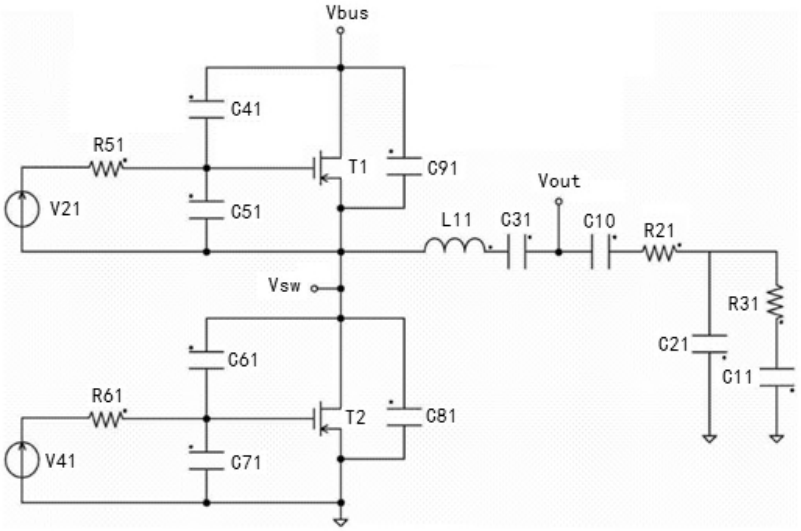

Vbus
C41
R51
T1
C91
V21
C51
Vout
L11
C31
C10
R21
Vsw
R31
C21
C11
C61
R61
T2
C81
V41
C71

