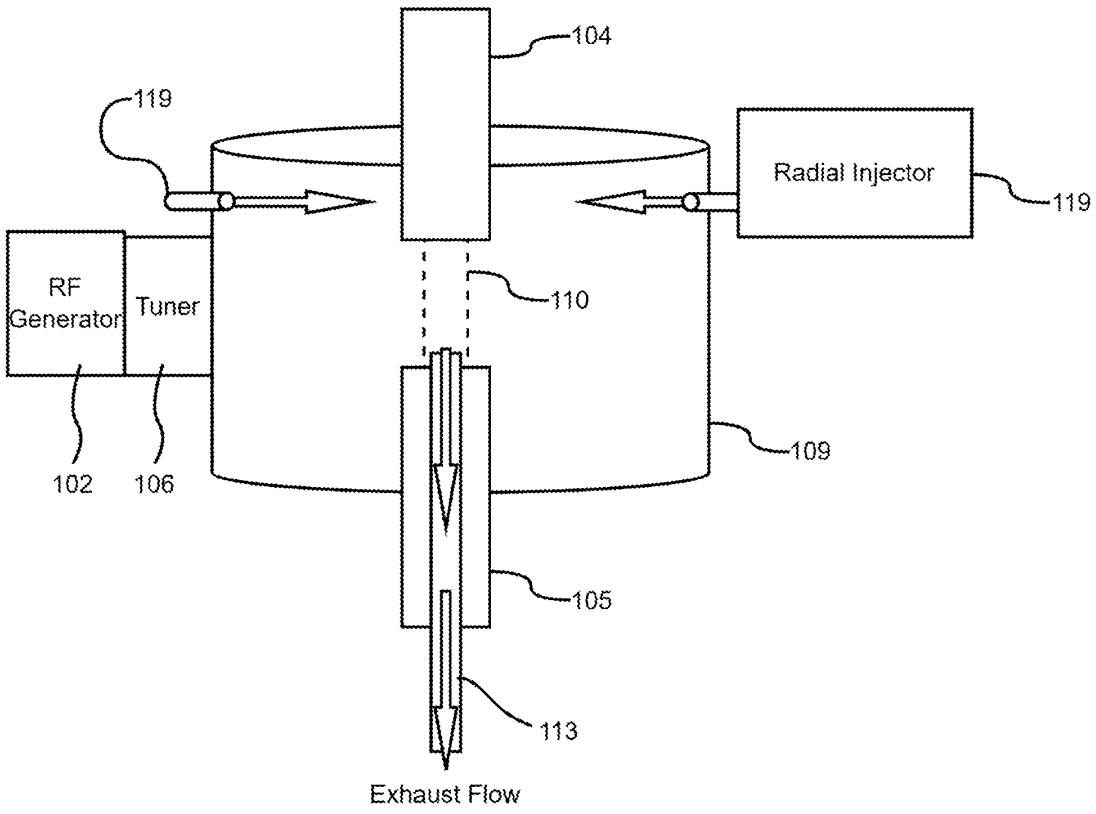

104
119
Radial Injector
119
RF Generator
Tuner
110
109
102
106
105
113
Exhaust Flow

Fig. 1F

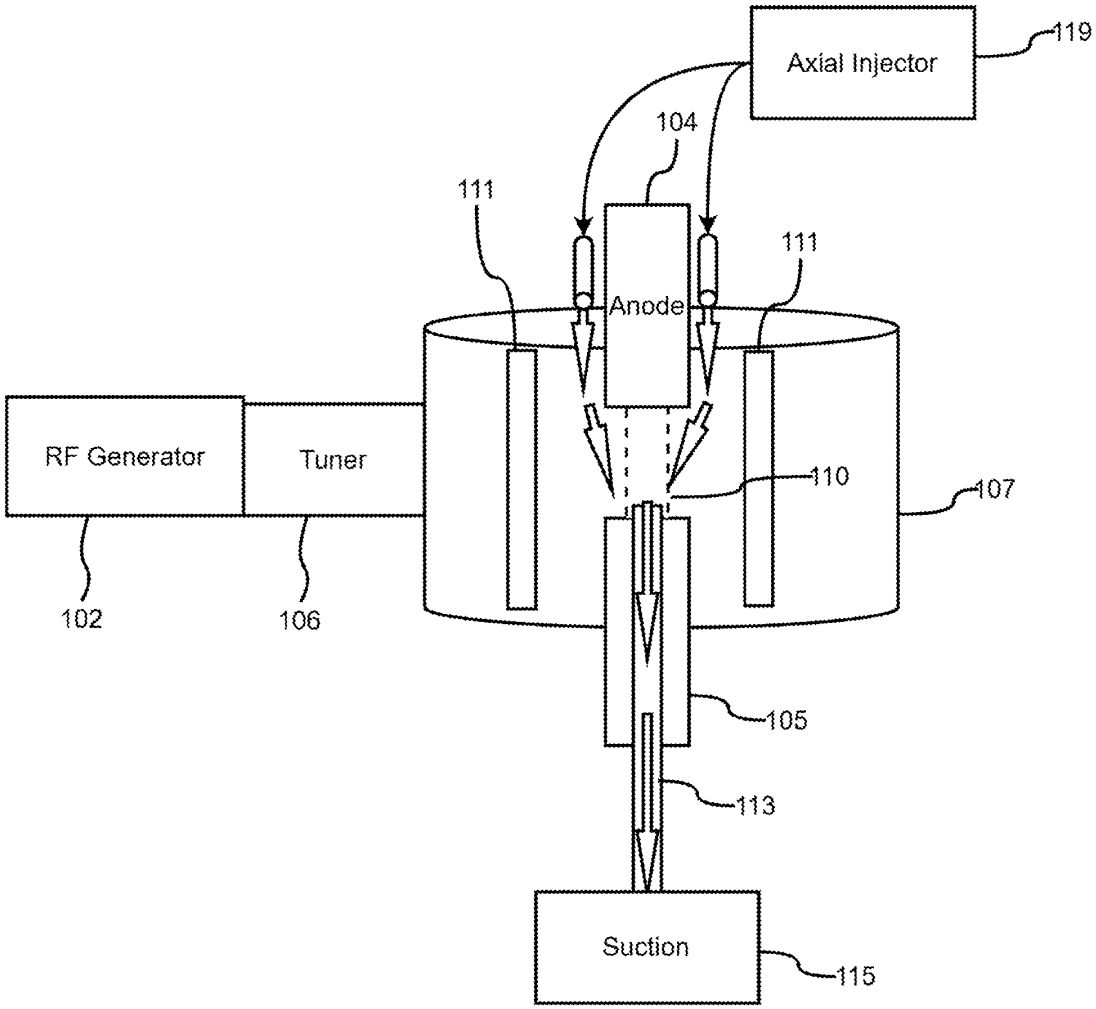

Axial Injector
119
104
111
111
Anode
RF Generator
Tuner
110
107
102
106
105
113
Suction
115

Fig. 1G

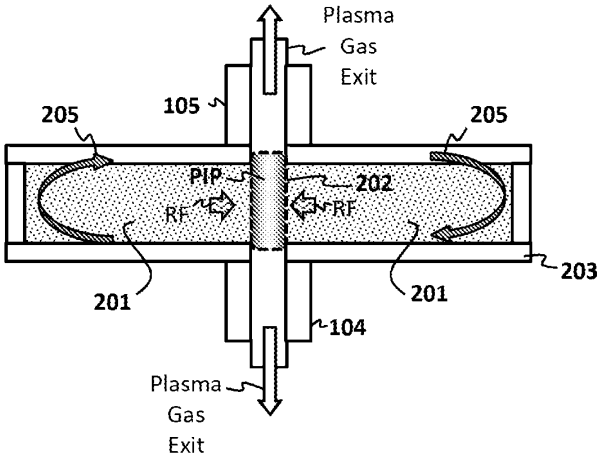

Plasma
Gas
Exit
105
205
205
PIP
202
RF
RF
201
201
203
104
Plasma
Gas
Exit

Fig. 2A

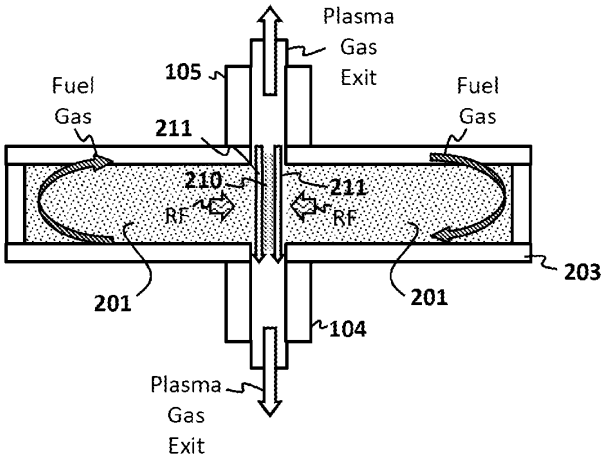

Plasma
Gas
Exit
105
Fuel
Gas
Fuel
Gas
211
210
211
RF
RF
201
201
203
104
Plasma
Gas
Exit

Fig. 2B

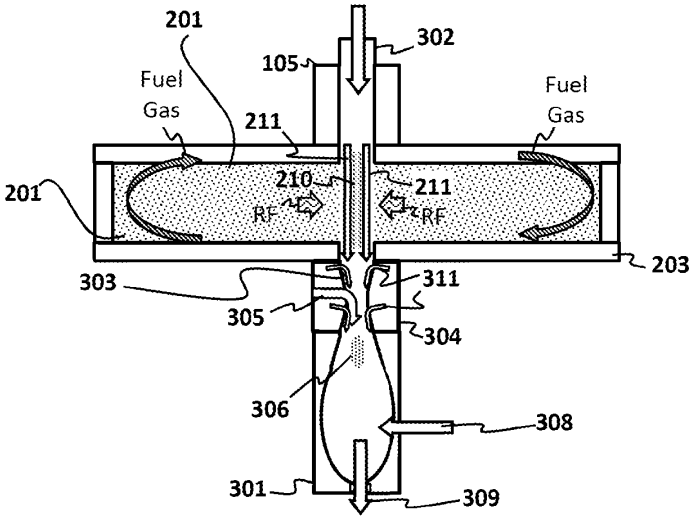

201
105
302
Fuel
Gas
Fuel
Gas
211
201
210
211
RF
RF
203
303
311
305
304
306
308
301
309