FIG. 1

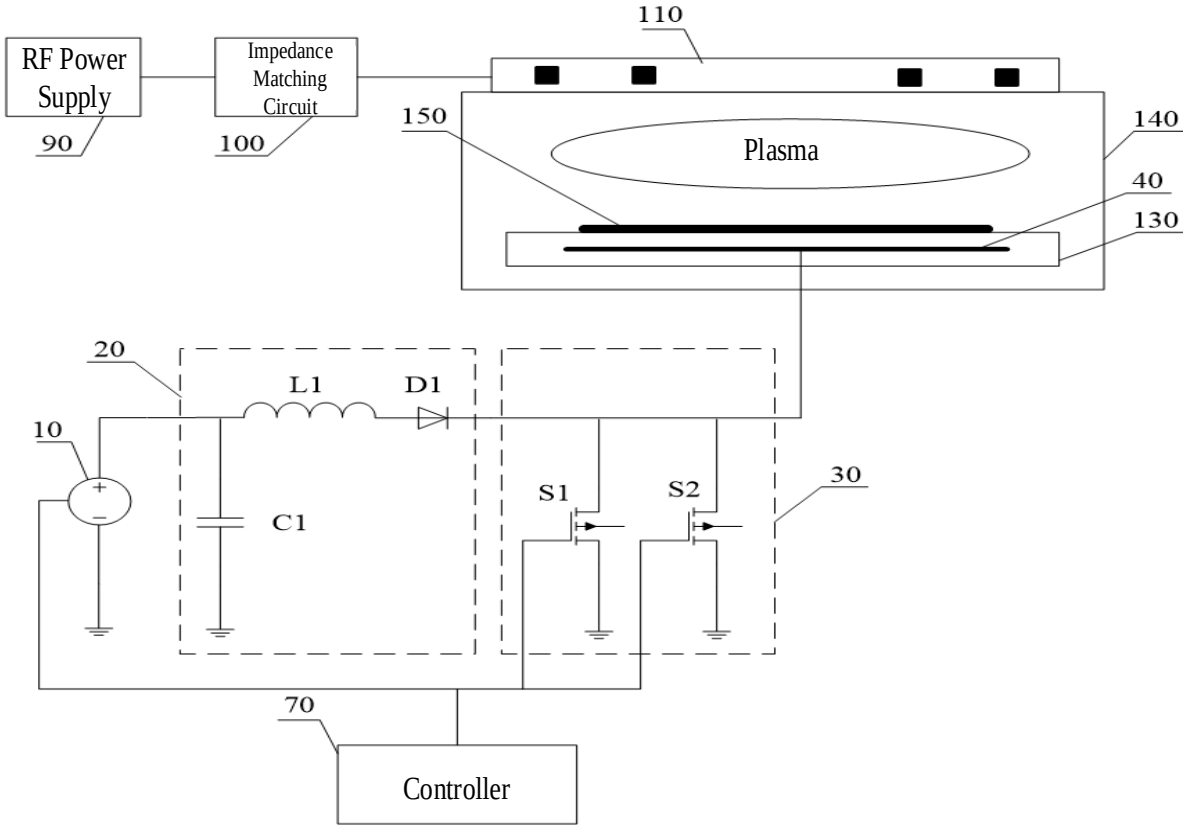

RF Power Supply
90
Impedance Matching Circuit
100
110
150
Plasma
140
40
130
20
L1
D1
10
C1
S1
S2
30
70
Controller

FIG. 2

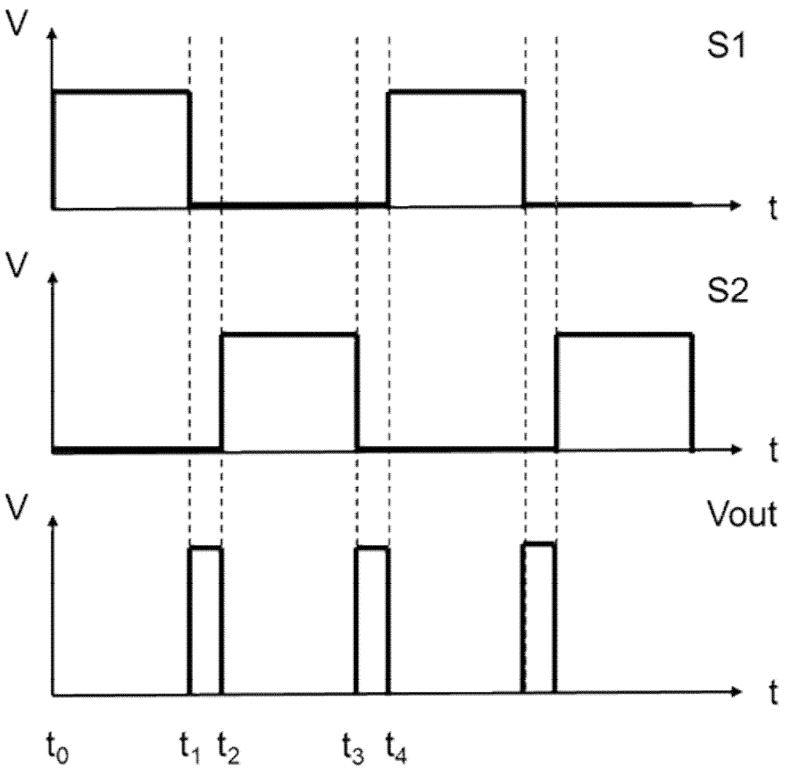


FIG. 3

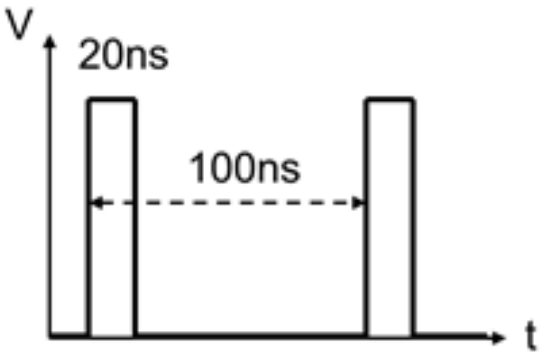


FIG. 4a

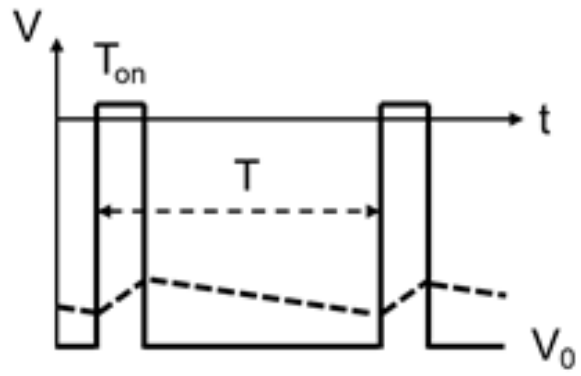


FIG. 4b

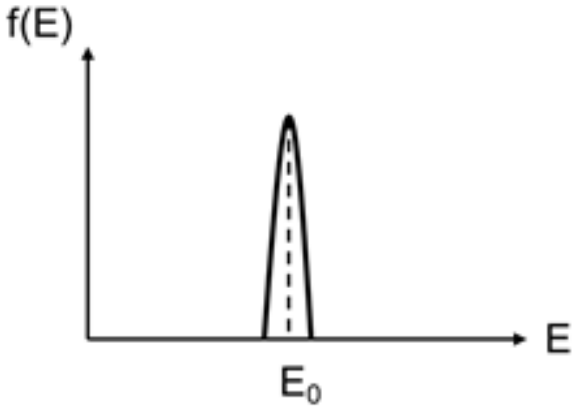


FIG. 4c

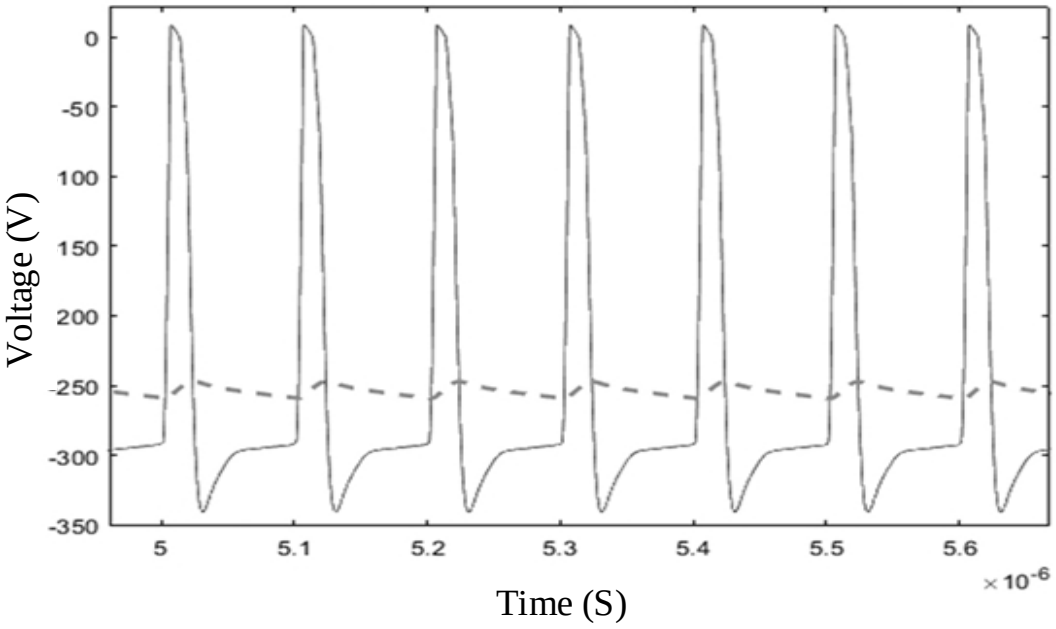

Voltage (V)
0
-50
100
150
200
-250
-300
-350
5
5.1
5.2
5.3
5.4
5.5
5.6
×10^-6
Time (S)