Fig. 3A

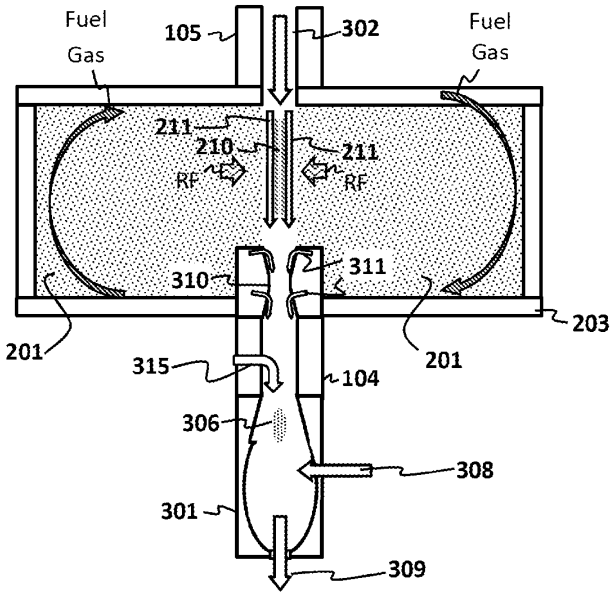

Fuel
Gas
105
302
Fuel
Gas
211
210
211
RF
RF
310
311
203
201
201
315
104
306
308
301
309

Fig. 3B

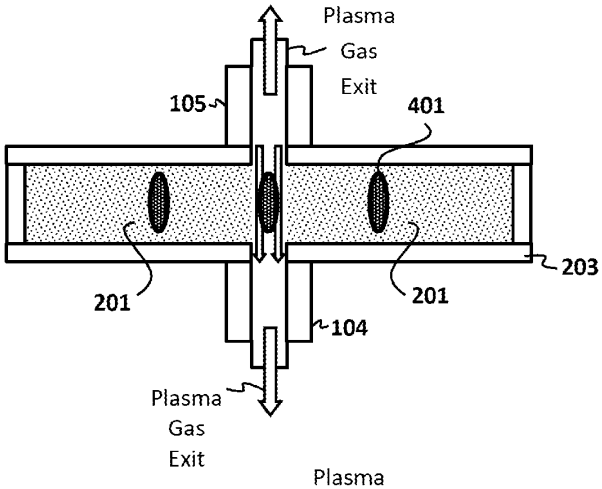


Fig. 4

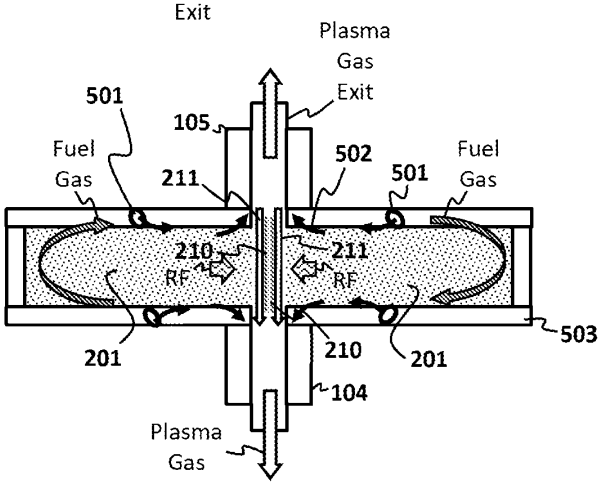


Fig. 5A

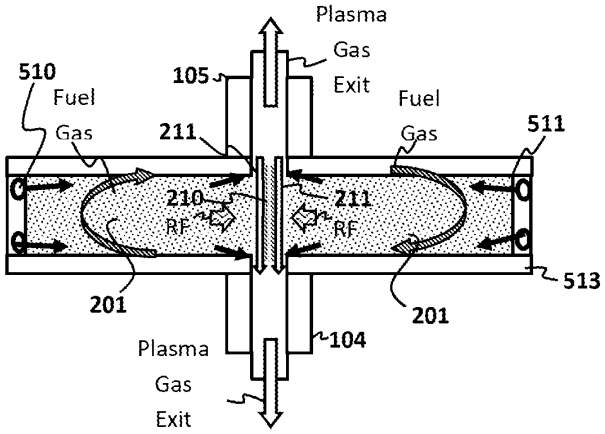


Fig. 5B

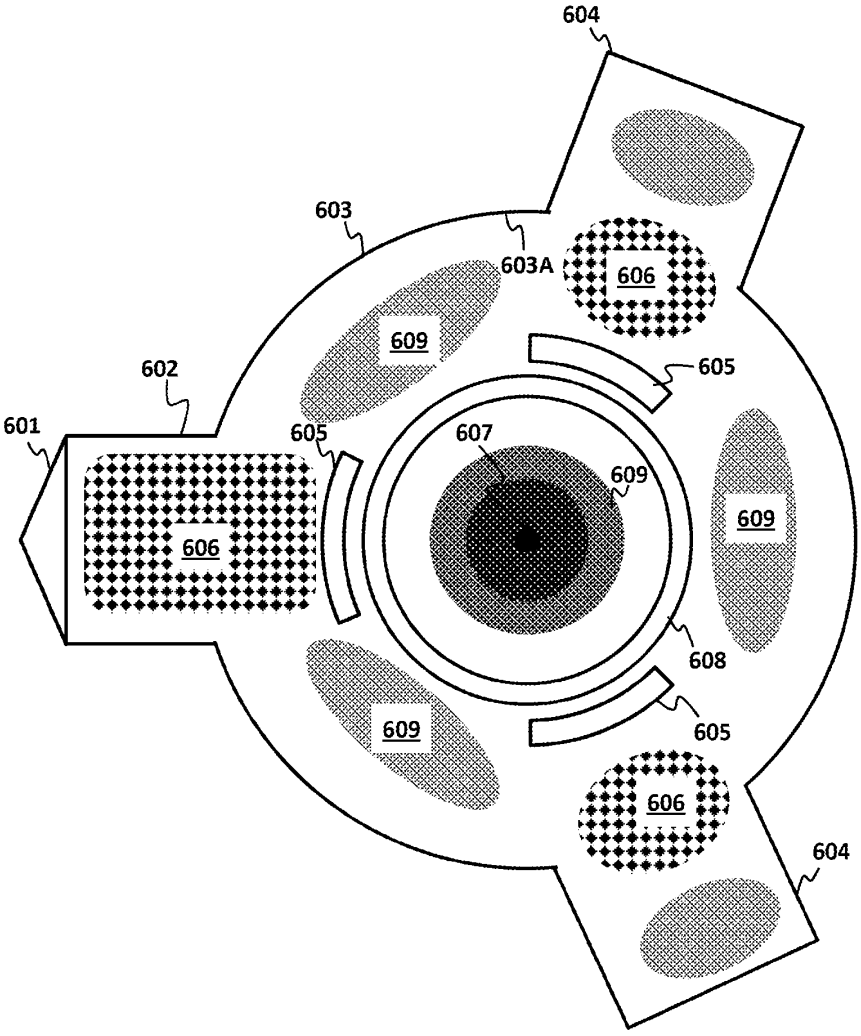

604
603
603A
606
609
605
602
601
605
607
609
606
609
608
609
605
606
604

Fig. 6A

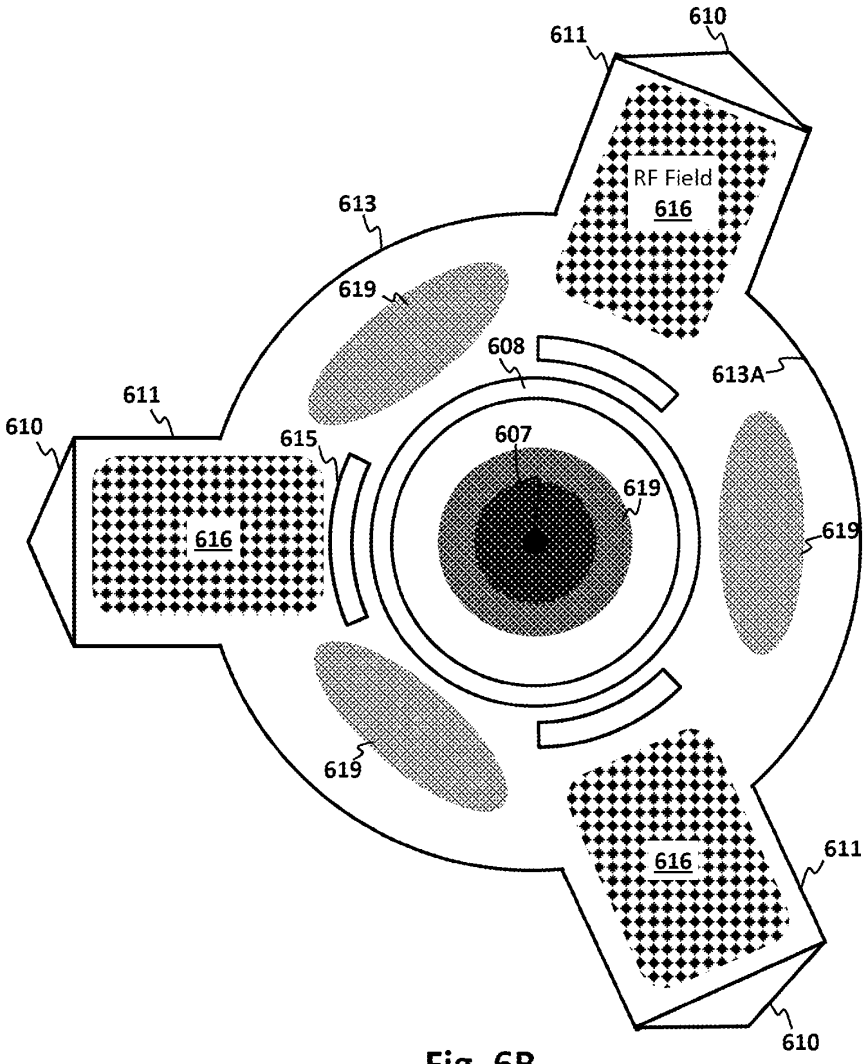

610
611
RF Field
616
613
619
608
613A
611
610
615
607
619
616
619
619
611
616
610