FIG. 5a

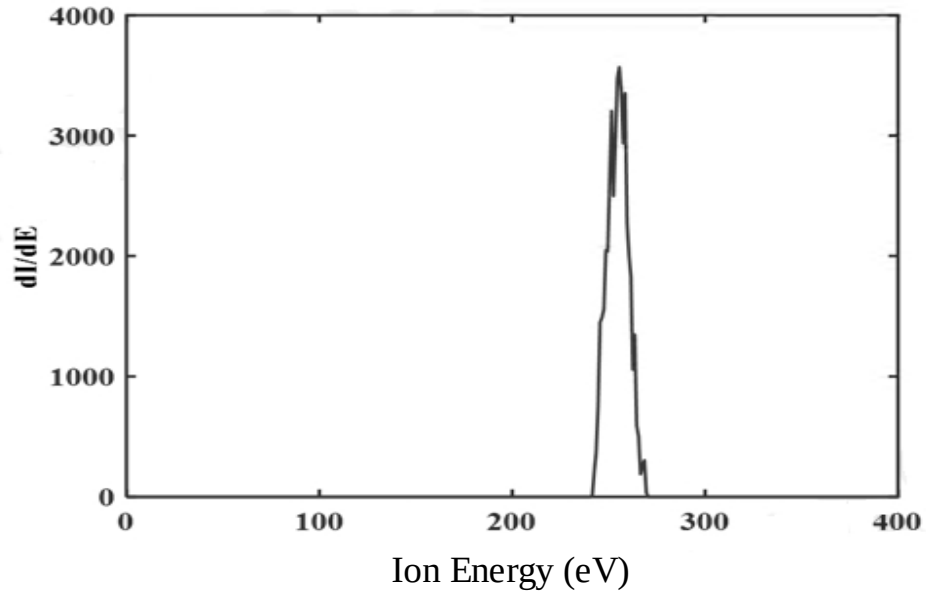

4000
3000
2000
1000
0
dI/dE
0
100
200
300
400
Ion Energy (eV)