Fig. 6B

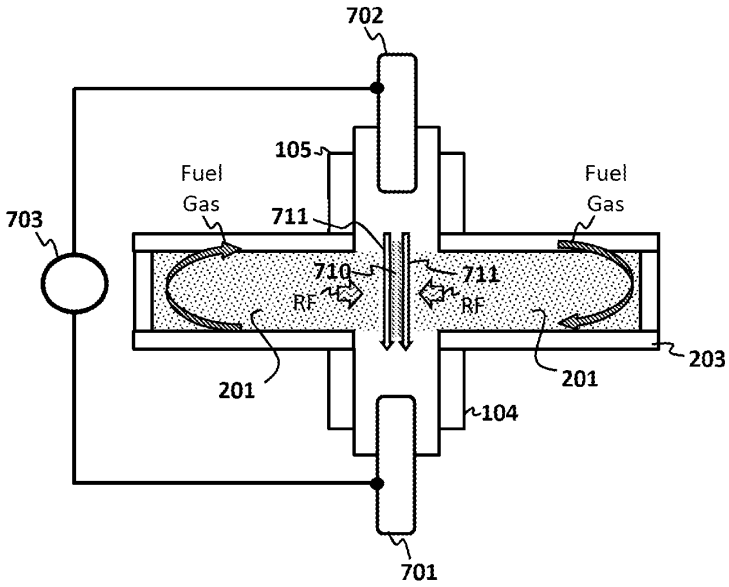

702
105
Fuel
Gas
711
Fuel
Gas
703
710
711
RF
RF
201
201
203
104
701

Fig. 7

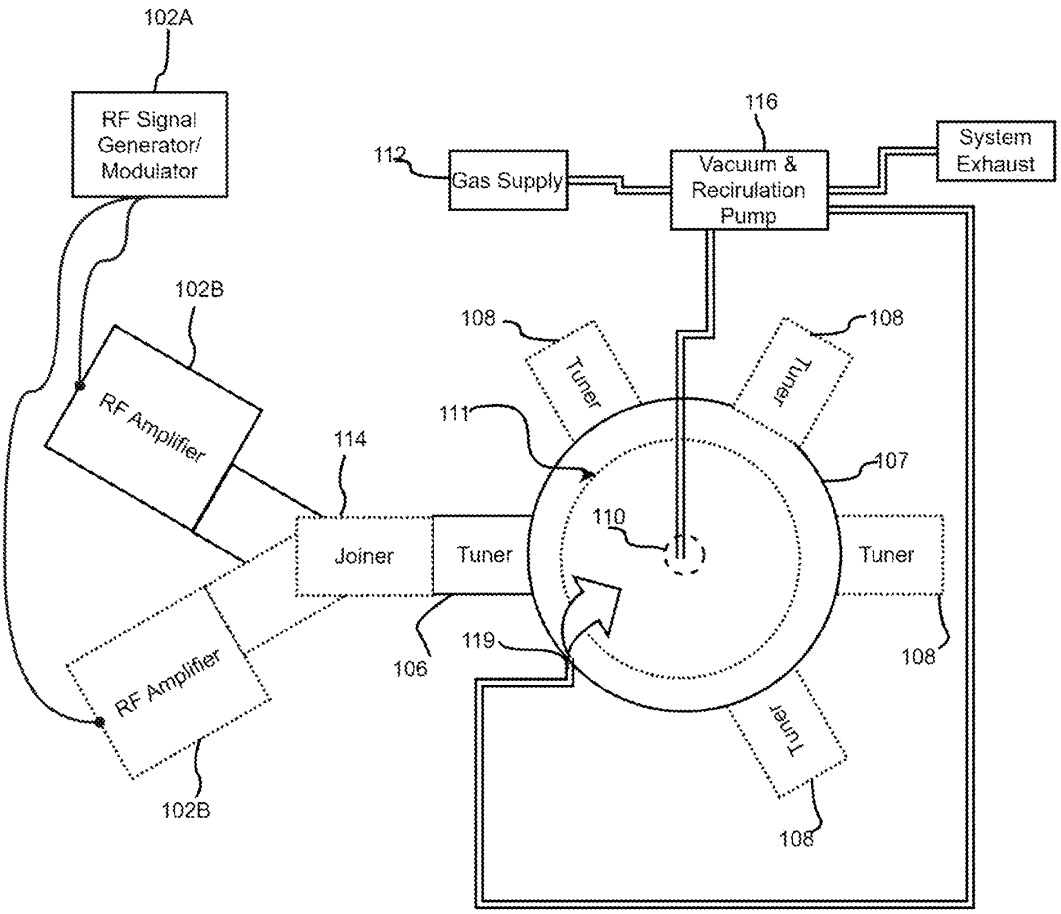

102A
RF Signal Generator/ Modulator
116
112
Gas Supply
Vacuum & Recirulation Pump
System Exhaust
102B
RF Amplifier
108
Tuner
108
Tuner
111
114
107
110
Joiner
Tuner
Tuner
RF Amplifier
106
119
108
Tuner
102B
108

Fig. 8A

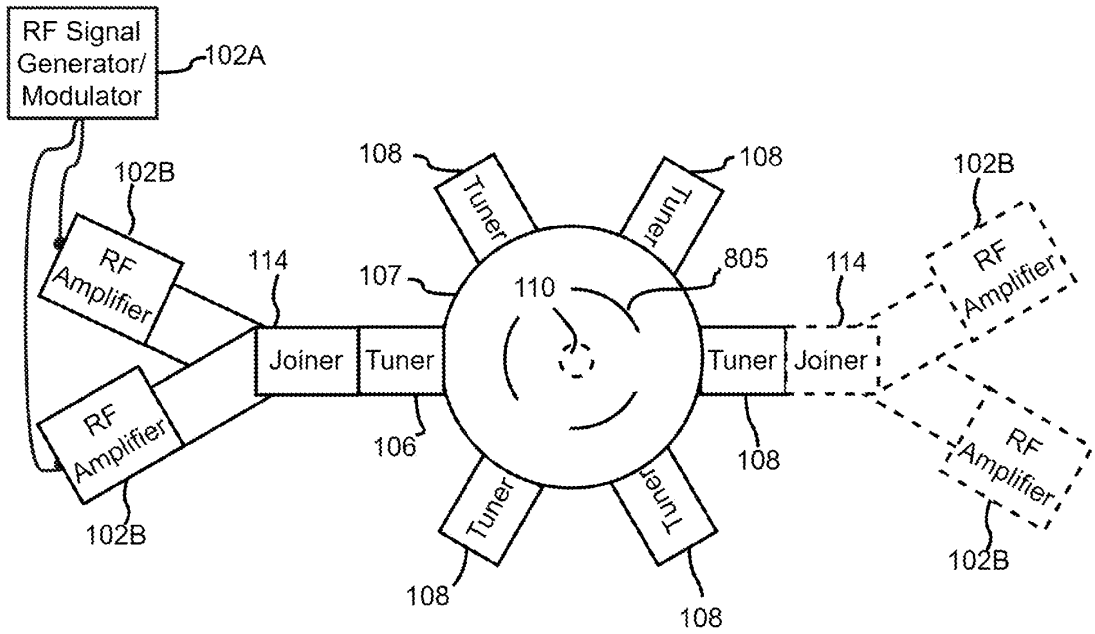

RF Signal Generator/ Modulator
102A
102B
RF Amplifier
RF Amplifier
102B
114
Joiner
Tuner
106
107
108
Tuner
108
Tuner
110
805
108
Tuner
108
Tuner
114
Tuner
Joiner
102B
RF Amplifier
RF Amplifier
102B

Fig. 8B

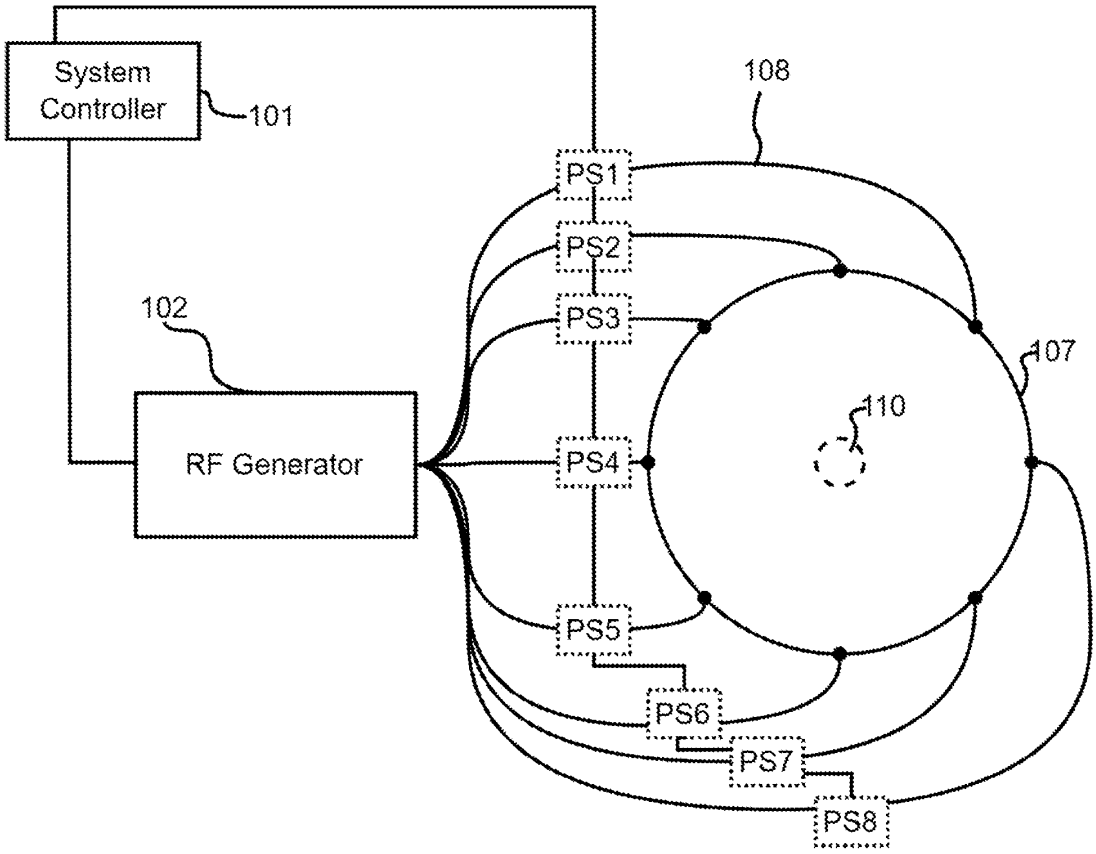

System Controller
101
102
RF Generator
108
PS1
PS2
PS3
PS4
PS5
PS6
PS7
PS8
107
110