FIG. 5b

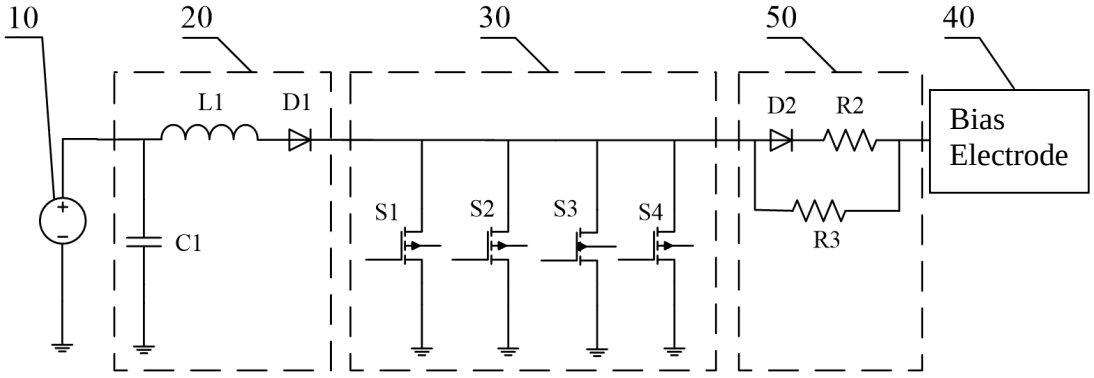


FIG. 6

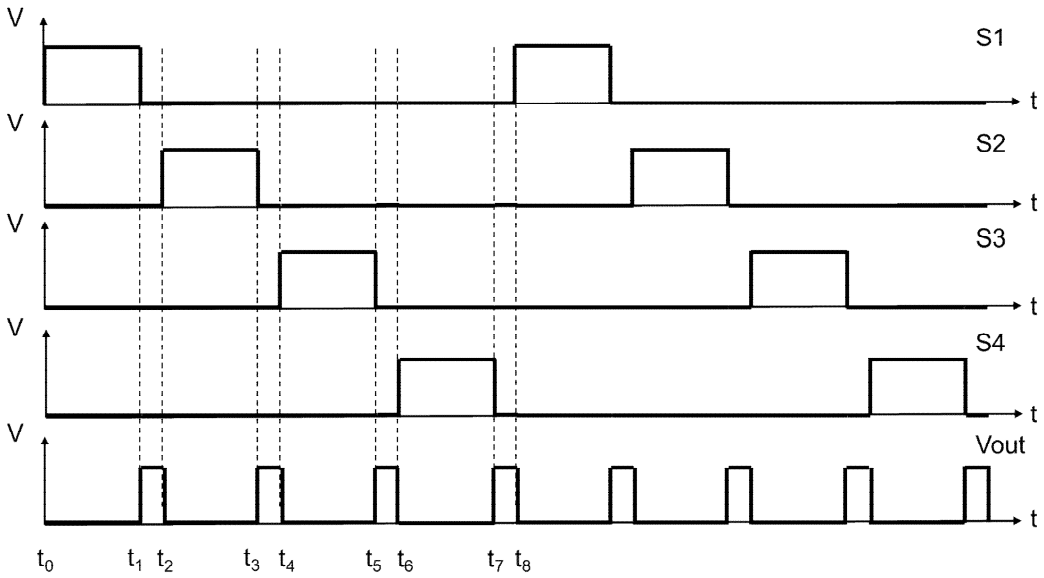


FIG. 7

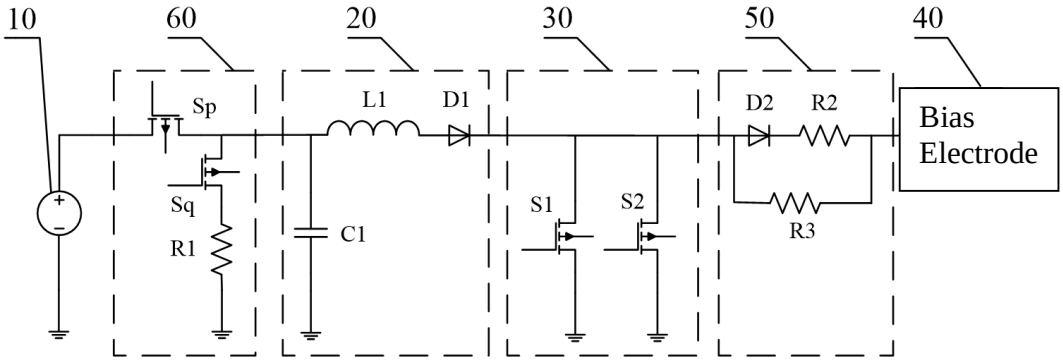


FIG. 8

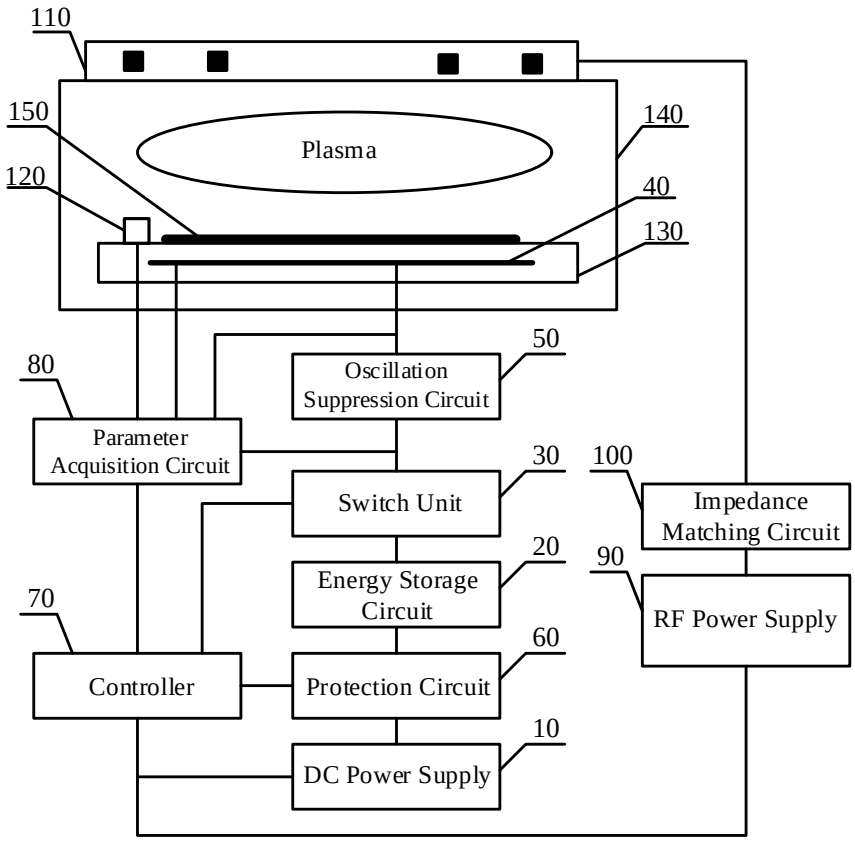

110
150
120
140
40
130
Plasma
50
80
Oscillation Suppression Circuit
Parameter Acquisition Circuit
30
100
Switch Unit
Impedance Matching Circuit
20
90
Energy Storage Circuit
RF Power Supply
70
60
Controller
Protection Circuit
10
DC Power Supply