Fig. 8C

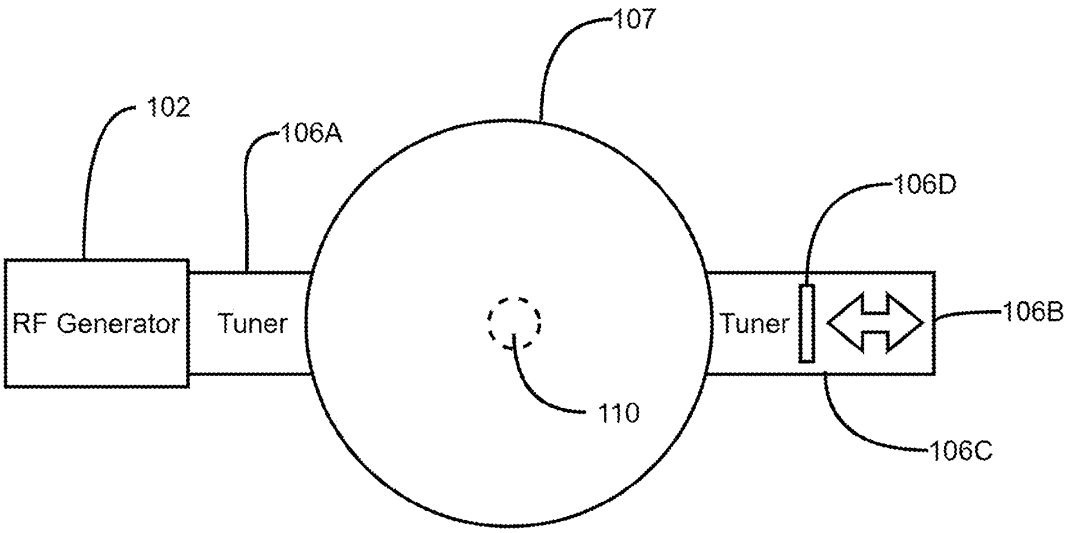


Fig. 8D

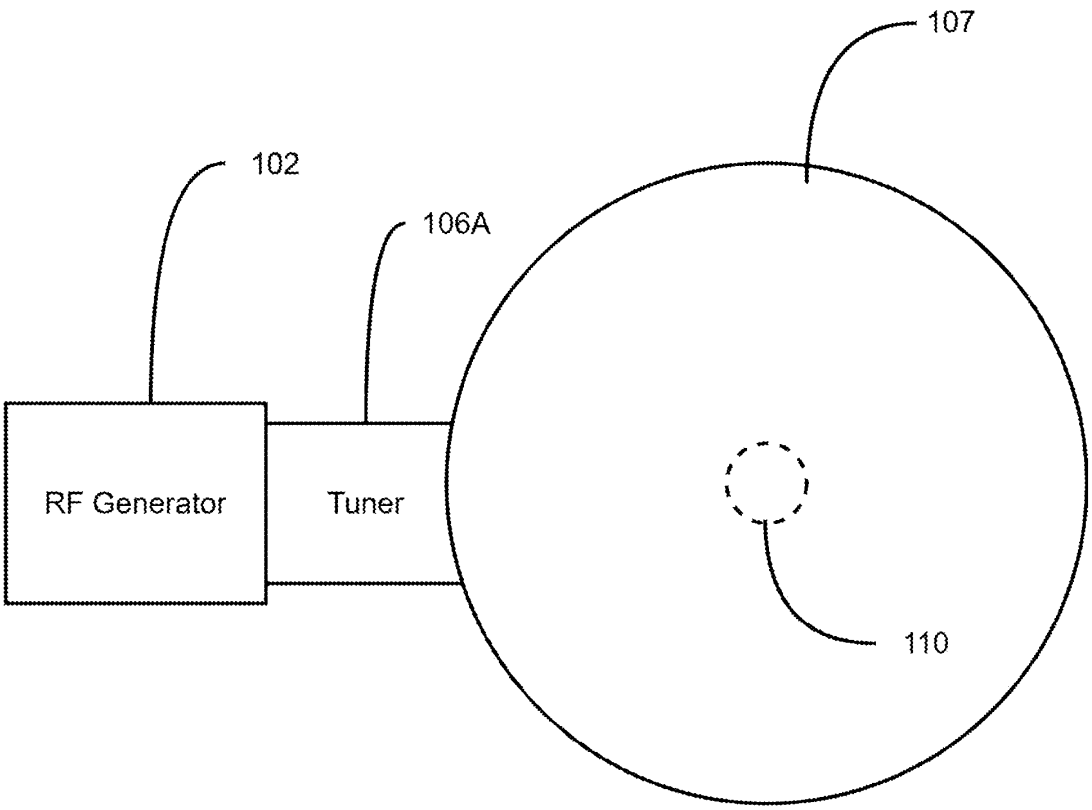


Fig. 8E

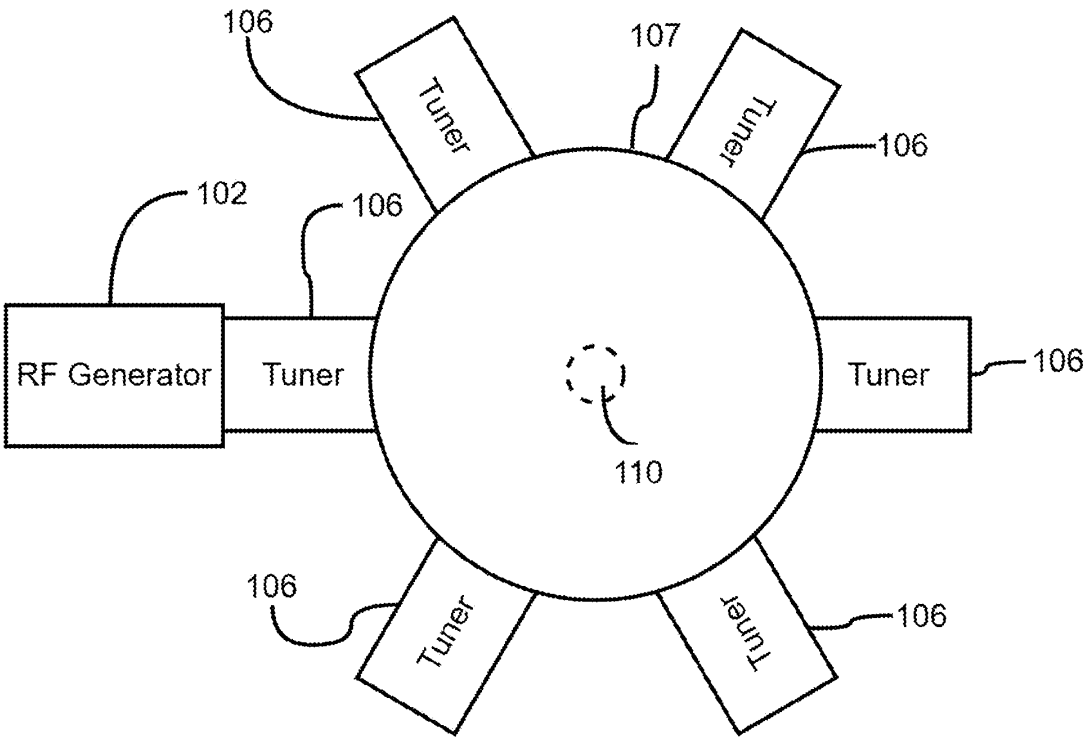

106
Tuner
107
Tuner
106
102
106
RF Generator
Tuner
Tuner
106
110
106
Tuner
Tuner
106

Fig. 8F

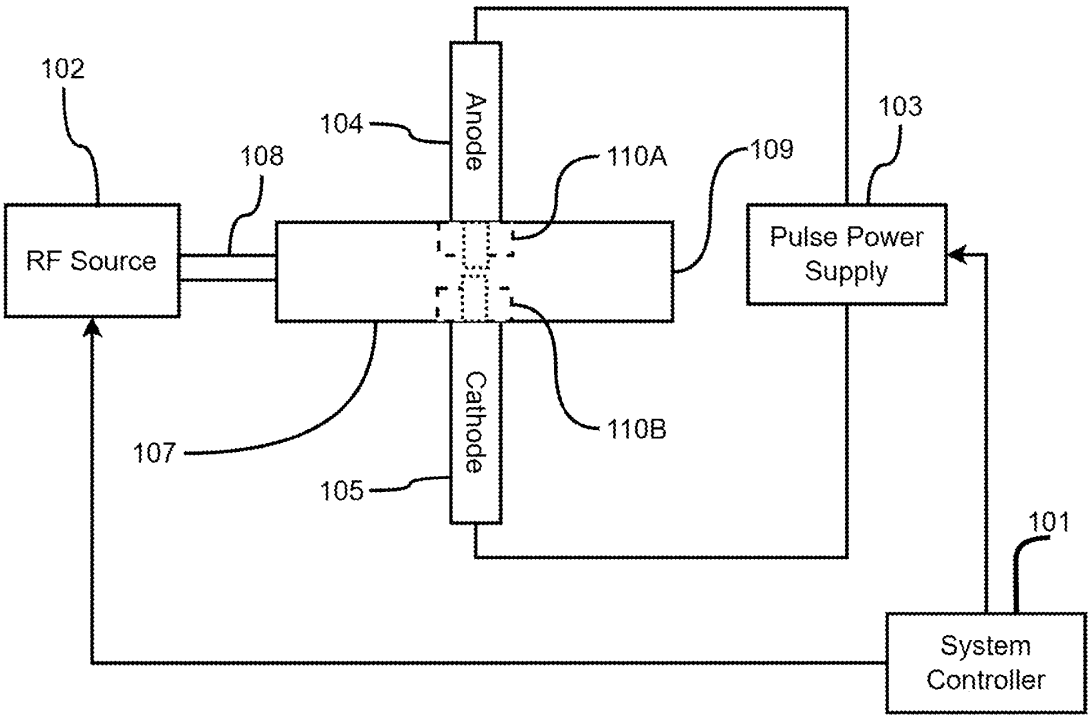

102
104
Anode
108
110A
109
103
RF Source
Pulse Power Supply
107
Cathode
110B
105
101
System Controller

Fig. 9A

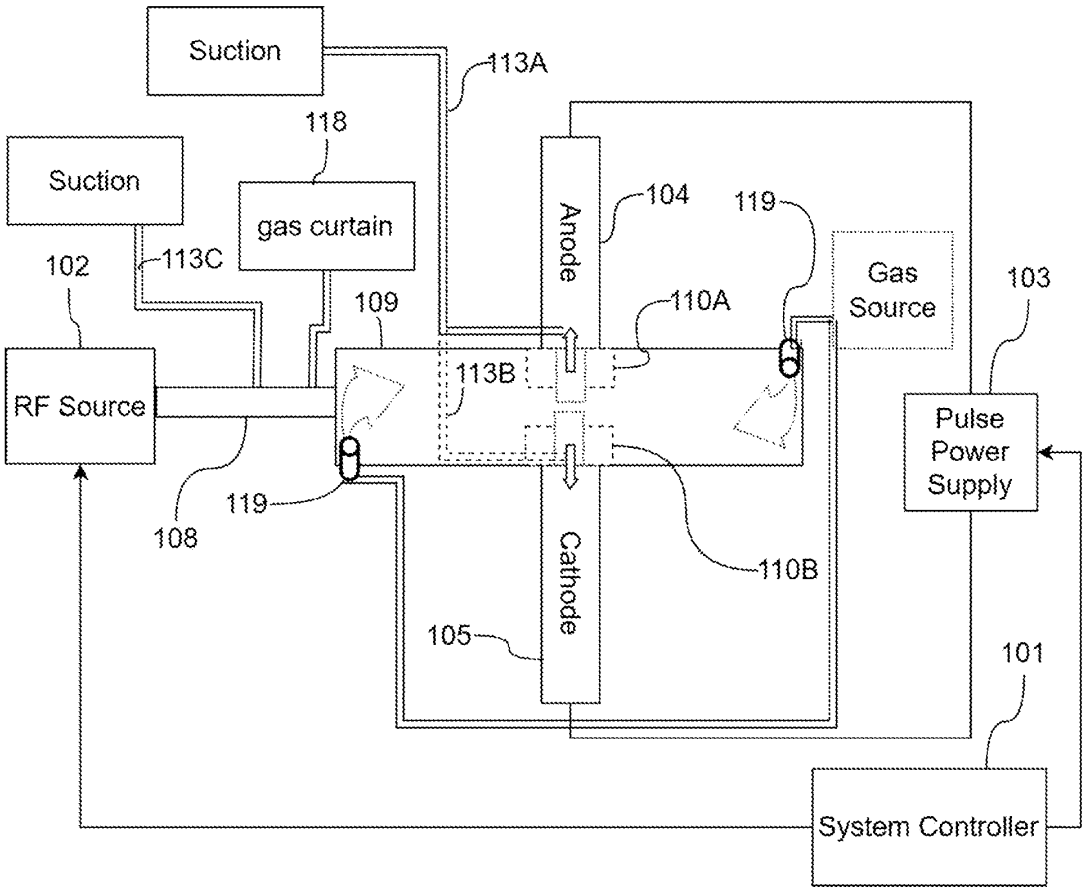

Suction
113A
118
Suction
gas curtain
Anode
104
119
Gas Source
103
102
113C
109
110A
RF Source
113B
Pulse Power Supply
119
108
110B
Cathode
105
101
System Controller

Fig. 9B

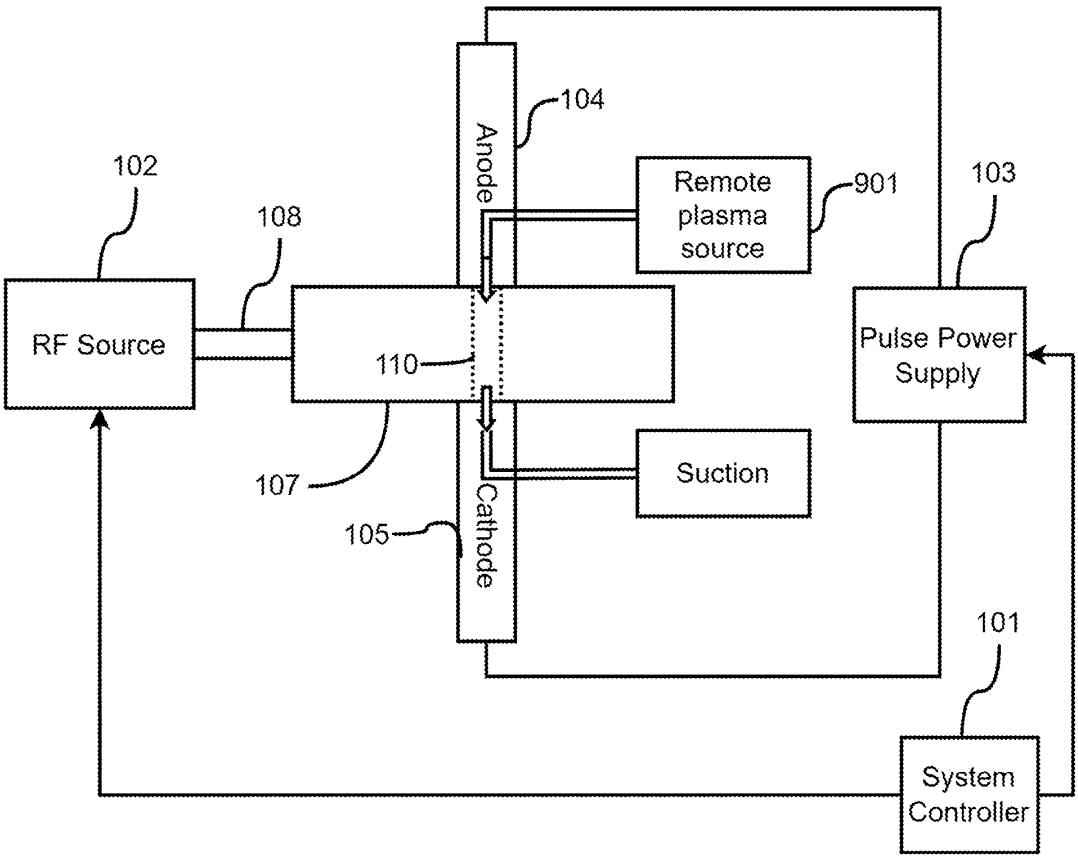

102
108
RF Source
110
104
Anode
Remote plasma source
901
103
Pulse Power Supply
107
105
Cathode
Suction
101
System Controller

Fig. 9C

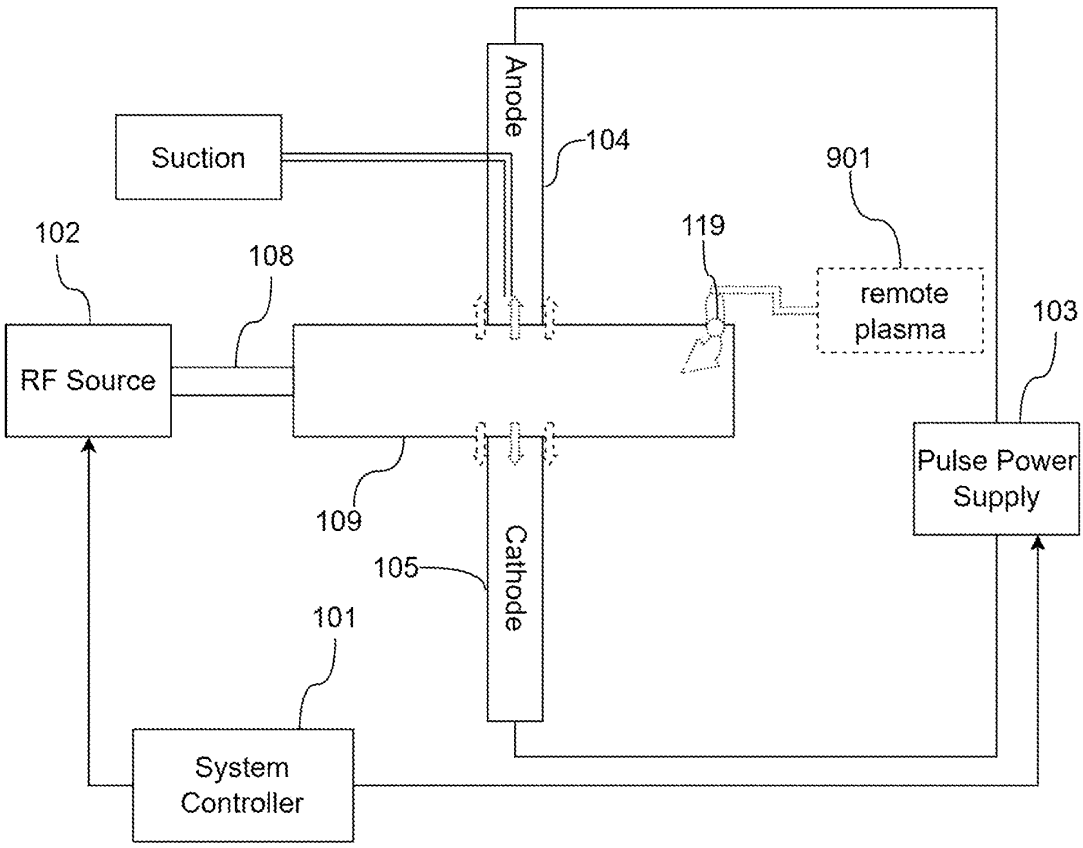

Anode
Suction
104
901
102
108
119
remote
plasma
103
RF Source
Pulse Power
Supply
109
Cathode
105
101
System
Controller

Fig. 9D

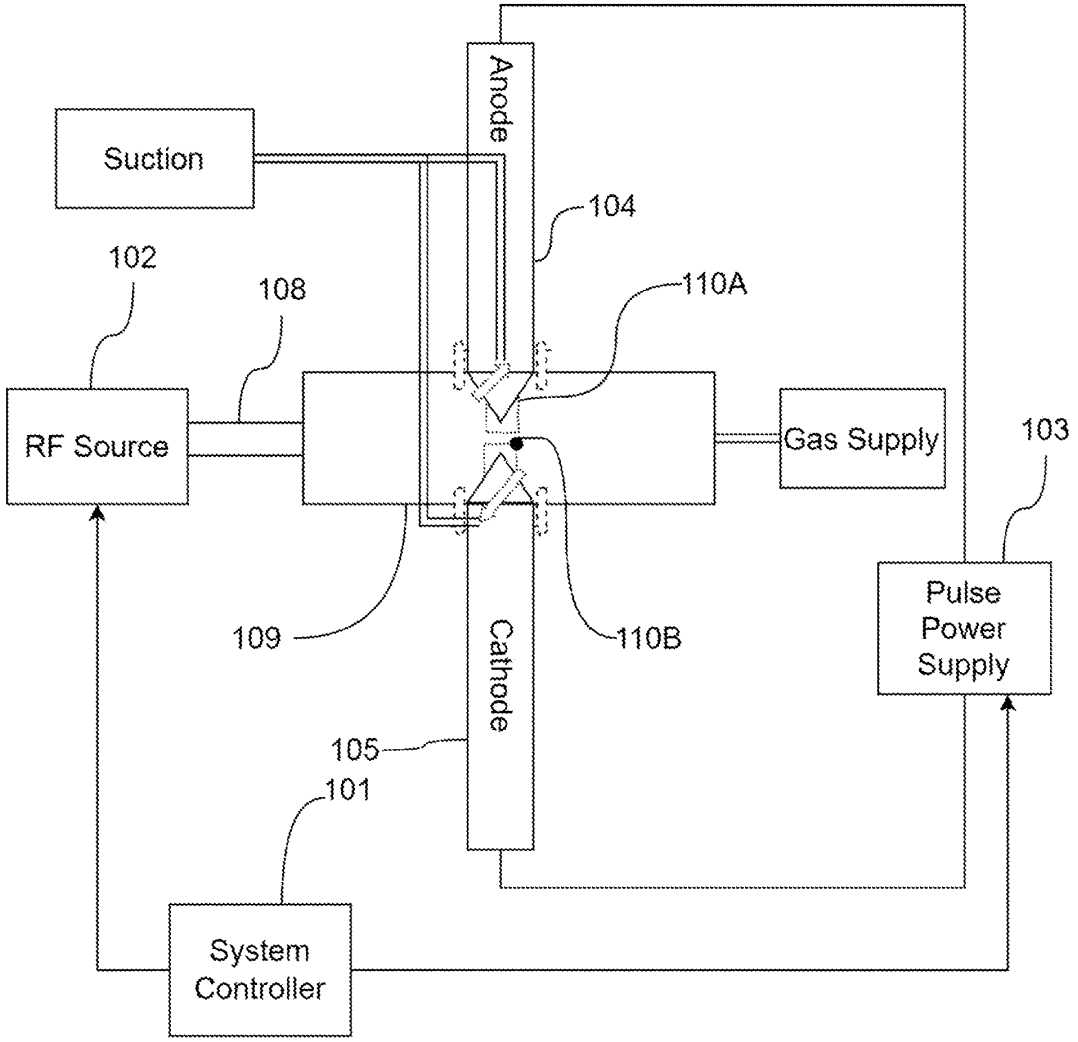

Anode
Suction
104
102
108
110A
RF Source
Gas Supply
103
109
110B
Pulse
Power
Supply
Cathode
105
101
System
Controller

Fig. 9E

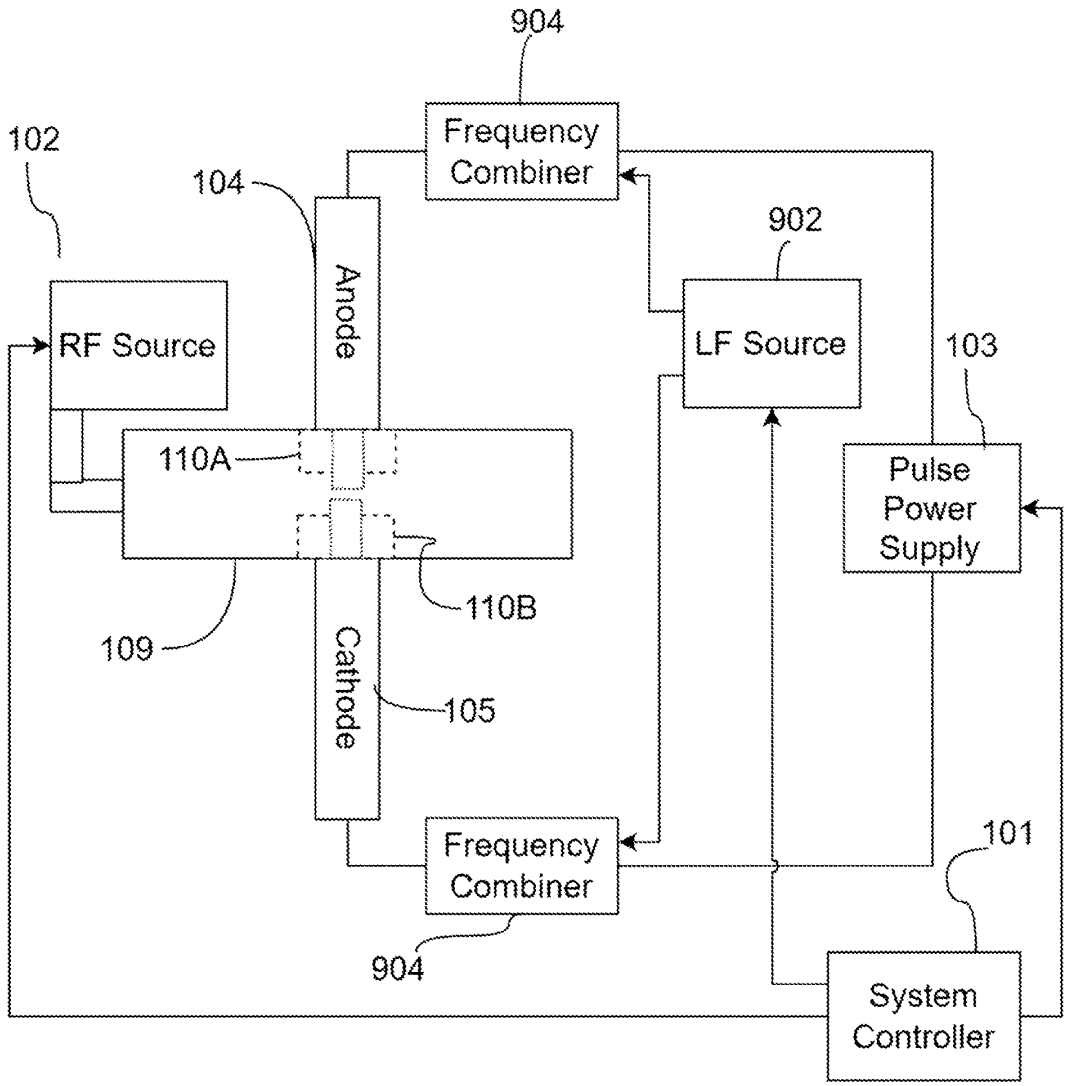

904
Frequency Combiner
102
104
Anode
902
RF Source
LF Source
103
110A
Pulse Power Supply
110B
109
Cathode
105
Frequency Combiner
101
904
System Controller