FIG. 9

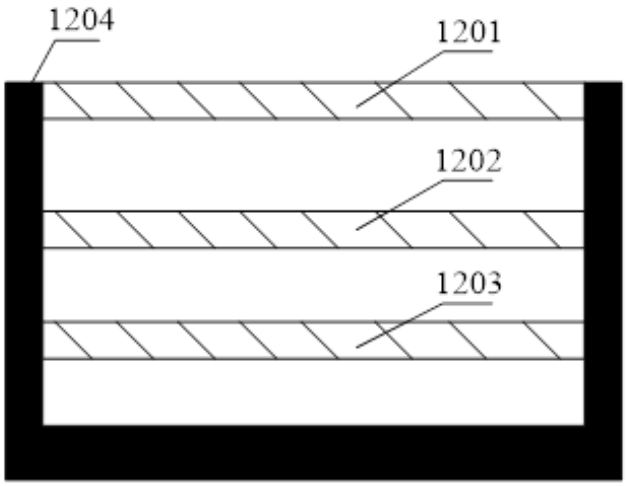

1204
1201
1202
1203

FIG. 10

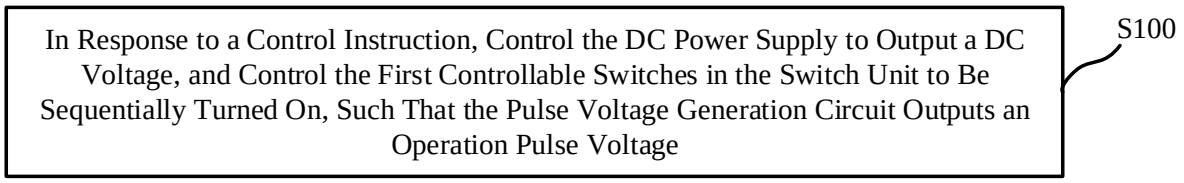

In Response to a Control Instruction, Control the DC Power Supply to Output a DC Voltage, and Control the First Controllable Switches in the Switch Unit to Be Sequentially Turned On, Such That the Pulse Voltage Generation Circuit Outputs an Operation Pulse Voltage
S100