Fig. 9F

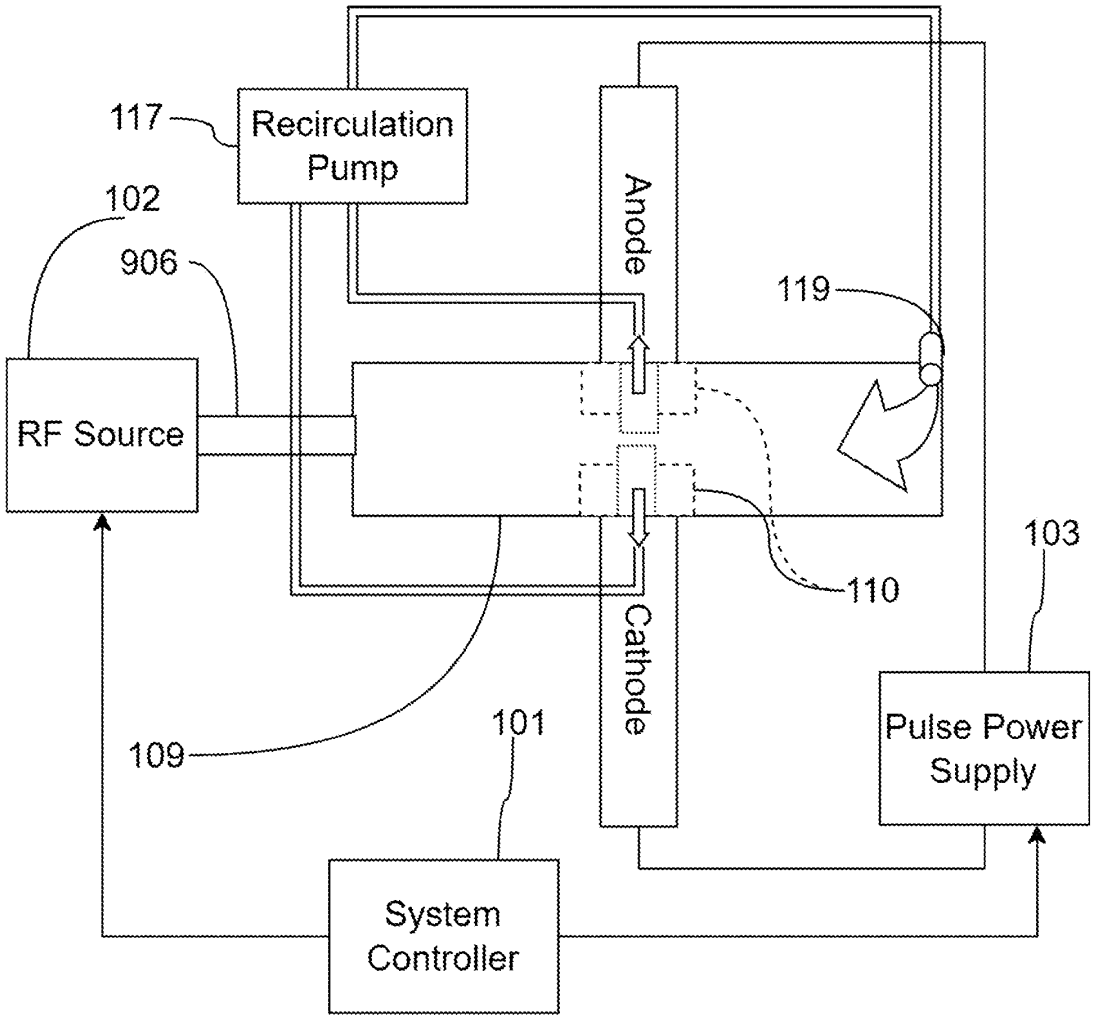

117
Recirculation Pump
102
906
Anode
119
RF Source
110
103
Cathode
109
101
Pulse Power Supply
System Controller

Fig. 9G

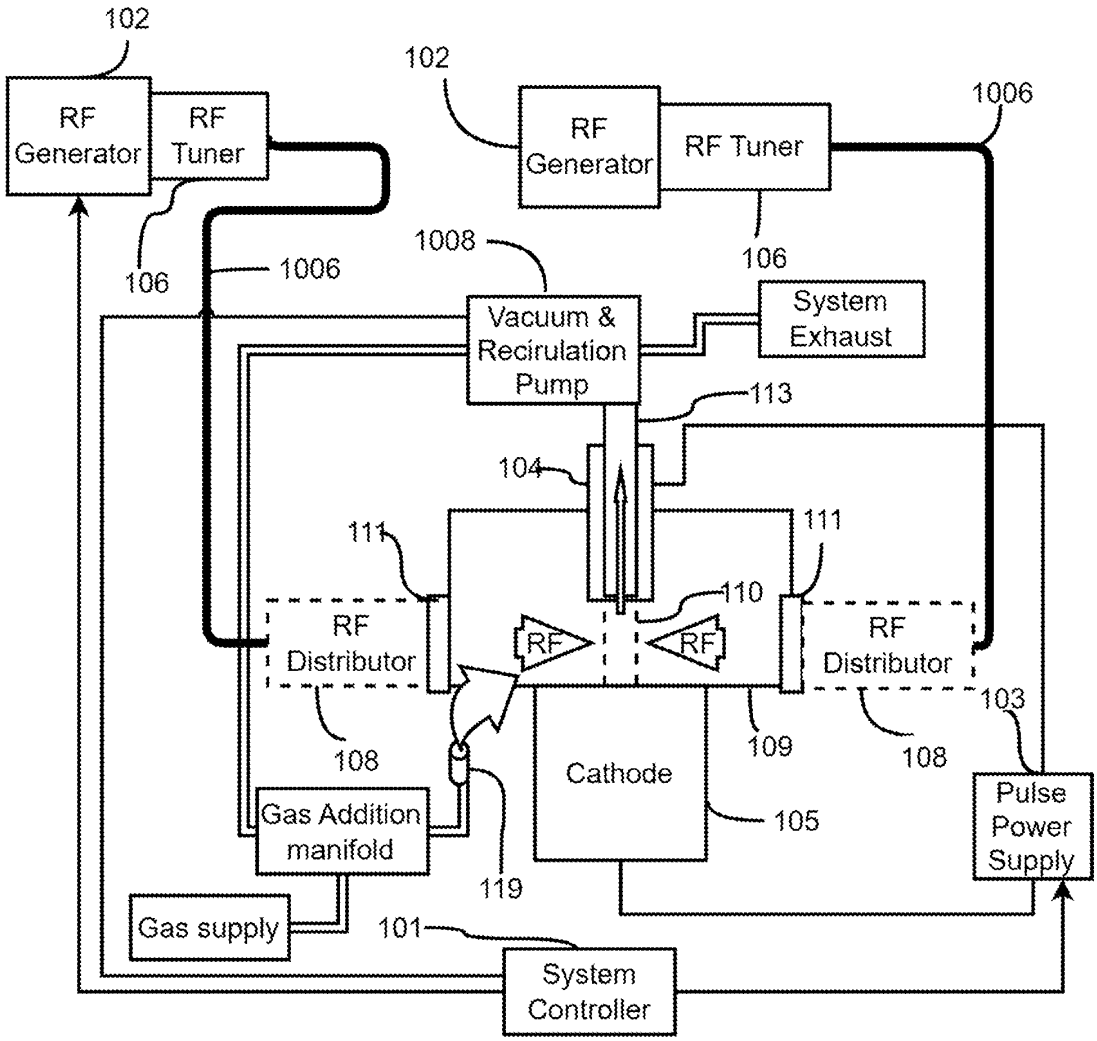

102
RF Generator
RF Tuner
106
1006
102
RF Generator
RF Tuner
1006
106
1008
Vacuum & Recirulation Pump
System Exhaust
113
104
111
111
110
RF Distributor
RF
RF
RF Distributor
103
108
109
108
Cathode
105
Pulse Power Supply
Gas Addition manifold
119
Gas supply
101
System Controller

Fig. 10A

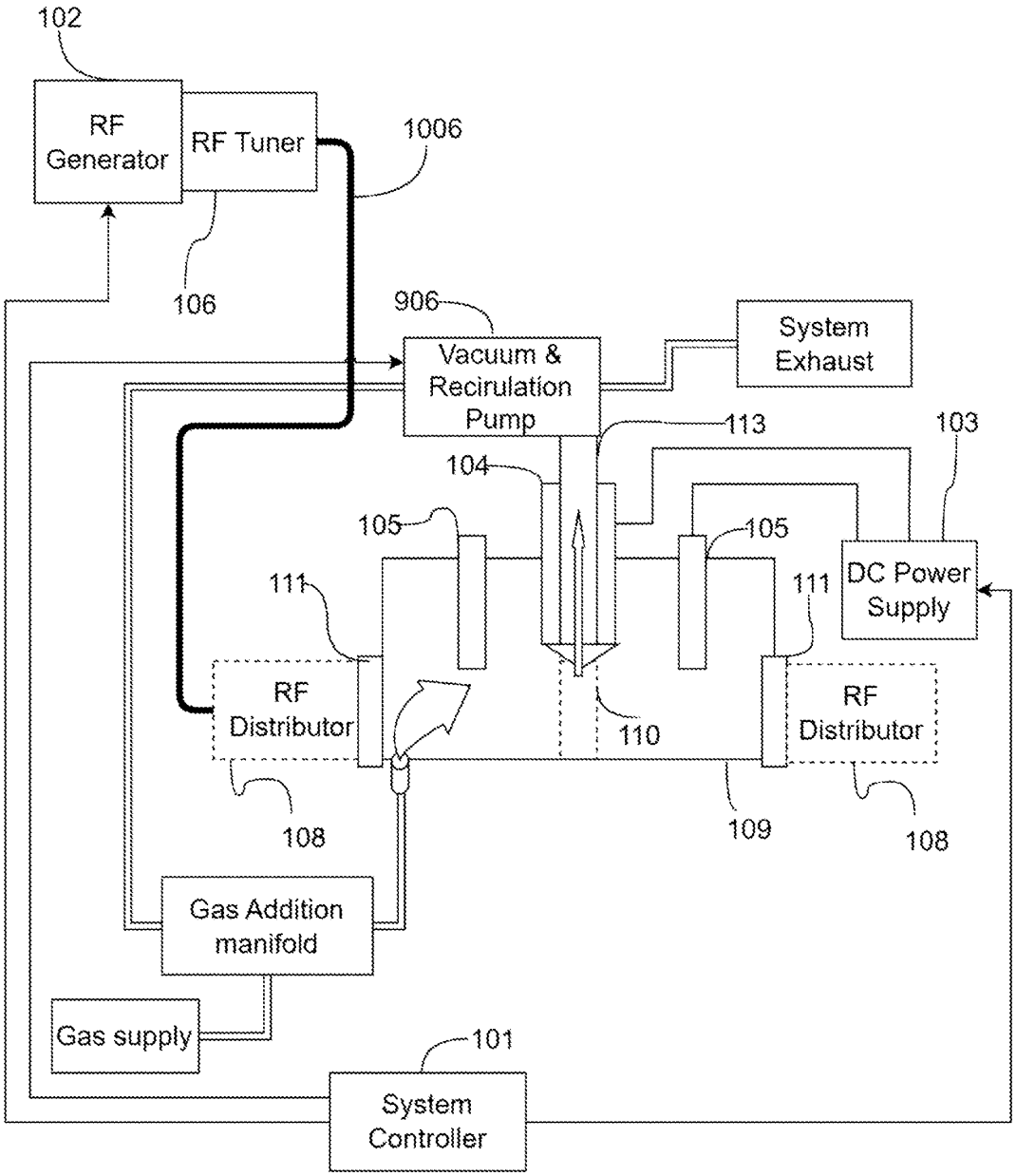

102
RF Generator
RF Tuner
1006
106
906
Vacuum & Recirulation Pump
System Exhaust
113
103
104
105
105
111
111
DC Power Supply
RF Distributor
110
RF Distributor
108
109
108
Gas Addition manifold
Gas supply
101
System Controller

Fig. 10B

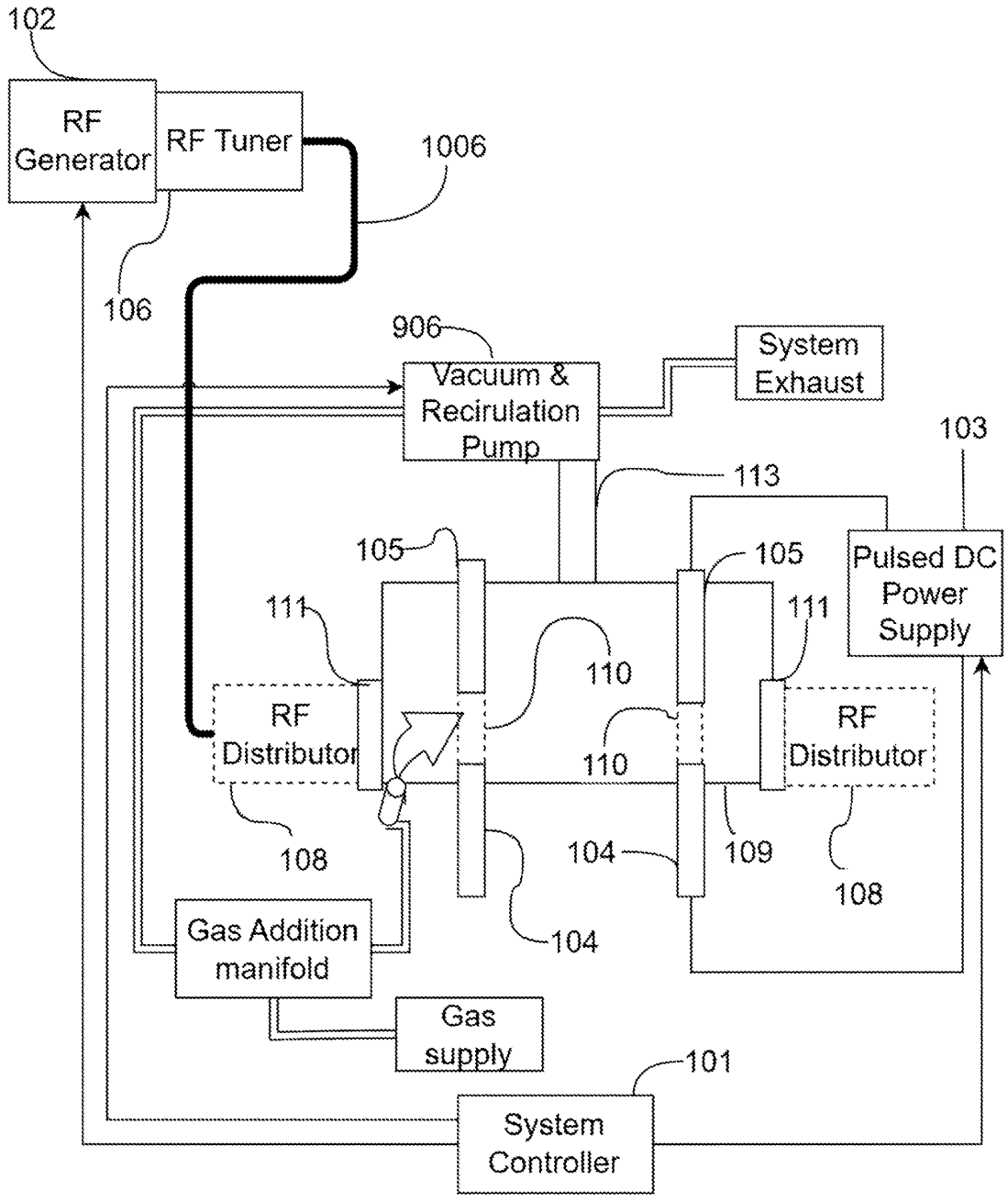

102
RF Generator
RF Tuner
1006
106
906
Vacuum & Recirulation Pump
System Exhaust
103
113
105
105
Pulsed DC Power Supply
111
111
110
RF Distributor
110
RF Distributor
108
104
109
108
Gas Addition manifold
104
Gas supply
101
System Controller

Fig. 10C

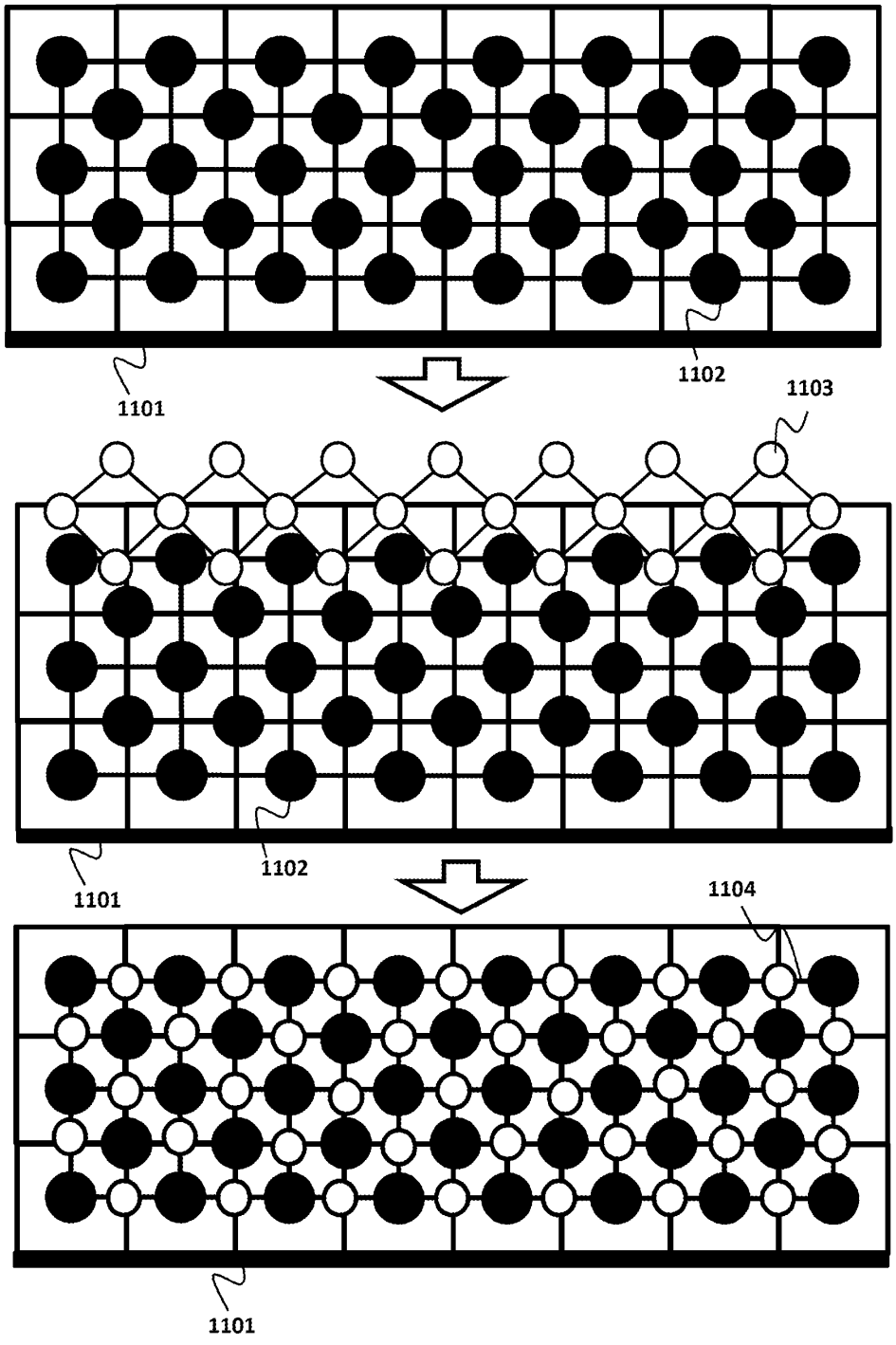


Fig. 11