FIG. 11

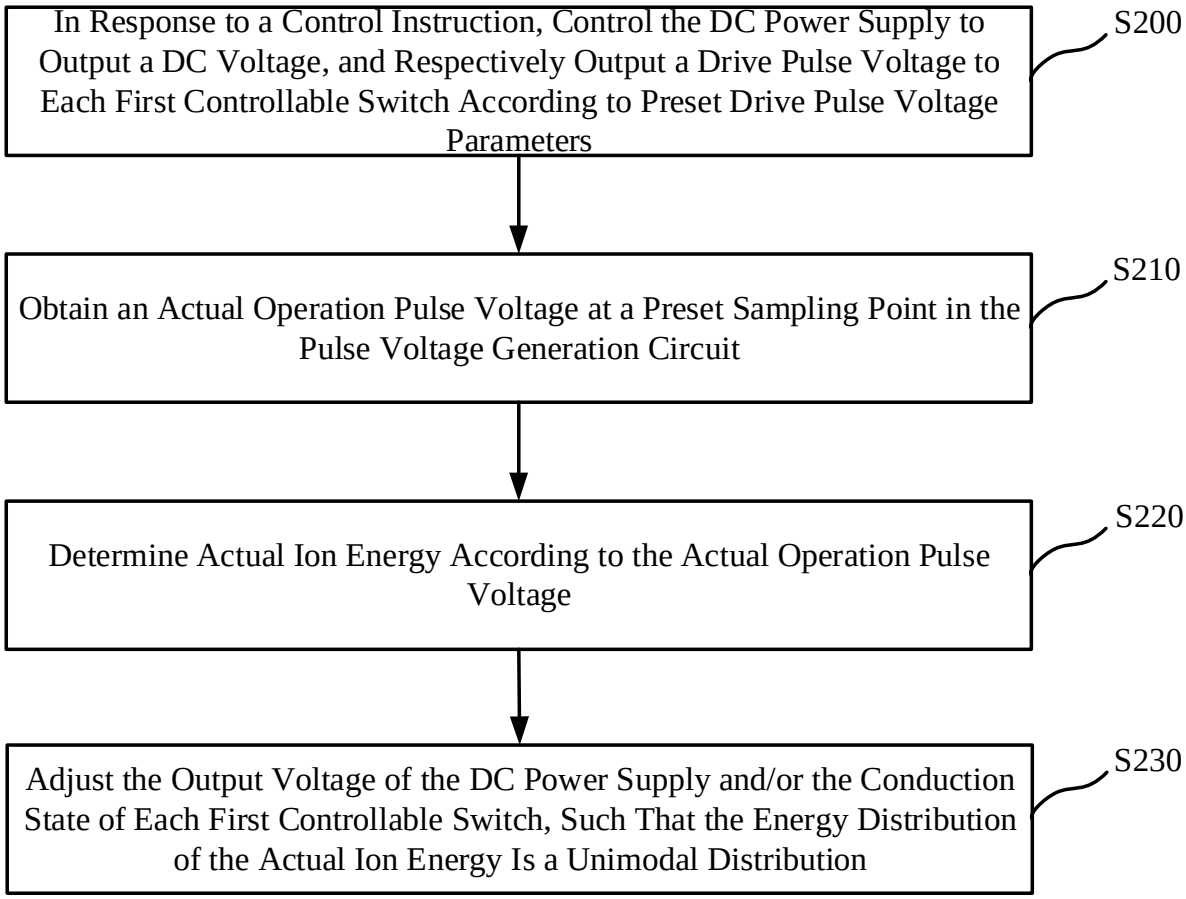

In Response to a Control Instruction, Control the DC Power Supply to Output a DC Voltage, and Respectively Output a Drive Pulse Voltage to Each First Controllable Switch According to Preset Drive Pulse Voltage Parameters
S200
Obtain an Actual Operation Pulse Voltage at a Preset Sampling Point in the Pulse Voltage Generation Circuit
S210
Determine Actual Ion Energy According to the Actual Operation Pulse Voltage
S220
Adjust the Output Voltage of the DC Power Supply and/or the Conduction State of Each First Controllable Switch, Such That the Energy Distribution of the Actual Ion Energy Is a Unimodal Distribution
S230

FIG. 12

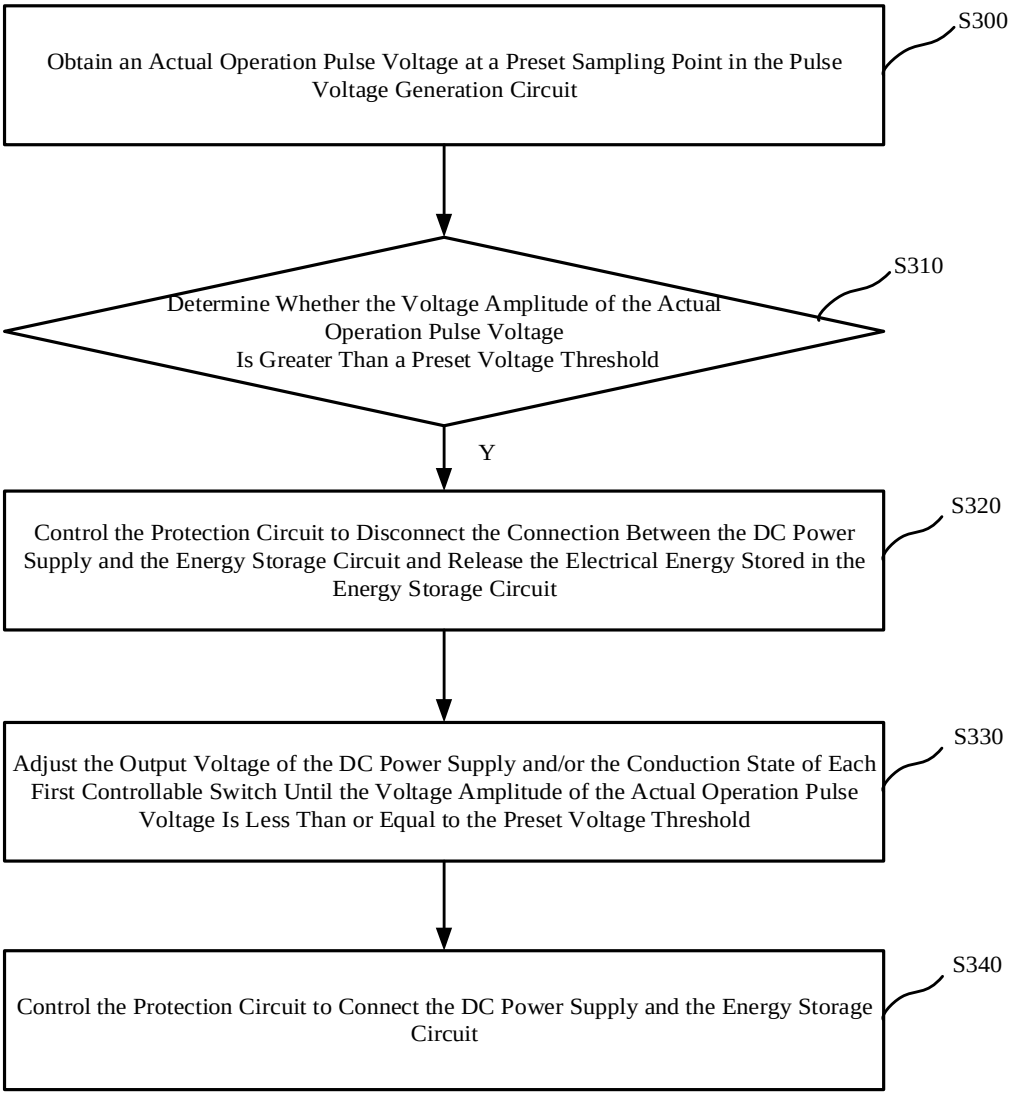

Obtain an Actual Operation Pulse Voltage at a Preset Sampling Point in the Pulse Voltage Generation Circuit
S300
Determine Whether the Voltage Amplitude of the Actual Operation Pulse Voltage Is Greater Than a Preset Voltage Threshold
S310
Y
Control the Protection Circuit to Disconnect the Connection Between the DC Power Supply and the Energy Storage Circuit and Release the Electrical Energy Stored in the Energy Storage Circuit
S320
Adjust the Output Voltage of the DC Power Supply and/or the Conduction State of Each First Controllable Switch Until the Voltage Amplitude of the Actual Operation Pulse Voltage Is Less Than or Equal to the Preset Voltage Threshold
S330
Control the Protection Circuit to Connect the DC Power Supply and the Energy Storage Circuit
S340

FIG. 13

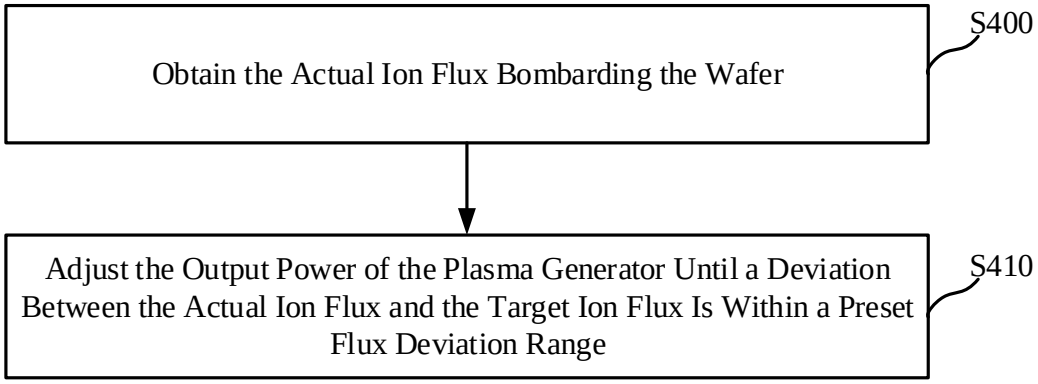

Obtain the Actual Ion Flux Bombarding the Wafer
S400
Adjust the Output Power of the Plasma Generator Until a Deviation Between the Actual Ion Flux and the Target Ion Flux Is Within a Preset Flux Deviation Range
S410

FIG. 14